PSYCHOSOCIAL IMPACTS OF AN ENVIRONMENTAL DISASTER

PSYCHOSOCIAL IMPACTS OF AN ENVIRONMENTAL DISASTER IN KARAKALPAKSTAN (UZBEKISTAN)

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ABSTRACT

The people of Karakalpakstan, along with those of the entire Aral Sea region, are facing a multitude of health problems corresponding to the drying of the Aral Sea and accompanying ecological problems. This research examines the contribution of the environmental disaster and other mediating variables on the psychosocial health of people in Karakalpakstan, about which no other data are available at present. Four research objectives are addressed within a cross-sectional research design using descriptive and logistic regression analysis: 1) *to determine people's perceptions (health and environmental) associated with the environmental disaster*; 2) *to examine the links between health and environment made by individuals*; 3) *to determine the prevalence of psychosocial impacts amongst local residents*; and, 4) *to investigate the determinants of psychosocial impacts*. As part of Médecins Sans Frontières' (MSF) operational research program, and with the assistance of local Universities, and local health care workers, an interview survey was carried out on a random sample of individuals (n=881) in three communities in Karakalpakstan. Results show that much of the study population is concerned about the environment and is experiencing high levels of emotional distress. Also, low levels of self-perceived health were reported in the three study communities, and health problems were commonly perceived as being associated with environmental problems. Further, results for a series of site specific analysis revealed that outcome measures can be successfully explained by a combination of external and mediating

factors including individual's location of residence, gender, age, social network characteristics and perceptions of the environmental situation. These results have added to our understanding of the severity and nature of risk perceptions and psychosocial impacts associated with a long term, multi-sourced environmental disaster in a developing world context. Furthermore, these findings have demonstrated that strategies aimed at addressing and alleviating psychosocial impacts need to be specific to the characteristics of the populations most affected.

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CHAPTER 1:

INTRODUCTION

1.1. RESEARCH PROBLEM

The people of Karakalpakstan along with those of the entire Aral Sea area, are facing a multitude of serious environmental problems which have culminated into what is today recognized as "one of the worst ecological disasters the world has seen" (Saiko,1994, p.12). This disaster involves a range of environmental problems from toxic dust storms and severe salinization of agricultural lands and drinking water, to a significant reduction in the surface area of the Aral Sea, problems which have been attributed to decades of destructive Soviet agricultural practices (O'Hara,2000; Glantz,1999; Glazovsky,1995; Micklin,1994; Smith,1991). These problems, combined with associated economic and social impacts, correspond to a wide range of health problems faced by the area's population. Rates of anemia, various cancers, tuberculosis and birth defects, for example, far exceed those of the rest of the former Soviet Union and present day Russia (Feshbach and Friendly,1992; Glazovsky,1995; Smith,1991). Considering the severity of the environmental and physiological health problems, the results of an early agenda-setting exercise suggested that the incidence of psychosocial health impacts[1] in this population may be an issue of concern (Upshur,1998). Given that psychosocial health is recognized

[1] psychosocial impacts are defined as a "complex of distress, dysfunction and disability, manifested in a wide range of psychological, social and behavioural outcomes, as a consequence of actual or perceived environmental contamination" (Elliott, *et al.*,1993, p.791).

as an integral component of health (WHO,1999), it is essential that we begin to understand its relative contribution to health if we are to prepare ourselves for the task of improving the overall health of the region's population. Thus, this research attempts to demonstrate the presence of environmental concern, the prevalence of psychosocial impacts and perceptions of attribution in the population living in the Aral Sea region, and further attempts to uncover the factors determining these impacts and perceptions.

1.2. RESEARCH CONTEXT

This research is part of MSF's ongoing operational research program in the Aral Sea area which is aimed at determining the links between the health of the region's population and environmental problems. In collaboration with local health care workers and scientists, the relationships between perceived environmental exposures and psychosocial outcomes, as well as the environmental, economic, social and psychological processes underlying these relationships was investigated. The objectives of this research stem, in part, from the key recommendations of a feasibility report written by R. Upshur (1998) of the McMaster Institute of Environment and Health. Specifically, the research objectives are:

1. to determine people's perceptions (health and environmental) associated with the environmental disaster;
2. to examine the links between health and environment made by individuals;
3. to determine the prevalence of psychosocial impacts amongst local residents; and,
4. to investigate the determinants of psychosocial impacts.

Using an exploratory, cross-sectional research design involving both quantitative and qualitative approaches, this research involved a geographic analysis of an environmental health relationship. Three communities located in the Shumanay, Kungrad and Muynak districts of the semi-autonomous Republic of Karakalpakstan (Uzbekistan) were studied. The study communities varied with respect to distance from the former seashore, urban/rural setting, ethnic composition and economic characteristics.

1.3. RESEARCH CONTRIBUTION

Only a handful of health studies have been done in the Aral Sea region and of these, most have focused on somatic disease outcomes (e.g. Frost,1997; DHS,1996). This present research complements previous work by examining psychosocial health impacts which had not, until now, been addressed. In doing so it contributes to our understanding of the relationships between environmental exposures and health outcomes. The World Health Organization's recent call for researchers to "identify psychological and physiobiological mechanisms of symptom formation and [determine] the prevalence, impact and outcomes of health beliefs concerning unexplained symptoms of environmental syndromes" (WHO,1999,p.9), clearly indicates a pressing need for such a study.

This research has broken new ground by examining risk perceptions and the psychosocial effects of a long term, multi-sourced environmental disaster in a developing world context. Most past research in this field has examined the psychosocial impacts of single-sourced, often short term hazardous events in developed nations contexts (e.g.

Seveso, Italy (Bertazzi,1989), Three Mile Island (Sorenson,1987) and Chernobyl (Havenaar *et al*,1996; Weisaeth,1991)), or low level chronic exposures to non-hazardous contaminants from solid waste facilities in Canada (Elliott,1998; Elliott *et al.*,1993; Eyles *et al.*,1993; Taylor, *et al.*,1991). Unlike these past studies, this research helps to determine the extent to which psychosocial impacts occur as a result of chronic exposures to hazardous contaminates in a population also impacted by a myriad of other social and economic circumstances (e.g. high levels of unemployment, poverty, a lack of essential services and a deteriorating health care system) (Small,1997; Glazovsky,1995; Feshbach and Friendly,1992).

It has become widely accepted that psychological morbidity characterizes toxic exposures or other environmental disasters such as Chernobyl or Seveso, Italy (Baum, *et al.*,1982; Bertazzi,1989; Elliott *et al.*,1993; Eyles *et al.*,1993; Havenaar,1998; Taylor, *et al.*,1991). There is also strong scientific evidence to support an association between somatic outcomes and the stress associated with perceptions of incurred risk (Bertazzi,1989; Havenaar,1998; Neutra,1991). By understanding these perceptions and the levels of stress associated with them, physicians and other health care professionals will be better able to recognize stress related morbidity and may thus be better able to more effectively address the health and health care needs of the local population.

Because this research has involved local health care workers and researchers, it has helped to fulfill MSF's mandate of setting up an effective health care program in the region which takes local knowledge, attitudes and practices into consideration (Upshur,1998). This in turn may contribute to the development of more effective,

situation specific health care as well as health education programs aimed at mitigating psychosocial impacts. Furthermore, as a result of extensive local participation, and because the research findings have been returned to the participating institutions and communities in the form of data and a report (Crighton *et al.*,1999), this research has an important capacity building effect. An increased local recognition and understanding of psychosocial impacts will serve to increase the local capacity to mitigate impacts.

1.4. CHAPTER OUTLINE

This thesis is comprised of 7 chapters. The following chapter *(Research Context and Literature Review)* examines the literature on psychosocial impacts firstly, by addressing psychosocial impacts within the broader context of human impacts of environmental disasters; secondly, through a critical appraisal of the psychosocial research literature to date; and finally, through an examination of the major theoretical perspectives which inform our understanding of psychosocial impacts of environmental disasters. This is followed by an explanation of the conceptual framework which has guided this research.

Chapter 3 (*Regional and Community Profile*) details the regional context of the study through a discussion of the environmental, economic and health problems known to exist in the Aral Sea area. This is followed by geographic, population and economic profiles of the three study sites. Site selection, questionnaire development, data collection and data analysis are then discussed in Chapter 4 (*Research Design*).

Chapters 5 and 6 document the findings of the survey. Chapter 5 (*Results of Descriptive Analysis*) presents respondent's perceptions (health and environmental) of the environmental disaster and the prevalence of psychosocial impacts among the exposed population and the results of bivariate analysis (objectives 1, 2, 3 and 4). Chapter 6 (*Determinants of Psychosocial Impacts*) presents the results of the multivariate logistic regression analysis. This analysis was done in order to reveal the determinants (i.e. environmental perceptions, socio-demographic characteristics and social and community network characteristics) of psychosocial impacts (objective 4).

In the final chapter (*Conclusions*), the major findings of this research are reviewed followed by a discussion of the major substantive, theoretical and methodological contributions of this research. Finally, the thesis concludes with recommendations for the direction of future research in this field in general and in the Aral Sea region in particular.

CHAPTER 2:

RESEARCH CONTEXT AND LITERATURE REVIEW

2.1. INTRODUCTION

Past research related to the study of the health impacts of environmental exposures has primarily focused on the physical health effects (i.e. cancers or birth defects). Psychosocial impacts, on the other hand, involve:

> "(t)he complex of distress, dysfunction and disability manifested in a wide range of psychological, social and behavioural impacts in individuals, groups and communities as a consequence of actual or perceived environmental contamination." (Elliott, *et al.*,1993, p.791)

Psychosocial impacts associated with environmental exposures have, in recent years, become increasingly recognized as legitimate health impacts. This is demonstrated by the World Health Organization's (WHO) call to "identify psychological mechanisms of symptom formation and determine the prevalence, impact and outcomes of health beliefs concerning unexplained symptoms of environmental syndromes" (WHO,1999, p.9). The recent contamination events including the Chernobyl nuclear meltdown, the Seveso, Italy dioxin exposure and the Love Canal chemical waste exposures have, however, demonstrated the lack of systematic knowledge about the long term psychosocial consequences of major disasters (Lechat,1990). This lack of systematic knowledge is particularly evident in the context of multiple source, chronic disasters such as the one which exists today in the Aral Sea region. By examining the psychosocial impacts associated with the Aral Sea disaster, this research helps to fill this knowledge gap.

This chapter will review the literature which addresses the physical and psychosocial impacts of environmental contaminant exposures. This will be done firstly, by examining the literature on human impacts related to both natural and human induced environmental hazards. Secondly, health impacts related to environmental disasters will be considered through a discussion of the evolving definitions and models of health and the types of health impacts (i.e. physiological and psychosocial) which may result from an environmental disaster. In doing so, the conceptual framework used in this study will be discussed along with findings from past psychosocial impact studies. Finally, psychosocial impacts will be discussed within the context of the Aral Sea disaster. Several other bodies of literature including the development and health literature and environmental equity literature were also examined, however, they were not found to be specifically applicable to this research and are therefore not reviewed in this chapter.

2.2. HUMAN IMPACTS OF ENVIRONMENTAL DISASTERS

2.2.1. Disaster Research in Geography

A principal area of study within geography is the relationship between humans and their environment. It is within this context that the study of human impacts of environmental disasters has evolved. In the past, disaster research within geography has tended to focus on natural disasters such as floods, earthquakes, landslides and tornadoes (Couch and Kroll-Smith, 1994; White,1994). This research evolved principally out of the need to reduce the costs associated with natural disasters (i.e. economic and human) while maximizing the benefits of human uses of potentially disaster prone lands (i.e. floodplains

and earthquake prone areas) (White, 1994). However, following World War II, with the rapid expansion of the chemical industry and the development of nuclear power, human populations have become increasingly at risk from a wide range of human induced local and global technological hazards (Glantz,1999; Cutter,1994; Bertazzi,1989). As a result, disaster research has begun to focus its attention on technological disasters and their associated human impacts (e.g. Baxter,1997; Cutter,1994; White,1994; Bertazzi,1989). Unlike natural disasters which may be influenced by human factors (i.e. population density or building design), technological disasters "are caused by human technological intervention in the environment, and further technical human intervention is required to contain or abate the disaster agent itself" (Couch and Kroll-Smith,1994). Further distinctions are associated with the fact that, unlike natural disasters, technological disasters can be slow in developing and are more likely to persist than natural disasters (e.g., Love Canal, Aral Sea disaster). Also, the risk associated with technological disasters are typically surrounded by scientific uncertainty (Greenberg,1994; Bertazzi,1989; Frank,1988), whereas the risks associated with flooding or earthquakes is for the most part evident. Differences along these dimensions have been found to influence the response of the populations affected (Couch and Kroll-Smith,1994).

When technological disasters occur, impacts on humans can be severe and far reaching, ranging from the destruction of property and infrastructure, the ruin of livelihoods and large scale evacuations or migrations, to the occurrence of a wide variety of health problems (physiological and psychosocial) (Glantz,1999; Greenberg,1994; Bertazzi,1989). Although industrial accidents have typically resulted in fewer fatalities

and have smaller catastrophic potential compared to natural disasters (Cutter,1994), behavioural responses to industrial accidents have been found to lead to much more profound behavioural responses (Zeiger and Johnson,1994) suggesting that they may have a greater psychosocial impact potential. As an example, it has been found that there is a very limited response associated with pre-impact evacuation advisories for natural disasters, however, the response associated with industrial accidents (i.e. magnitude of the evacuation and the geographic extent of the evacuation shadow) is typically much greater (Zeiger and Johnson,1994). This variation in behavioural responses is explained by Slovic's findings (1987) that 'unknown risk' (i.e. hazards which are unobservable, unknown, new and delayed in their manifestation of harm) and 'dread risk' (i.e. perceived lack of control, dread, catastrophic potential and fatal consequences), which typify many technological hazards such as nuclear power and chemical technologies, are perceived as posing a greater threat than are risks associated with natural hazards.

Like disaster research in general, technological disaster research has also evolved. Past technological disaster research primarily focused on the hazardous event itself while ignoring the much larger and more complex political, social, economic and technological contexts within which the events occur (Cutter,1994). Today, it is not only recognized that a given hazardous event may potentially result in wide ranging impacts, but also that the social, economic, political and technological environments within which the hazard exists will play an important part in determining the likelihood, nature and severity of the event (Cutter,1994). For example, factors including economic status, education level, family support, community support, media coverage and emergency services have all been

found to play important roles in the level of psychosocial impacts experienced by populations in the vicinity of an industrial disaster (Lepore,1997; Evans *et al.*,1994; Bertazzi,1989; Edelstein,1988; Sorenson *et al.*,1987) (see Section 2.2.3).

Recent examples of several severe technological disasters include: the 1986 Chernobyl nuclear accident which exposed thousands of reactor workers and local residents to high levels of ionizing radiation, led to the evacuation of the region and is suspected to be the cause of many health problems including high rates of thyroid cancer amongst children (WHO,1995; Gale,1987); and the 1970's Love Canal landfill chemical exposures in Niagara Falls, New York which led to high levels of psychological and social stress (psychosocial impacts) in local residents due to the suspected links of toxic chemical exposures to birth defects and cancers, and finally to the evacuation of a large residential area (Bertazzi,1989; Janerich *et al.*,1981; Holden,1980). Often more difficult to determine are the human health impacts associated with 'global' environmental problems such as global warming or ozone depletion. However, many now attribute the rise in skin cancer in various countries to increased UV exposures associated with the depletion of the stratospheric ozone layer, and various cancers and other health problems are attributed to the bioaccumulation of toxic chemicals in humans and the entire food chain due to decades of industrial neglect (Environment Canada,1991).

Certainly the majority of the high profile industrial disasters which have received international media attention have occurred in the industrialized world (i.e. Seveso, Italy, Chernobyl and Three Mile Island), however, the frequency and severity of these types of disasters is reportedly increasing, and can be expected to further increase, in the

industrializing world (Cutter,1994; Bertazzi,1989; Everest,1986; Jeyaratnam,1985). With emerging patterns of industrialization, the modernization of agriculture, the application of imported or adopted technologies and products to potentially inappropriate contexts, the tightening of regulations in the developed world, and the subsequent movement of hazardous industries to nations where environmental laws are often less stringent, it is suspected that the developing world is "facing a season of 'disasters in development'"(Bertazzi,1989,p.87). A notable example of the culmination of these problems is the Union Carbide gas leak in Bhopal, India in 1984 (Chauhan,1996; Bertazzi,1989; Everest,1986; Zaidi,1985). Due to a variety of issues including inadequate worker training and the absence of 'standard' safety systems, an accident in a fertilizer producing factory released a cloud of poisonous chemicals into surrounding neighbourhoods leaving thousands dead and tens of thousands injured giving it the unenviable status of one of the worst chemical industrial disasters ever (Chauhan,1996; Everest,1986; Zaidi,1985). Such disasters are magnified further in developing countries like India, which are believed to be the most threatened by industrial or other environmental disasters, due to the lack the resources available to effectively react to minimize associated impacts (Bertazzi,1989; Everest,1986). With the exception of the above example, comparatively few studies have examined health effects of industrial disasters or other human induced environmental problems in developing nation contexts. By examining the health impacts of Aral Sea disaster in Karakalpakstan, this research begins to address this knowledge gap.

Different in nature than natural disasters or single-sourced, rapid-onset disasters such Chernobyl or Bhopal, are the world's many 'creeping environmental problems' (CEP's). Glantz (1999) defines these problems as "long-term, low-grade, and slow onset cumulative processes". Examples of CEP's include global warming, the destruction of the ozone layer and the destruction of the world's rainforests (Glantz,1999;1998). According to Glantz (1999), the common feature that all CEP's share is that the problem today does not appear to be much worse than it was yesterday and, as a result, societies typically do not recognize or acknowledge the full extent of the problems or their associated risks early on. As a result, little is typically done to address the problems or to minimize the risks associated with them. On the other hand, crises such as the Bhopal or Chernobyl disasters, which presented sudden step-like adverse changes in the environment, incited immediate reaction, albeit insufficient and too late (Chauhan,1996; WHO,1995; Gale,1987).

Several factors characterize society's delayed recognition and reaction to CEP's: Firstly, as has been discussed, CEP's are characterized by environmental degradation which often goes unnoticed in the short term. As a result, there is little motivation in the early stages for action to be taken to address the problem. Secondly, even when small changes are noticed, it is easier, cheaper and more common to interpret them as being a transformation and not a degradation. Finally, the cause of the CEP's are often shrouded in scientific uncertainty as a result of the complex environmental processes commonly involved. The debate about whether global warming is due to natural fluctuations or CO^2 emissions from automobiles and industry illustrates this point. As a result of these factors, societies (individuals, governments etc.) generally are not prompted to react to CEP's in

their early stages (Glantz,1999). "People fear change and, unless a crisis situation is perceived, they are not likely to change their behaviour in the absence of any incentive to do so" (Glantz,1999,p.6). These environmental 'transformations', however, often accumulate until a certain threshold level is crossed and "those previously imperceptible increments of change 'suddenly' appear as serious crises" (Glantz,1999,p.4). Important examples of several CEP's are readily seen in the Aral Sea region (Glantz,1999) (see Section 3.5).

There is little controversy in the literature about the causes or the severity of the environmental problems in the Aral Sea region. The literature collectively points a finger at the Soviet government's imposition of 'modern' cotton farming methods and the associated diversion of waters away from the Aral Sea for irrigation (for example, see Glantz,1999; Pearce,1995; Micklin,1994 and Smith,1991). As a result of river diversions for irrigation, the surface area of the sea has been reduced to less than half the area it covered in 1960 and the salinity of the sea water has risen from an almost drinkable 10 g/l to approximately 35g/l, a level comparable to that of the world's oceans (Glantz,1999; Glazovsky,1995; Micklin,1994 and 1991; Feshbach,1992). Another frequently reported problem is the salinization of agricultural land resulting from over irrigation as well as the wind transport of salts from the exposed sea bed (for example, see Micklin,1994; Smith,1991). Glazovsky (1995), reported that an estimated 377,000 hectares out of 485,000 hectares of irrigated land in Karakalpakstan are salinized to a moderate or extreme degree, severely reducing agricultural productivity. Furthermore, due to decades of chemical dependent agricultural practices, high levels of pesticides, defoliants and

fertilizers have been found to be present in the air, land, water and food chain (see for example, O'Hara,2000; Glantz,1999; Krutov,1999; Glazovsky,1995; Smith,1991). According to Glazovsky (1995), up to 54 kg/h of pesticides are used in the Aral Sea basin compared to an average of 3 kg/h in the former USSR. In a recent study, O'Hara *et al.* (2000) found that airborne dust deposition rates in the region are among the highest in the world. Dust was commonly found to have high concentrations of the organophosphate phosalone, and further research is expected to demonstrate that concentrations of cadmium and lead are also high (for a detailed description of the region's environmental problems see Section 3.5).

The continued development of the Aral Sea CEP since the 1950's and the absence of appropriate remediation efforts, according to Glantz (1999), can be attributed to a variety of factors typical of CEP's: firstly, the problems started slowly and occurred over a period of decades making them initially easy to ignore; secondly, a small reduction in the size of the sea could be read as a minor transformation and not degradation, and; finally, as the sea was historically prone to natural fluctuations in size, early changes could be interpreted as such and not due to the diversion of river waters into irrigation systems (i.e. scientific uncertainty). The relatively minor drop in the Aral Sea's level of between 10 to 20 cm per year in the early 1960's (Bjorkland, *et al.*,1998), although noticeable, was easily written off as natural or simply disregarded as being a small price to pay for the economic benefits of the cotton agricultural boom – thus the attitude of 'business as usual' was maintained. However, these changes began to mount and to accelerate such that by the early 1980's the level of the sea was dropping by almost a meter per year (Bjorkland,

et al.,1998). Unfortunately, economic dependence on cotton and a perception that the environmental problems are largely irreversible has resulted in continued inaction. Today the disappearance of the Aral Sea along with an accompanying host of other environmental problems has become one of the major human-induced environmental disasters of the 20th century (Glantz,1999; Saiko,1994), a disaster which is commonly blamed for the many health problems faced by the region's population (e.g. Elpiner,1999; Glantz,1999; Glazovsky,1995; Smith,1991). To date, however, few studies have examined this health/environment relationship.

2.2.2. Health and the Environment

The relationship between humans and the environment is a primary area of study in the field of human geography and it is within this context that health geography investigates the health and environment relationship. In doing so, health geographers have recognized the need to go outside the body and to move beyond the traditional biomedical health perspective (Elliott,1999; Jones and Moon,1987) – a perspective which proposes that health is merely the absence of disease and illness (Curtis and Taket,1996) – and by doing so have contributed to the development of a broader social and environmental perspective on health (Jones and Moon,1987). This transition was seen with the World Health Organization's 1948 adoption of a definition of health which asserts that health is "a state of complete physical, mental, and social well-being". The adoption of this definition further set the stage for the development of health models which emphasize not only multiple determinants of health but also the role of social, cultural, political and

economic environments in shaping health and well-being (White,1981). With the further recognition of the important roles that lifestyle and biology play in determining health, the WHO now defines health as "a resource for everyday living which allows individuals to manage, cope with, and even change their environments" (WHO,1986). Implicit within this health perspective is the recognition of the role of psychosocial health as a component of overall health (WHO,1999).

To attempt to understand psychosocial impacts in the context of the Aral Sea disaster, this research required a health model which went beyond the traditional biomedical perspective. The model most appropriate for doing this was the socio-ecological model which was developed out of the perspective that illness consists of subjectively defined illness states as well as disease processes. Where disease processes are biological, illness states are behavioural changes associated with disease or the perception that disease is present (White, 1981). This model is open to the possibility that psychosocial impacts may occur based on perceptions of contaminate exposure which "does not minimize the importance of subjective experience, including the experience of stress" (Wakefield,1998,p.8).

2.2.2.1. Environment and Health Research

As natural disasters have been the focus of most environmental hazards research, physical health impacts have been the focus of most environment and health research. There is a large body of literature examining the physical health impacts of technological disasters of which some the most well known are related to what Bertazzi (1989) refers to

as overt disasters[2]. Examples of overt disasters include the Union Carbide gas leak in Bhopal, India and the Chernobyl nuclear accident in Belarus.

In Bhopal in 1984, the leakage of 40 tons of methyl isocynate (MIC) gas from a pesticide plant left over 3000 people dead of pulmonary edema within three days, and another 20,000 people with long-term lung and eye ailments (Varma and Guest, 1993; Everest,1986; Zaidi,1985). In this case the links between the disaster and physical health impacts were readily demonstrated by both epidemiologic and experimental data (Varma and Guest,1993; Zaidi,1986). The Chernobyl nuclear accident which occurred in 1986 killed 30 individuals at the reactor site, caused the hospitalization of hundreds of others, and exposed five million people to ionizing radiation caused by fallout of radioactive nuclides (WHO,1995). Again, due in part to the severity and overt nature of the disaster, the known health effects associated with radiation exposure, and good exposure measurements, it has been possible to demonstrate strong exposure/health relationships. Immediate health consequences from the disaster included acute radiation syndrome which affected hundreds and killed 31 within a year of the accident. Eight years after the accident, there has been a reported increase in childhood thyroid cancer to about 100 times the pre-accident levels in the Gomel Oblast of Belarus, the area which was in the direct path of the initial cloud of radioactive fallout (WHO,1995; Bertazzi,1989).

Often, demonstrating the health impacts of an environmental exposure are much less clear cut than in the cases discussed above. Even in a major overt exposure situation such as the 1976 Seveso, Italy, dioxin spill where several square kilometers of populated countryside were contaminated, the link between the exposures and physical health effects

[2] There is ambiguity about the source of the environmental release or the potential or actual harm.

remains unclear (Bertazzi,1989). Reported findings suggest that mortality for several cancers was elevated in the exposed vs. control group, however, issues including small numbers of reported cases adds considerable uncertainty to these findings (Bertazzi, *et al.* 1989). The findings did however demonstrate significantly higher rates of cardiovascular mortality in the exposed group. Given that dioxin exposure is not believed to be associated with cardiovascular illness, the author proposed the hypothesis that individuals experienced sufficient stress for it to precipitate conditions of preexisting cardiovascular disease (Bertazzi,1989).

When the level and duration of exposures are not clear, multiple contaminants are involved, and a myriad of other potentially health influencing economic and social problems exist, determining specific health impacts becomes even more uncertain. To examine these issues in the context of the Aral Sea region, a systematic search of the health literature was performed on the MEDLINE database. Commonly used Roman spellings of regional place names (e.g. Uzbekistan, Karakalpakstan, Kazakhstan, Turkmenistan and Aral Sea) covering the past 30 years were searched as subject and textwords. Several reports and journal articles were also located in the MSF library in Tashkent. All studies published in English were obtained and reviewed. There are many studies published in Russian that allude to the ecological or health crises. Many of these articles have been obtained and are in the process of translation and appraisal by MSF staff in Tashkent.

There is little debate in the health literature about the seriousness of health problems faced by much of the Aral Sea region's population (Elpiner,1999; Frost,1997;

Reynolds,1996; Glazovsky,1995; Smith,1991). According to Glazovsky (1995), the severity of health problems in the region are reflected in a variety of indicators including high infant mortality rates which are reported to be 110/1000 in parts of Karakalpakstan. High incidences of renal diseases, Tuberculosis, typhoid, acute respiratory illness and diarrheal disease are also frequently reported to be amongst the many health problems that the region faces today (Elpiner,1999; Glazovsky,1995; Smith,1991). Although studies claim associations between health problems and the continuing deterioration of the environment, only descriptive evidence is provided to back this claim up. Studies by Giebel *et al.* (1998); Frost (1997), Morse (1994) and DHS (1996), demonstrated that some of the highest rates of anemia in the world are found amongst women and children in Karakalpakstan. Morse (1994), for example, found that 80% of children between the ages of 1 and 3 living in Muynak, Karakalpakstan, were anemic. The finding by DHS (1996) that anemia rates are high throughout Uzbekistan suggest, however, that anemia may not be directly linked to the Aral Sea environmental problems but rather other factors.

In an effort to examine links between the region's environmental problems and health problems, Jensen, *et al.* (1997) examined blood levels of compounds including PCB and DDT in Kazakh children and found that levels were significantly higher than in children elsewhere. Hooper *et al.* (1997), in a separate study, detected similar chemicals as well as organochlorine residues in breast milk. The high body burdens of chemicals found are consistent with the ongoing DDT and other chemical exposures in the population. The impact that this has had on the population is, however, unclear.

is clearly demonstrated that much more work is required to between the many environmental problems and health problems region. This work, however, presents many challenges. Firstly, data exists and there are few resources available to carry out the re are a wide range of environmental contaminants which may inders, thus pinpointing the effect of any particular contaminate For example, the population is facing a wide range of social and luding shortages of healthy foods, warm clothes and proper Glantz,1999) and the deterioration of local health care services (Stevenson,1998), all of which may impact on health and are thus important potential confounders which must be considered carefully when examining environment and health relationships. Finally, given that physical health outcomes may result from the psychosocial impacts of real or perceived exposures (Bertazzi,1989), the relationship between exposures and outcomes becomes even more confused.

2.2.3. Psychosocial Health Research

It is only recently that the psychosocial impacts associated with industrial accidents and contaminate exposures have begun to receive attention in the research literature as demonstrated by the growing body of research in this field (see for example Elliott, *et al.*,1998; Havenaar,1996; Baum and Flemming,1993; Bertazzi *et al.*,1989; Edelstein,1988; Sorenson *et al.*,1987; Mellick and Logue,1986). Examples of the results of these studies demonstrate the complexity and seriousness of impacts associated with

real or perceived contaminate exposures. Havenaar, for example, in his 1996 study of the Chernobyl disaster found high levels of emotional distress and psychiatric disorders combined with higher risks of mental health problems in residents living in the affected region. For example, using the General Health Questionnaire (Goldberg,1972), 65% of respondents reported scores above the GHQ normal cut-point which indicates a probable case of emotional distress. Using the Somatic Symptom Checklist of the Symptom Checklist-90 (Derogatis,1973), Baum *et al.* (1983a) examined the pshychosocial impacts associated with living in close proximity to Three Mile Island following a nuclear accident. Here, high levels of emotional distress were also found as demonstrated by the mean Symptom Checklist score of 0.55. Control group mean scores, on the other hand, were much lower – mean scores of people living 20 miles away from TMI were 0.24, people living near a coal-fired power plant were 0.29, and people living near an undamaged nuclear plant were 0.30. Evelvated blood pressure and decrements in task performance was also frequently reported. And Bertazzi, in a 10 year mortality study of a major dioxin spill in Seveso, Italy, found that exposed individuals demonstrated significantly higher rates of cardiovascular mortality. Given that dioxin exposure is not believed to be associated with cardiovascular illness it was concluded that there are sufficient scientific grounds to "...support an association between cardiovascular death (particularly in the form of precipitation of preexisting ill health) and stress experience" (Bertazzi,1989,p.93).

Despite the growing body of research on psychosocial impacts related to environmental exposures, most research has only taken place within European or North

American contexts. Also, until now, no studies have examined psychosocial impacts associated with multi-sourced CEP's in a developing world context as in the case of the Aral Sea disaster (Glantz,1999, Couch and Kroll-Smith,1994). Attempting to fill this gap while moving beyond the biomedical research being carried out in the region today, this research focuses on the prevalence, awareness and determinants of the psychosocial impacts.

The theoretical framework that has been used to examine psychosocial impacts is based on works related to environmental stress and coping. Baum *et al.* (1982,p.15) define environmental stress as: "a process by which environmental events or forces, called stressors, threaten an organism's existence and well being and by which the organism responds to this threat." The reaction to stress involves symptoms of fear, anxiety and anger, as well as the process of perceiving the threat, coping with it, and adapting to it (Baum *et al.*,1982).

Research on environmental stress derives from the physiological effects models as well as the social and psychological effects models (Taylor *et al.*,1989). The physiological model proposes that an environmental disruption (stressor) leads to an alarm reaction (stress) which leads to a stage of resistance (adaptive coping response) and eventual exhaustion. Prolonged or repeated stress, or the responses it produces "are known to have deleterious effects on a number of biological systems and to give rise to a number of illnesses" (Evans,1994,p.13).

More appropriate to the study of psychosocial effects of exposure are the psychological models of environmental stress. The psychological model of stress

proposed by Lazarus and Folkman (1984) is a useful two stage model for understanding human responses to environmental stress. In the first stage, *primary appraisal*, the individual appraises the stressor and makes judgements about how threatening, harmful or challenging it is (risk perception). If a situation is judged to be stressful then *secondary appraisals* are made which involve appraisals of coping resources whereby the individual searches for coping responses that will reduce the threat. There are two potential coping responses. Firstly, the individual may take direct action (problem focused coping) by trying to "directly manipulate or alter his or her relationship to the stressful situation" (Baum *et al.*,1982,p.20). For example, changing their setting, fleeing, or removing themselves from the physical presence of the stressor. Secondly, if the individual cannot take direct action, then he/she will accommodate the stressful situation by altering his/her 'internal environment' (emotion focused coping) by, for example, learning to relax, creating or learning psychological defense mechanisms or taking drugs (Baum *et al.*,1982; Edelstein,1987). Following this, the individual will reappraise the situation with altered perceptions or coping resources (Lazarus and Folkman, 1984).

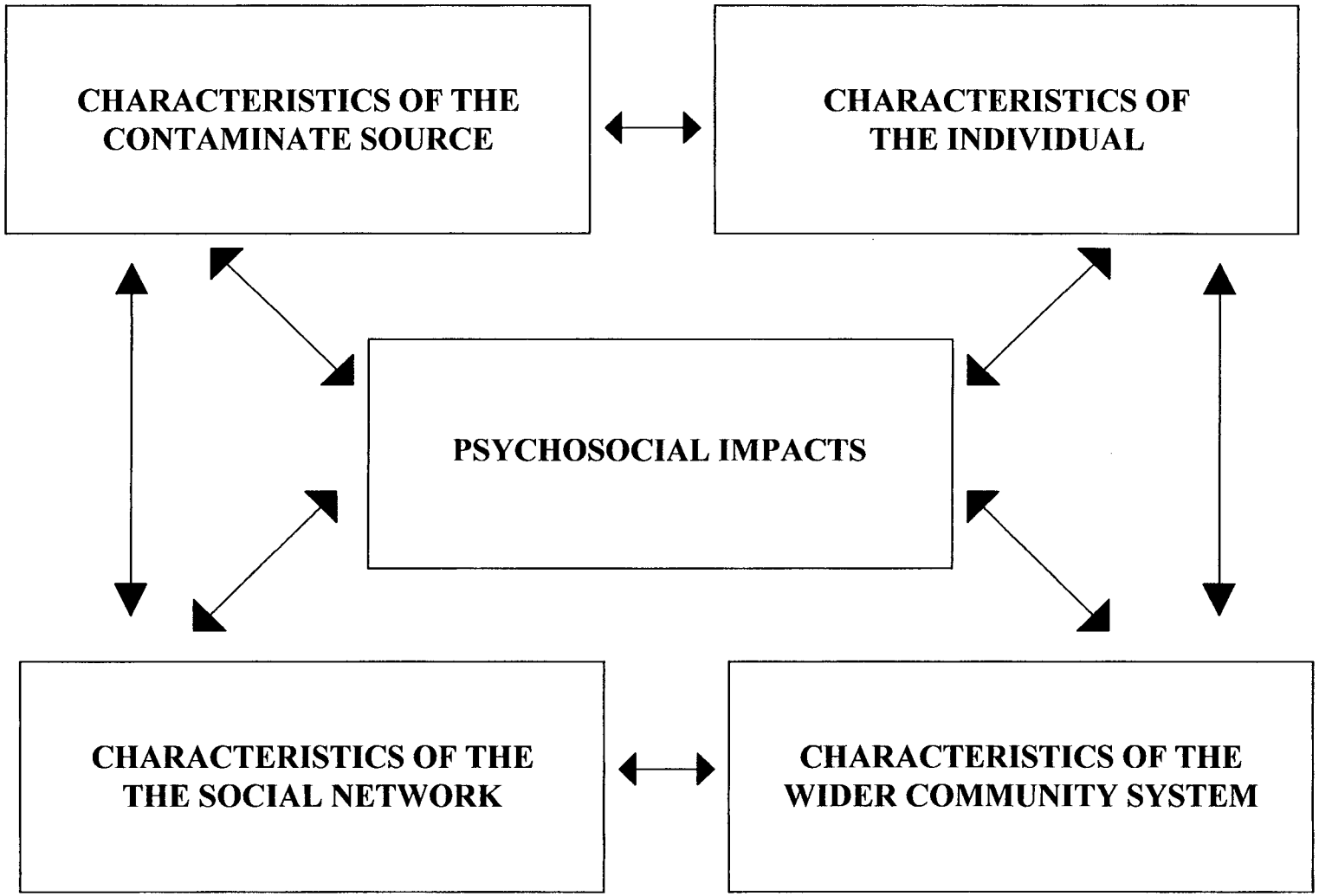
2.2.4. Conceptual Framework

Given the reported seriousness of the environmental situation in the Aral Sea region (e.g. O'Hara,2000; Glantz,1999, Glazovsky,1995) combined with the equally serious physical health problems faced by the population (e.g. Elpiner,1999; Frost,1997; Glazovsky,1995), it was suspected that the population has also been experiencing serious environmental stress and psychosocial impacts (Upshur,1998). However, to comprehend

the nature, intensity and pervasiveness of these impacts, an understanding of factors which determine them is required.

The experience of environmental stress, the choice of a particular coping response, and the incidence of psychosocial impacts are dependent on several mediating factors (Figure 2.1) as defined by numerous authors (e.g. Lepore,1997; Havenaar,1996; Elliott *et al.*,1993; Bertazzi,1989; Edelstein,1988). The first of these factors is the *characteristics of the contaminant source*. It has been suggested that the psychosocial impacts of an exposure may be greater if the contaminate is invisible or if it is detectable through other senses; if the individual has had prior exposure to the stressor; if severity and acuteness of the exposure increases; or if there is no economic benefit related to it (Taylor *et al.*,1994; Sorenson, *et al.*,1987). Proximity of residence to the contaminate source has also been found to play an important role in determining the experience of psychosocial impacts whereby living closer to the contaminate source leads to increased impacts (Elliott and Taylor,1996). Proximity however, was not found to be an important contributor to impacts by Richardson *et al.* (1987) in a study of the effects of living in close poximity to a nuclear power plant, nor by Horowitz and Stefanko in their study of living near a toxic-waste landfill site.

FIGURE 2.1: CONCEPTUAL FRAMEWORK



The second mediating factor determining psychosocial impacts of environmental stress is *the characteristics of the individual.* It has been found, for example, that a wide variety of factors including gender, age, education, income, maternal education, level of family stability, birth weight and cultural characteristics have important mediating effects (Elliott,1998; Havenaar,1996; Evans *et al.*,1994; Edelstein,1988). Many conflicting findings have emerged in the literature, however, as to how these factors affect psychosocial impacts. Havenaar, (1996) in his study of the psychological effects of the Chernobyl accident found that psychological effects were higher for those who were female, had higher levels of education or were older. Edelstein (1988), however, in his study of the Love Canal, found that increased age resulted in increased denial of the environmental problems and decreased psychosocial impacts. Horowitz and Stefanko (1989), in a study of living in close proximity to a toxic landfill, similarly found a decrease in the risk of psychosocial impacts as age increases, and higher risks from women than for men. Elliott (1998), in her study of the psychosocial impacts of living near solid waste incinerators, and Gibbs (1983), in her study of the psychological impacts of living near Love Canal, both found that age and gender had little affect on psychosocial impacts.

In a study of the mental health effects of the TMI nuclear reactor restart, individuals with young children were found to have increased psychosocial effects as compared to those without (Dew *et al.*1987). Havenaar and van den Brink (1997), having a similar finding explain this by suggesting that individuals with young children are libel to carry the threat of a disaster for themselves as well as for their children, thus increasing

their overall stress burden. It is also believed that individuals with a low degree of self esteem or control over a situation (real or perceived) will experience greater psychosocial effects than individuals who have some control over the situation (real or perceived) (Dalgard and Haheim,1998; Evans,1994; Pearlin and Aneshensel,1989). Character traits such as being a 'worrier' or 'nonworrier' have also been found to play an important mediating role (Compas *et al.*1997).

Thirdly, *the characteristics of the social network* are believed to further contribute to the choice of coping techniques an individual makes and in turn affects the degree of psychosocial effects they experience (Dalgard and Haheim,1998; Elliott,1998; Evans *et al.*,1994; Pearlin and Aneshensel,1989; Bertazzi,1989; Edelstein,1988). For example, individuals who participate in community organizations or live in a supportive family environment may react more with problem focus coping techniques as opposed to emotion focused coping techniques (Edelstein,1988). The buffer effect of social support has been demonstrated by Bertazzi (1989) in a study on the impacts of the Seveso industrial accident, where he concluded that increased social support was negatively correlated to psychosocial impacts. Furthermore, it has been suggested that individuals living in a supportive social environment benefit from greater immunoconfidence and thus experience few stress induced physical health problems (Lepore,1997).

The final mediating factor of psychosocial effects is *the characteristics of the wider community system.* Community system characteristics such as the nature of institutions, social and health services and media all help to determine how an individual copes with an environmental stressor (Elliott *et al.*,1993; Taylor *et al.*,1991;

Edelstein,1988). Sorenson *et al.* (1987), in an examination of the psychosocial impacts of TMI, concluded that the way the emergency services handled the incident played a role in determining impacts (i.e. a poor emergency response elevates impacts). Likewise, the media coverage that a disaster receives (Edelstein,1988) or the quantity and quality of information available (Weisaeth,1991) has been shown to greatly affect risk perceptions and psychosocial impacts.

Prior to this research, little information related to the aforementioned mediating factors in the Karakalpak context existed. Although many studies have examined the environmental problems (e.g. Glantz,1999; Glazovsky,1995; Micklin,1994; Smith,1991), only recently have limited attempts been made to determine actual environmental exposures (i.e. O'hara *et al.* 2000) and no studies have examined perceptions of the contaminate source. With regards to remaining mediating factors (i.e. individual, social network and community system characteristics) even less information existed. Data on sociodemographic characteristics (i.e. ethnicity, religion, education, occupation etc.) was found in a report done by DHS (1996), and data on diet, healthcare preferences and hygiene practices came out of a report on the findings of a Knowledge, Attitudes and Practices survey (Falzon,1998) done for Médecins Sans Frontières. This information was of limited use for this research beyond providing sociodemographic background information on which the representativeness of this study's sample could be tested. In the context of the Aral Sea region, considerably more information was needed regarding the relative influence of each of the psychosocial impact mediating factors previously discussed. This research has attempted to address this need.

2.3. SUMMARY

This chapter began with a general discussion of the human impacts of natural and industrial environmental disasters along with their increasing relevance in the industrializing world, demonstrated through the use of such examples as the Bhopal Union Carbide disaster. The concept of 'creeping environmental problems' (CEP's), a concept particularly relevant to the case of the Aral Sea disaster, was then introduced along with the characteristics which define and typically determine society's inaction to reduce, stop or reverse their development. Following this was a discussion of the evolving models and definitions of health and the physical and psychosocial health impacts associated with industrial disasters. In doing this, the relevant literature on health impacts was examined. Although a growing body of research has been done on the psychosocial impacts of environmental disasters, the literature revealed that studies have been predominately focused on acute single source contamination events in the context of industrialized nations. Until now, no studies have examined psychosocial impacts within a developing world, multi-sourced, CEP context as exists today in the Aral Sea region.

The relationship between perceived risks and psychosocial impacts was discussed using a conceptual framework proposed by Taylor, *et al.* (1991). Taylor suggests that psychosocial impacts are determined by four sets of concomitantly interacting characteristics: the contaminate source, the individual, the social network and the community system. A review of the literature demonstrated the relationship of these characteristics to psychosocial outcomes. The conceptual framework and information needs were then discussed within the Karakalpakstan context.

The following chapter, *Regional and Community Profile*, provides a general description of the Aral Sea Region, Uzbekistan and Karakalpakstan along with the environmental and health problems occurring there. Profiles of the three study communities are also given.

CHAPTER 3:

REGIONAL AND COMMUNITY PROFILE

3.1. INTRODUCTION

The purpose of this chapter is to provide a profile of the Aral Sea region and the study communities. This will be done in order to place this research within its historical, cultural, demographic, economic and environmental contexts and to provide possible baseline information related to psychosocial impacts. The profile will cover the entire Aral Sea region generally, a region which includes parts of Turkmenistan, Kazakhstan, Uzbekistan, and the semi-autonomous Republic of Karakalpakstan. The focus, however, will be placed on the Republic of Karakalpakstan where this research took place: the area considered to be most affected by the Aral Sea disaster (Saiko,1994). Following this will be a description of the three study communities: Shumanay, Kungrad and Muynak. Also within this chapter, the significance of the region to the study of psychosocial impacts and, in turn, the importance of the study of psychosocial impacts to the region will be demonstrated.

3.2. UZBEKISTAN AND KARAKALPAKSTAN

Located in Central Asia between the Amu Dar'ya and Syr Dar'ya Rivers, Uzbekistan is bordered to the north by Kazakhstan, to the south and east by Turkmenistan, Afganistan and Tadjikistan, and to the east by Kyrgyzstan. (Figure 3.1). To the east the

Figure 3.1: Location map.

terrain is mountainous, with plains and desert to the west. The Republic of Karakalpakstan is the far northwestern oblast (akin to a province or state) of Uzbekistan. Karakalpakstan, occupying approximately 37% of Uzbekistan's 447,000 km^2, is bordered to the north by Kazakhstan and to the south by Turkmenistan. Determining Karakalpakstan's southern border, the Amu Dar'ya flows northward from Nukus eventually turning into a delta whose channel once reached the Aral Sea. The northernmost area of Karakalpakstan, once covered by the waters of the Aral Sea, is today occupied by a desert wasteland.

Partially occupied by Russia since the mid 19^{th} century and part of the USSR since 1924, the economic, political and social structures of Uzbekistan have been heavily influenced by the Russians. On the one hand, it is claimed that the Russian influence is responsible for the republic's industrial development, high level of education, low levels of illiteracy, women's rights, Western health care system, and skilled labour force (DHS,1997). On the other hand, Russia's policies are commonly perceived as having been colonial in nature, leading to the exploitation of the region and the devastation of its environment (Feshbach and Friendly,1992). Since the 1991 breakup of the Soviet Union and Uzbekistan's subsequent independence, any of the once positive aspects of the Soviet system have disappeared. Over the past decade, Uzbekistan has been facing economic decline, increased corruption and the collapse of many social services in its transition to a market economy (DHS,1997; Glazovsky,1995;). At the same time the environmental legacy of the USSR remains and conditions continue to deteriorate as is demonstrated by the further retreat of the Aral Sea, the increased numbers of dust storms, and the growing

shortage of clean drinking water (Altan,1995; Glazovsky,1995; Micklin,1994; Smith,1994; Murzayev,1992).

3.3. ECONOMY

Although rich in mineral resources, and oil and gas, Uzbekistan is considered to be one of the poorest states of the former Soviet Union (Upshur,1998) with an economy driven to a large extent by the agricultural output of the country's predominately rural population (Glazovsky,1995; Small,1997). Traditionally growing a range of grains, fruits and vegetables, Uzbekistan's farmers were required during the Soviet era to devote 85-90% of all arable land to cotton production as part of the Soviet plan to make the region the biggest exporter of cotton in the world. This had a disastrous effect on other sectors of agriculture and "(a)s a result, food production in the Aral Sea coastal region is far below the rates required for good nutrition" (Elpiner,1999). In 1990, cotton agriculture occupied 75% of all of Uzbekistan's agricultural lands (McKee and Curtin,1996). Apparently, the government is reconsidering this policy and is promoting the development of other agricultural sectors such as livestock farming and the production of grains, fruits and vegetables (DHS,1997).

Karakalpakstan, considered one of the poorest regions of Uzbekistan, has possibly suffered the most from the Soviet agricultural policies. The cotton agricultural system has contributed to many serious environmental problems which in turn have had economic impacts. Like other republics in the region, inappropriate agricultural policies have led to decreasing agricultural productivity due to often severe soil salinization, nutrient

depletion, and an increased need for large quantities of often expensive fertilizers and agricultural chemicals (Bjorkland,1999; McKee and Curtin,1996; Glazovsky,1995; Feshbach and Friendly,1992; Kotlyakov,1992). Karakalpakstan along with southern Kazakhstan, also suffered from the collapse of a once huge fishing industry. This has occurred due to the intense use of downstream flow for irrigation and the subsequent retreat, contamination and salinization of the Aral Sea (Glantz,1999; McKee and Curtin,1996; Glazovsky,1995; Micklin,1994;). In 1983 the factory employed 1000 people to cover day and night shifts, all year round. The cannery remains operational, however, only as a result of shipments of fish coming from other areas of the Soviet Union or from the lakes around Muynak. In 1997, 600 people were employed to work day shifts between January to March with regular stoppages commonly occurring due to shortages of fish as well as tins and oil for canning (cannery manager, personal communication).

3.4. POPULATION

With a population of approximately 23 million people, Uzbekistan is one of the most populous of the Central Asian countries. Karakalpakstan's population of 1.6 million represents about 6% of this total. Within Karakalpakstan's population considerable ethnic variation exists with Karakalpaks (32.3%), Uzbeks (32.8%) and Kazakhs (26.7%) making up the majority of the population and other ethnic groups such as Russians, Turkmens and Koreans making up the rest (8%). Karakalpaks and Kazakhs are concentrated in the central and Northern rayons (districts) and Uzbeks predominate in the southern ones (Frost,1997). Typically the Russians are concentrated in the capital, Nukus. The

population of Karakalpakstan, like that of Uzbekistan, is predominately Muslim (Sunni) although, during the Soviet era, religion played a relatively small roll in society. However, in recent years, with the breakup of the Soviet Union, Islam has begun to re-emerge as an important social and political influence (McKee and Curtin,1996; Hale,1994).

Compared to Uzbekistan's average population density of 47 persons/km^2, Karakalpakstan is sparsely populated having an average density of only 8 persons/km^2, most of which is concentrated along the Amu Dar'ya, in Nukus, Tahitash and Khodjely urban areas, and in the rural southern areas near Khorezm oblast. Much of the rest of Karakalpakstan's territory is uninhabited desert (Frost,1997). The population of Karakalpakstan and Uzbekistan has been growing rapidly in recent years. In Uzbekistan, for example, the population has tripled in size between 1959 and 1989 and today has one of the fastest growing populations in Central Asia with a mean annual growth rate of 2.85% (Glazovsky,1995; Upshur,1998). The low average age of 23.9 years (43% are under the age of 15) (McKee and Curtin,1996) has resulted in a high birth rate (25.8 births per 1,000 population) and a low death rate (5.8 deaths per 1,000 population) (Government of Uzbekistan)[3]. With an average annual population growth rate of approximately 2.5 percent, the population can be expected to double in the next 33 years (DHS,1997). Karakalpakstan is remarkably similar to the rest of Uzbekistan in this regard (Small,1997). The average life expectancy for Karakalpakstan is 64.8 years, considerably lower than the average for other states inside or outside of the region (Table 3.1). The result of such a

[3] it should be noted that many health statistics or for the region are either estimates or questionable government data, neither of which necessarily reflect the true situation

fast growing, young and highly dependent (i.e. outside the working age range) population has been several decades of serious social and economic decay along with a wide variety of other problems that are typically associated with rapid population growth. (Glazovsky,1995; Small,1997).

Table 3.1
Comparative data on average life expectancy (years)[1]

Location	*Males*	*Females*
Karakalpakstan[2]	64.8[3]	
Uzbekistan	64	71
Kazakhstan	63	72
Russia	61	73
Iran	69	70
Turkey	67	72
Canada	76	82
Japan	77	83

[1] World Health Organization, 1999
[2] Elpiner,1999
[3] data for life expectancy for both males and females

3.5. THE ENVIRONMENT

Possibly the greatest problems facing the region today are related to the environmental legacy of cotton monoculture practices. Beginning in the early 1950's with the Soviet plan to make Central Asia the world's biggest producer of cotton, increasingly large amounts of water began to be diverted from the Syr Dar'ya and Amu Dar'ya for irrigation. Between 1960 and 1990 the area of irrigated lands almost doubled in the Aral basin (Table 3.2). To do this, irrigation canals which transport water thousands of

kilometers over sandy soils, were constructed without linings or adequate drainage. In many cases, instead of draining irrigation run-off back into the rivers, water was simply diverted into depressions in the desert (Bjorkland,1999).

Table 3.2
Irrigated lands in the Aral Sea Basin (x1000 ha)

Political Unit	*1960*	*1970*	*1980*	*1990*
Uzbekistan	2570	2750	3527	4171
Karakalpakstan	196	250	350	490
Tadjikistan	427	524	627	703
Turkmenistan	496	670	960	1350
Kyrgyzstan	313	338	378	420
Kazakhstan[1]	305	373	635	760
Basin Total	4111	4655	6127	7403

[1]includes only Chimkent and Kyzyl-Orda Oblasts

Source: Zonn,1999

As a result of these irrigation practices, the amount of water reaching the sea from the Amu Dar'ya and Syr Dar'ya went from 40 km^3 in 1960 to nothing in 1980 (Table 3.3). The Aral Sea, once the fourth largest inland body of water with an area of 67 900 km^2, began to retreat. By 1994 its size had decreased to 33 100 km^2 , less than half its 1960 size, and one quarter its volume. Consequently, the mineral content has gone from a brackish 10 g/l to up to 40 g/l making the sea uninhabitable for most fish, wildlife and other organisms. Today, two of the once twenty commercially viable fish species are still able to survive in the sea, however, they now inhabit a sea more than 100 kilometers away from any fishing ports (Glazovsky,1995). Since the late 1980's, the sea has been split into

a 'large' and 'small' sea which, when combined today, are estimated at being approximately 25,000 km^2 (Glantz,1999; Bjorkland,1999; Glazovsky,1995; Micklin, 1994; Smith,1994).

Table 3.3
Hydrologic parameters of the Aral Sea from 1960 to 1994

Year	Sea level (m a s l)	Sea area ('000s km^2)	Sea volume (km^3)	Mineral content (g/l)	Total river run-off into sea (km^3)
1960	53.3	67.9	1 090	10.0	40
1965	52.5	63.9	1 030	10.5	31
1970	51.6	60.4	970	11.1	33
1975	49.4	57.2	840	13.7	11
1980	46.2	52.4	670	16.5	0
1985	42.0	44.4	470	23.5	0
1989	39.0	37.0	340	28.0	5
1994[1]	36.9	33.1	277	34.0 – 40.0[2]	-

[1]Bortnik, 1999
[2]Krutov, 1999

Source: Bjorkland, *et al*, 1998

With the disappearance of the Aral Sea have come many associated environmental impacts. The sea once had important climatic, hydrological, and hydrogeological effects on the surrounding area, however, since the sea has receded these effects have been reduced. For example, an increase in continentinality (the removal of the sea's temperature moderating effect) in the surrounding region has been reported such that today the winters are colder and summers are hotter. This has contributed to making an already very extreme climate more so, which has had various negative impacts including a reduction in agricultural productivity (Smith,1994; Kotlyakov,1992). Also, the retreat of the sea has exposed tens of thousands of square kilometers of sea bed to desert winds

which has led to an increase in dust storms; storms which carry large quantities of salt as well as a variety of chemical residues originating from the agricultural industry. From these storms it is estimated that, in 1988, an average hectare of agricultural land received more than ½ a tonne of airborne salt (McKee and Curtin,1996). Associated impacts from this include a rise in the salt content of soils and a subsequent fall in agricultural production, the destruction of natural vegetation, as well as a series of possible health impacts from inhaling salts, chemical residues and dust (Elpiner,1999; McKee and Curtin, 1996; Micklin,1994; Feshbach and Friendly,1992; Smith,1991).

The agricultural practices that are depriving the Aral Sea of its water, have also resulted in a wide variety of other environmental problems. For example, over-irrigation has led to a significant rise in the water table in many areas contributing to the problem of crop waterlogging. The rise in the water table has also led to the deposition of dissolved salts and other minerals on the soil surface resulting in widespread salinization of agricultural lands. Today it is estimated that 377,000 ha out of 485,000 hectares of irrigated land in Karakalpakstan are salinized (Glazovsky,1995). Estimates suggest that agricultural production is 30% lower in Uzbekistan as a direct result of this problem (Glazovsky,1995). As a consequence of salinization and low rates of crop rotation, soil fertility has decreased and crops have become less pest-resistant. This situation has led to even more irrigation to flush out salts from the soil and increased use of fertilizers and pesticides to improve productivity (Smith,1991). Fertilizer use in Uzbekistan increased from an average of 151.5 kg/h to 297 kg/h between 1965 and 1988 exceeding the average for the USSR by 2 ½ times. Similarly, the use of agricultural chemicals (pesticide and

herbicides and defoliants) which include DDT and other human carcinogens are used in large quantities. Smith (1991), calculated that, in 1980, 44% of all agricultural chemicals used in the USSR were applied in Uzbekistan, thirty times more than the national average. The use of agricultural chemicals has, in recent years, declined (Orlovsky,1999). Although a positive change in trends, it is unfortunately due to economic problems rather than increased environmental awareness (Krutov,1999)

From the leaching of agricultural chemicals into the water table, and from agricultural run-off, large quantities of chemicals and salts have contaminated river water and groundwater. Combined with the discharge of untreated sewage and industrial wastes, the river water, having concentrations of nitrates, phosphates, lead and pesticides well above permissible standards (Smith,1991), is considered unfit for humans or even livestock. Despite this, two thirds of the drinking water drawn by Karakalpak residents living along the lower reaches of the Amu Dar'ya comes from this source (McKee and Curtin,1996). These chemicals are also finding their way into humans and other animals from windstorms which blow across the exposed sea bed, transporting large quantities of salt and agricultural chemicals through the air they breath (McKee and Curtin,1996; Micklin,1994).

Although many plans have been devised over the past several decades to combat the growing environmental problems in the region, none have been realized. Infeasible plans to refill the sea by diverting Siberian rivers over thousands of kilometers or by blowing up glaciers in the Hindu Kush which feed the Amu and Syr Dar'ya have been proposed (Tsukatani,1998; Kotlyakov and Micklin,1992). More realistic plans more

closely addressing the real problems have also been suggested. These include improving the efficiency of irrigation systems through lining and repairing canals, diverting irrigation run-off back into the rivers, reintroducing less demanding and more locally beneficial crops than cotton, and reducing the dependence on agricultural chemicals (Kotlyakov,1992; Murzayev,1992; Glazovsky,1991). Although these latter plans are feasible, "the reduction of the Aral region's problems, at least in the initial stage, will require considerable expenditures and the introduction of modern technologies and methods" (Glazovsky,1991). Unfortunately little money appears to be available and the environmental problems continue to worsen.

3.6. HEALTH CONDITIONS

A host of environmental problems resulting directly from destructive cotton monoculture practices are believed to have played an important part in the development of many of the region's health problems (Elpiner,1999; Upshur,1998; Frost,1997; Reynolds,1996; Glazovsky,1995; Feshbach and Friendly,1992; Smith,1991). These problems are illustrated, in part, in infant mortality rates which have been calculated as ranging from 59.9/1000 (Elpiner,1999) to 90/1000 across Karakalpakstan (McKee and Curtin,1996) to as high as 110/1000 in Karakalpakstan's Bozatau Rayon (Table 3.4) (Glazovsky,1995) - the highest of any of the former Soviet republics (Smith,1991). Furthermore, since the 1970's, in some areas of the Aral Sea region, the mortality rate has increased 15 times, cardiovascular morbidity 6 times, tuberculosis 6 times and typhoid 20 times (Glazovsky,1995). High incidences of anemia, renal diseases, typhoid, acute

respiratory diseases and diarrheal disease are amongst the other health problems that the region faces today (Elpiner,1999; Glazovsky,1995; Pearce,1995; Smith,1991). In Karakalpakstan and Khorezem Oblast, rates of anemia among women and children have been found to exceed those of most other regions of Uzbekistan by more than four times (DHS,1997). A recent study has also found that the Muynak District of Karakalpakstan has one of the highest prevalence rates of anemia among young children in the world: 72% of all children between 1 and 4 years suffer from some degree of anemia (Giebel *et al.*,1998).

Table 3.4
A comparison of infant mortality rates

Location	***Rate (per 1000 live births)***	***Year***	***Source***
Karakalpakstan[1] (1)	110.0	1988	Glazovsky,1994
Karakalpakstan (2)	90.0	1986	McKee and Curtin,1996
Karakalpakstan (3)	59.9	1988	Elpiner,1999
Uzbekistan	64.0	1990	UNICEF,1992
Kazakhstan	29.0	1986	Uzbekistan,1988[2]
Turkmenistan	58.2	"	"
Kyrgyzstan	38.2	"	"
Tadjikistan	46.7	"	"
USSR	25.4	"	"
Bulgaria	14.6	"	"
Hungary	19.0	"	"
Cuba	13.6	"	"
Canada	6.3	1991-93	WHO,1996
United States	8.8	1991-93	"

[1] data represents an estimate for particular problem areas and does not represent an average for the republic.
[2] in Glazovsky, 1995

Given the existing environmental circumstances, there are strong suspicions of environmental contributions to the current health status of the population. "Although a precise allocation of disease causation, including that attributable to ecological degradation, is not possible at this time, it is likely that child mortality rates and the high incidence rates of health problems mentioned above, reflect not only inadequate medical attention but environmental deterioration as well" (Glazovsky,1995:p.109). Furthermore, demonstrating a temporal pattern in environmental deterioration and health problems is not possible given the unavailability of reliable data.

It has only been within the last several years that the environmental and health problems in the region have started to become recognized globally and very little in the way of combating the problems has been done. To stabilize the population's health in the region several major developments must occur, these include: the development of a clean drinking and municipal water supply; the construction of sewage systems; the cessation of pesticide use; the creation of modern medical institutions; the supply of high-quality food products; and the distribution of more effective information on sanitary, hygienic and ecological issues (Glazovsky,1995). Due to limited resources, few actions have thus far been taken by local governments or NGO's to address these needs. Due to limited awareness or interest, few international NGO's even have a presence in the region. Those who do include the WHO, UNDP (United Nations Development Program) and MSF. The only substantial work which has been done, however, has been by MSF which over the past 3 years has been instrumental in the implementation of a Tuberculosis program (DOTS) in association with the Ministry of Health. Furthermore MSF, through its

operational research program has been investigating the associations between environmental problems and health outcomes, including psychosocial health impacts. Given the severity of the environmental and health problems in the region, it was expected that psychosocial impacts would also be severe. Determining the severity of these impacts, would help to inform MSF, other NGO's and local healthcare workers in their development of health policies and programs for the region.

3.7. STUDY SITES

All three sites were located in Karakalpakstan (Figure 2). The three study sites will be referred to by the districts or rayons in which they are located (i.e. Shumanay, Kungrad and Muynak) as each site is comprised of several villages or health administration areas called FAPs (Felchar[4] and Obstetrics Point) of different names. Other than population figures, little official data was available at the FAP or Rayon level from these sites.

In Shumanay (Figure 2), the study site includes six FAPs within Duslyk Bairogy collective farm, Shumanay Rayon. The farm is comprised of FAP Center Duslyk Bairogy, FAP Azat, FAP Narimonova, FAP Kalinina, FAP Leningrad, FAP Duslyk Bairogy. The six FAPs are rural, sparsely populated areas with few services. Agricultural work is the principal occupation here. Shumanay Rayon, whose population is 42 000 (Table 3.5), is located close to the border with Turkmenistan and subsequently has a relatively large Turkmen population. Of the three sites, Shumanay is located the furthest from the Aral

[4] a felchar is a healthcare worker whose position is between that of a doctor and a nurse

Sea. Environmental problems in Shumanay are less visibly obvious than the other sites and the various environmental attributes such as Usturt Plateau and other natural areas make it seem relatively pristine.

Table 3.5
Populations of study site rayons 1998

Site	*Population*
Shumanay Rayon	42 000
Kungrad Rayon	107 444
Kungrad New Town	34 347
Muynak Rayon	28 470

Source: Local rayon and city Hakim (local government) offices

The Kungrad site is comprised of several FAPs in Kungrad New Town. The city of Kungrad itself, is comprised of two parts: New Town and Old Town which combined have a population of 107 444 people. As the name suggests, Kungrad New Town, with its population of 34 347, is relatively modern and much more Russian in its appearance (i.e. apartment blocks, wide avenues etc.) than Kungrad Old Town. Kungrad New Town is a densely populated urban area whose economy is based on agriculture, industry and administration. It has good services (gas, water etc.) compared to the rural sites and it has a variety of stores and markets which offer many fresh and packaged foods along with most other necessities. The town is, however, grey, dirty, with few trees or green areas making it appear to be the most polluted of the three sites (personal observation).

Muynak Rayon is located the closest to the former Aral Sea of the three study areas. The study site itself is comprised of three collective farms within the rayon which also correspond to FAP administrative areas. These farms are Porlatau, Shegerlyk, and

Uchsay. On the three farms, the economy is based largely on fishing (Porlatau, for example, is located near a large lake) or farming. Uchsay is located on the former banks of the Aral Sea whereas the other two are located approximately 20km further South. Few services such as gas or piped water are available here. Food and other necessities are markedly more expensive and less available than in Shumanay or Kungrad, likely due to its distance from any major centers and minimal local food production. Muynak is enduring a wide range of environmental problems. The disappearance of the Aral Sea alone has had a major impact on Muynak as the district was inherently dependent on it for food, jobs, transportation and recreation. Of the three sites, Muynak, along with other areas bordering the former sea, are suspected of being amongst the areas most impacted by Soviet agricultural practices in terms of the deterioration of the environment, the population's health, the economy and social conditions (Elpiner,1999; Stone,1999; Pearce,1995). These impacts are reflected in a decrease in Muynak's population due to out-migration by approximately 30% between the 1960's and 1970's (Table 3.6), the period when the effects of the disaster first started to be noticeably felt (Micklin,1994). Due to natural increase, the population of the rayon today has grown to 28,470, just under the 1960 level (Table 3.5). The dried sea bed surrounding Muynak, the nearly abandoned fish cannery and the hulls of rusted ships on the sea bed are constant obvious reminders of the area's many problems.

Table 3.6 Population change in Muynak Rayon 1960-1998	
Year	***Population***
1960	30 100
1970	21 600
1980	22 100
1990	24 400
1998	28 470

Source: Muynak's Hakim (local government) office

3.8. CONCLUSIONS

The chapter has examined the geography, history, economy and population of the region. Also environmental and human health problems were discussed. In doing so, it has described the severity and pervasiveness of the Aral Sea disaster and has provided information required to understand the potential degree of psychosocial impacts resulting from the disaster and the possible variation in psychosocial impacts between sites. Although the impacts of this disaster can be seen throughout the Aral Sea basin, nowhere have they been more apparent than in Karakalpakstan and particularly the area near the Aral Sea bed around Muynak and the Amu Dar'ya delta (Saiko,1994; Upshur,1998). For this reason MSF has focused their work in Karakalpakstan. In an effort to understand the extent of psychosocial impacts resulting from the disaster this research was also focused on Karakalpakstan where impacts were expected to be the greatest and the resulting information would have the most benefit.

The following chapter outlines the methods used for site selection for this research,

the development and administration of the survey instrument that was used, and the management and analysis of the data.

CHAPTER 4

RESEARCH DESIGN

4.1. INTRODUCTION

The previous chapter provided a description of the research study area in an attempt to set the context within which this research took place. A focus was given to the environmental and health situations in Karakalpakstan, however, Uzbekistan, and the Aral Sea region as a whole were also discussed. This was followed by a description of the three study communities: Shumanay, Kungrad and Muynak.

In this chapter, the research methods used to address the following study objectives will be examined. These objectives, stemming in part from the key recommendations of an initial feasibility study (Upshur,1998) are:

1. to determine people's perceptions (health and environmental) associated with the environmental disaster;
2. to examine the links between health and environment made by individuals;
3. to determine the prevalence of psychosocial impacts amongst local residents; and,
4. to investigate the determinants of psychosocial impacts.

The chapter begins with a discussion of site selection criteria and survey development followed by an examination of methodological issues associated with qualitative and quantitative methods. Survey administration and data analysis are then discussed and sample characteristics are presented. It should be noted that exposure measurement was not a part of this research design. The definition of psychosocial

impacts utilized here (Elliott, *et al.*,1993) does not distinguish between real or perceived exposures.

4.2. SITE SELECTION

The choices of the three study sites in Shumanay district, Kungrad district and Muynak district (see Section 3.7) were made based on series of criteria. Firstly, sites were chosen to ensure variation in the type and severity of the environmental problems (i.e. distance from the exposed Aral Sea bed). This allowed for the hypothesis to be tested that psychosocial impacts would decrease with potentially decreased exposure (distance decay effect). Secondly, sites with variation in their ethnic composition and economic base were chosen so as to help ensure that the sample reflected, as much as possible, the diversity of the Karakalpakstan population. Also, including an ethnically or otherwise mixed population made it possible to test the mediating effects of differing sociodemographic characteristics. Thirdly, both urban and rural sites were selected so that the mediating effects of rural versus urban characteristics (i.e. employment, environment, community and service characteristics) on psychosocial impacts could be examined. Fifthly, sites were chosen which had not been excessively studied in the past, such that research fatigue, reported to be a growing problem in parts of Karakalpakstan (Upshur,1998), would not hinder respondents' openness to this research. Sixthly, communities were chosen where MSF had had some presence in the past so as to reduce suspicion about this work and at the same time contribute to presently existing MSF data about the study populations. Finally, only sites where accurate population lists existed were included. With the

exception of Shumanay, where there has been no MSF presence in the past, all criteria were met in the three sites.

4.3. QUALITATIVE AND QUANTITATIVE METHODS

This research, though principally quantitative in design, also involved the use of qualitative open ended questions within the quantitative questionnaire. Qualitative methods are defined as "an inductive method (e.g. interviews, participant observation, focus groups) which seek to interpret or reconstruct reality in order to understand how people live, and give meaning to their own lives" (Elliott and Baxter,1994: p.136). They help one to "see the world in terms of multiple realities where there is no one truth but truths, contingent on the perceptions and perspectives of the respondents" (Eyles,1998: p.11). In a qualitative approach, importance is placed on context as well as particularity and variability. This is often considered to be useful in that it can help to reveal the social, cultural and value connections that exist (Eyles,1998; Taylor *et al.*,1989).

On the other hand, "quantitative methods emphasize the fact that there is one external reality that is external to researcher and knowable through direct observation. This research aims to discover regularities and patterns to be able to generalize and predict" (Eyles,1998: pp.10-11). Quantitative methods are considered by many to be hard, objective and rigorous, whereas qualitative methods are considered to be soft, subjective and speculative (Burgess,1984). With quantitative methods, however, one is unable to include context, perceptions and perspectives into his/her research, all of which have been essential in this case.

Despite these varying strengths and weaknesses, both approaches have their positive characteristics and by combining them, the strengths of both may be realized (Burgess,1984; Burgess,1982; Elliott and Baxter,1994; Eyles,1998). Quantitative methods have been useful for attempting to determine levels of environmental stress, psychosocial health and self-reported physiological health, along with the relationship that various socio-demographic factors have on them. Qualitative methods have proven useful for determining perceptions of the environmental disaster, the prevalence of various perceptions, and the effects that perceptions, beliefs and attitudes have on psychosocial impacts. The integration of both approaches has been critical to this research.

To analyse the qualitative open-ended responses from the questionnaire, it was first necessary to categorise them. In, for example, questions asking about environmental concerns, responses such as 'dirty water' or 'salty water' were categorized to 'water'. Similar categorising was done on questions regarding 'likes about the place where you live', 'dislikes about the place where you live' and 'perceived cause of problems mentioned in the SCL'. Bivariate and multivariate techniques could then be employed, the results of which are discussed in Chapters 5 and 6. The collection and analysis of the quantitative data is discussed below.

4.4. SURVEY DEVELOPMENT

The quantitative questionnaire used for this survey was designed to measure psychosocial impacts of exposure to environmental contaminants in a general population (Elliott, 1992) and to date has been used in approximately a dozen communities in

Canada. In consultation with scientists from the Karakalpak Academy of Science and McMaster University, the questionnaire was modified to suit the Karakalpak context. Modification consisted of determining the appropriateness of standardized questionnaires, creating a variety of new questions relevant to the Karakalpakstan situation, translating the questionnaire into Russian and Karakalpak, field testing it, and finally back translating it into English. Back translations from Karakalpak and Russian were done in order to expose any major translation errors. Questionnaire modifications and translations were done between January and April 1999.

The questionnaire (Appendix 1) consists of 10 sections. The first section addresses individual perceptions of, and attitudes toward the region including likes and dislikes as well as satisfaction ratings. Of particular interest here is whether environmental dislikes were volunteered. Also, past community involvement and neighbour to neighbour interactions were documented in this section.

The second section addresses measures of both primary (family and friends) and secondary (neighbours and community) social networks as possible mediating factors of psychosocial impacts. Research done by Flemming *et al.* (1982) and Sorenson, *et al.* (1987) on the impacts of living near Three Mile Island, and Elliott (1998) on living near solid waste disposal sites, illustrate the importance of both the quantity and quality of social support in coping with everyday life in the face of serious environmental problems. Therefore, questions addressing the quantity of available social support (i.e. number of close friends and relatives; community group membership) and the perceived quality of

social support (i.e. satisfaction with social activities; someone to confide in) were included in this questionnaire.

The third, fourth, fifth and seventh sections include standardized measures of perceived psychosocial health and well-being including general health status, the General Health Questionnaire (GHQ-20) (Goldberg,1972), the somatic symptom checklist from the Symptom Check List-90 (SCL-90) (Derogatis, *et al.*1973), and a subset of items from the Critical Life Events Scale (Holmes and Rahe,1967). The GHQ-20 scale (Goldberg,1972) measures emotional distress by seeking responses to 20 items related to stress and worry. If respondents answered positively to any, they were asked to report on whether they felt 'better than usual', 'same as usual', 'more than usual' or 'much more than usual'. Several scoring systems for the GHQ have been devised. Goldberg (1972) recommends a two point scoring method rating problems as either present or absent, thus responses are coded 0-0-1-1 (conventional GHQ). Alternatively, the Likert method uses a 0-1-2-3 scoring method (Goldberg,1972). A third scoring system was devised by Goodchild and Duncan-Jones based on the criticism that although the GHQ "is good at detecting disorders of recent onset" it is "poor at detecting chronic disorders" (Goodchild and Duncan-Jones, 1985, p.372). Using the previous scoring methods, 'same as usual' indicates normality and thus no point is allotted to this response. However, "since chronic conditions can influence current mental health, it can be argued that they should be taken into account when deriving a score from the GHQ" (Huppert, *et al.*1988, p.1002). Based on this rationale, the scoring system 0-1-1-1 was devised which is applied to the negative items in the questionnaire. The conventional scoring method is used in the positive items.

The GHQ, using this revised scoring method is referred to as the CGHQ (Goodchild and Duncan-Jones,1985). Given the chronic nature of the environmental problems in the region (see Section 3.5) and the possibility of associated chronic distress, both the CGHQ and the conventional GHQ scoring systems were used. The recommended cut-point for the CGHQ-30 is 12 or 13 (Goodchild and Duncan-Jones,1985) and 4 or 5 for the GHQ-28 (Goldberg,1972). The same cut-points are applied to the 20 item version (Shapiro *et al.*, 1985). Goldberg (1972), recommends, however, that threshold scores may have to be altered depending on the purpose of the study (i.e. prevalence surveys versus detection of severe disorders). Scores at the cut-point or above indicate a probable case of emotional distress (Goldberg,1972).

The GHQ has proven to have high degrees of reliability and validity (Baldonado,1991; McDowell & Newell,1987; Tennen, *et al.*,1985). A meta-analysis of 43 studies indicates a sensitivity coefficient of 89% and a specificity coefficient of 80% for the GHQ-12. Comparable coefficients were obtained for the GHQ-20, 28, 30 and 60 (Baldonado,1991; Goldberg,1972). Test-retest reliability coefficients for the various versions of the GHQ have been shown to range from 0.73 to 0.76 for all versions and 0.73 for the GHQ-20 (Goldberg,1972). The CGHQ is reported to be more reliable than the GHQ in cases of chronic distress (Huppert *et al.*,1988; Goodchild and Duncan-Jones,1985).

The 12 item somatic symptom checklist from the Symptom Check List-90 (Derogatis *et al.*,1973) was developed to measure distress as manifest in somatic symptoms. Following the method of Elliott (1998), four items related to sleeping and

eating disorders as well as rashes and skin conditions, corresponding with exposure to environmental contaminates, were added to the sub-scale. Respondents rated how much they had been bothered about a symptom on a 5-point scale from 0 ('not at all bothered') to 4 ('extremely bothered') (Derogatis *et al.*, 1973). A respondent's score is recorded as being above or below the published population norm cut-point[5] (0.36; Derogatis *et al.*1973) to identify a probable case of emotional distress manifest in somatic symptoms. Test-retest reliability coefficients ranging from 0.77 to 0.90 for different subscales within the questionnaire demonstrate that the SCL-90 instrument is highly reliable (Tennen, *et al.*,1985).

Cultural applicability of the standardized GHQ-20 and the SCL-90 surveys was a concern as both were developed for a North American or European context. In the case of the GHQ, concern related to cultural applicability is minimized by the fact that the GHQ "is now used in diverse settings, has been translated or adopted in 38 languages, and has undergone 50 validity studies" (Baldonado,1991,p.235). In the case of the SCL-90, Cambodian, Laotian, Vietnamese (Mollica, *et al.*1987), Farsi (Siassi, *et al.*,1982), Hebrew (Roskin and Dasberg, 1983;) and Chinese (Zheng and Lin,1994) versions have been developed and validated. A study by Aroian, *et al.*(1995) testing the Brief Symptom Inventory (a highly correlated shortened version of the SCL-90), on Filipino, Irish and Polish immigrants demonstrated that the SCL is a "reliable and valid cross-cultural measure". The SCL-90 has also been used in a variety of situations relevant to this research including the examination of stressful life events in a study by Baum, *et al.*

[5] To determine if a respondent scored above or below the cut- point, scores were summed and the total was divided by the number of items in the checklist.

(1983) of people living near Three Mile Island and a study by Elliott (1998) examining the response of people living in close proximity to municipal solid waste incinerators in Ontario. Although comparing the results of these surveys to the standardized measures and published population norms that exist for both the SCL-90 and the GHQ is important and potentially telling, because these surveys have not been tested in a Central Asian, or more specifically, in a Karakalpak cultural or environmental context, comparisons have been made with caution. Nevertheless, this study has provided an important opportunity to test these survey tools in a Karakalpak and CEP context which will prove useful for future research in the area.

The eighth section contains a series of closed and open-ended questions regarding individual's environmental concerns, the nature of those concerns, health experiences, and perceptions of attribution (i.e. links between environment and health status). Concern about the environment was either volunteered in section 1 of the questionnaire or elicited here. For those who responded as having an environmental concern, the intensity of concern was determined and then, using open ended questions, the type of concern was ascertained. In order not to miss any environmental concerns, these questions (h821 to h826e; Appendix 1) were asked three times. Action taken related to environmental concerns were addressed using a series of closed questions. These questions were developed to cover a variety of activities plausibly related to action-focused coping given the nature of the environmental exposure being studied. Unfortunately, it was discovered too late that question 8.7 (see Appendix 1), which asks, "Have any of the environmental or health concerns mentioned affected you daily life?", was mistranslated. The data from

this question were therefore excluded from analysis. Finally, all respondents (with and without environmental concerns) were asked about their main source and other sources of information related to the region's environmental problems.

The final section includes socio-demographic questions about gender, life cycle (age, marital status, number and ages of children), socio-economic status (income, occupation, education) and residential status (length of residence, housing type, housing tenure), in order to check on the characteristics of the sample and to determine the relative importance of these variables as mediators of psychosocial impacts.

A series of questions on health care preferences (section 6) and diet (section 9) were added at the request of the Karakalpakstan Academy of Science for the purpose of their own research interests and have not been included in this analysis. A pilot test of the questionnaire was done on three randomly selected people in Kungrad to determine if all the questions were understandable. No major misunderstandings were reported.

In combination, the various components of this survey address the four mediating factors of psychosocial impacts outlined previously in the conceptual framework of this thesis (see Section 2.6). *Characteristics of the individual* were examined through the use of questions focused on respondents' perceptions and attitudes of the region and their socio-demographic circumstances. *Characteristics of the social network* as well as *the characteristics of the wider community system* were examined by asking questions pertaining to the relative role of family, friends, neighbours, institutions and so on in the respondent's lives. *Characteristics of the contaminate source* were examined both in terms of individuals perceptions of the local environmental problems and through more

concrete characteristics such as the site's location relative to the Aral Sea. These four sets of characteristics have been compared to the findings obtained from the GHQ, SCL-90 and Critical Life Events Scale along with their published population norms. Through this process, determining the relative effect that each mediating factor has had on psychosocial and self-perceived health was possible.

4.5. SAMPLE SELECTION

In all cases population lists came from local FAPs. These lists are believed to be relatively up to date and accurately represent the local populations. The FAP lists include all people within their administrative jurisdictions, and not only those people who have come for medical treatment.

Population lists were received from the chief doctors of the three study areas. The lists typically contained the names of approximately 1000 individuals above 18 years of age (born before May, 1981). From these lists survey samples were randomly drawn. In the case of Shumanay, we chose a collective farm (rural population), and using *full* population lists of all FAPs, we selected all people over 18 years of age and from this a random sample was drawn. In Kungrad New Town (urban population) a population list was provided containing 1000 people over 18 years of age which had been randomly selected from the entire population list of Kungrad New Town's four FAPs. From this list our random sample was drawn. In Muynak, three FAPs were chosen by us so as to include both farming and fishing communities (rural populations). From lists representing

these three FAPs' entire population over 18 years of age, a random sample was drawn. This method therefore represents a random sampling within communities.

Drawing the sample from the population lists involved assigning a number to each of the individuals and then, using a computer generated random numbers list, selecting approximately 370 people from each site. This process gave us a total sample of 1113 people over the age of 18 (Table 4.1). The sample included 4.8% of the total population over 18 years of age within the selected communities.

Table 4.1
Study site populations and samples

Study Site	*Population ≥ 18 years of age*	*Sample Size*	*% of population ≥ 18 years of age sampled*
Shumanay (1999)			
FAP center Duslyk Bairogy	459	62	*13.5*
FAP Azat	234	38	*16.2*
FAP Narimonova	289	61	*21.1*
FAP Kalinina	511	83	*16.2*
FAP Leningrad	322	53	*16.5*
FAP Duslyk Bairogy	507	77	*15.2*
Total[1]	**2322**	**374**	***16.1***
Kungrad New Town (1998)			
Total	**19211**	**370**	***1.9***
Muynak (1998)			
Porlatau	505	106	*20.9*
Shegerlyk	542	125	*23.1*
Uchsay	569	138	*24.3*
Total[1]	**1616**	**369**	***22.8***
Total all sites	***23149***	***1113***	***4.8***

[1]Does not represent Rayon totals, rather totals of FAPs included in sample

Source: Local rayon and city Hakim (local government) offices

4.6. SURVEY ADMINISTRATION

The interview team consisted of one translator, eleven interviewers, three field coordinators, a main investigator (myself), four drivers and an off-site project coordinator (MSF operational research coordinator). With the exception of two field coordinators who were previously involved in a MSF survey, all interviewers and field coordinators were recruited from the Karakalpakstan Academy of Sciences. The interviewers had no medical or psychosocial impact research background prior to this work. All interviewers and field coordinators took part in five days of full-time training on basic aspects of epidemiology, survey methodology, and survey familiarization. Training consisted of approximately 15 hours of formal lecturing and discussion, 15 hours of questionnaire role play, and 6 hours of field practice.

The actual survey was carried out in Shumanay from May 10th to 14th, Kungrad from May 17th to the 21st, and Muynak from May 24th to June 1st, 1999 - 17 days in total. Each person was visited up to 3 times in order to maximize the chances of finding them at home or to catch them at a convenient time to participate in the survey. After 3 visits, if the individual was incapable or unavailable for questioning, they were determined to be 'non-respondents'. Commonly, if a respondent was unavailable on the first visit an appointment was arranged for a future visit. On average, each interview lasted about 45 minutes.

A work day lasted for approximately 8 to 10 hours. Field coordinators, each working with 3 or 4 interviewers and 1 driver, organized the transportation to respondents' houses, managed the respondents list, and checked every questionnaire for accuracy and

completeness. At the end of each day a meeting was held with the field coordinators to discuss any problems related to the questionnaire, logistics, or the work of the interviewers.

The field conditions were considerably better for interviewing in Kungrad New Town than in Shumanay and Muynak with the former being more urban in nature and spread over a much smaller area which was easily accessible by car. In Shumanay and Muynak, respondent's houses were sometimes several kilometers apart and often inaccessible by car. Walking these distances commonly took a big part of the interviewer's day. Despite the long distances, poor road conditions, and lack of maps, street names and house numbers, interviewers had little trouble finding respondents' houses thanks to the support of nurses and felchars. Nurses and felchars helped us organize our respondent lists by area to minimize travel distances, and in many cases were available on a one to one basis for interviewers as guides. This assistance was due to the cooperation and official support of all three Shumanay, Kungrad and Muynak rayon's chief doctors and the Karakalpakstan Minister of Health.

The importance of weather as a perceived environmental problem and factor affecting health and perceived health cannot be ignored. In rural sites particularly, much of the population live in poorly insulated mud-brick or other traditional style houses. As a result, seasonal changes in climate may affect health and perceived health and likely influence people's relative concern about a given environmental problem (i.e. bad weather vs. dirty water). Recognizing this, it is important to note that this research was carried out over a three week period during which very little climatic variation occurred. With the

exception of one or two hot days (i.e. 40°C), temperatures were generally pleasant with little precipitation or cloud cover.

The average response rates at all three sites was 79% with Muynak having the highest response rate and Kungrad the lowest (Table 4.2). Most non-respondents were classified as 'away for an extended period' or 'moved' (Table 4.3).

Kungrad had considerably lower response rates than the other sites as a large number of people in the sample lived away from home for several weeks per month for work and were thus unavailable to participate (Table 4.2.). Many of those classified as 'Unable to respond' were classified as such because they were inebriated each of the three times they were visited (Table 4.3). This was a particularly common problem in Muynak because the survey coincided with the 'Last Bell' or last day of school celebration, which commonly involves not only students but parents as well. This celebration lasted for several days. If the response rate is calculated by including only 'refused' non-respondents, the response rate for this study area is over 99%.

Table 4.2
Response rates

Place	*Sample Size*	*Non-Respondents*	*Total Completed*	*Response Rate*
Shumanay	374	73	301	*80%*
Kungrad	370	97	273	*74%*
Muynak	369	62	307	*83%*
All Sites	1113	232	881	*79%*

Table 4.3 Reasons for non-response		
Reason for Non-Response	***Non-Respondents***	***% of Non-Respondents***
Unable to respond	27	*11.6%*
Away for extended period	120	*51.7%*
Moved	54	*23.3%*
Died	6	*2.6%*
Refused	10	*4.3%*
Missing data	15	*6.5%*
Total	232	*100.0%*

4.7. DATA ENTRY

Data entry took place between June 2nd and June 18th, 1999, in the MSF office in Nukus. This task was performed by 6 field coordinators and interviewers using 3 computers (i.e. 3 data entry teams). In each team, one person read the questionnaire responses and one person entered the data. The software that was used for data entry and preliminary data analysis was EPIinfo (version 6). The qualitative responses were all translated during the entry phase and therefore it was essential that each data entry team had at least one trilingual (English/Russian/Karakalpak) data entry assistant. Data entry took place in English.

Prior to the data entry phase, there was some basic training given in EPIinfo however, formal data entry training was minimal. The data entry assistants knew the questionnaire well and had had previous experience with computers and in some cases EPIinfo. Furthermore, the work of the data entry assistants was monitored closely and someone was always available to answer questions. To test for data entry accuracy, 33 questionnaires were re-entered using the EPIinfo '*Validate*' function. After re-entering the same questionnaire twice, the computer checks for differences between the original

and re-entered data. Very few differences were found and of those that were, most were spelling mistakes or minor translation variations. Daily manual inspections of the database for errors and inconsistencies further helped to minimize data entry problems.

4.8. SAMPLE CHARACTERISTICS

A cross tabulation of the sample population for socio-economic variables by each study site shows that there is little difference between sites with regard to age, the number of individuals living in a household, or mean number of years living in the area. There were, however, fewer female respondents in Shumanay (52%) than in Kungrad (55%) or Muynak (56%) (Table 4.4). Also ethnic composition between sites varies considerably. The largest reported ethnic group in the Shumanay sample is Turkmens with the majority of the remainder being Karakalpak and Uzbek. In Kungrad, a mix of Kazakhs, Uzbeks and Karakalpaks were reported, while in the Muynak site, there is a nearly even split between Karakalpaks and Kazakhs. Karakalpaks and Kazakhs were found to be the two largest ethnic groups across the three sites, representing over 65% of respondents. Differences in the composition of the samples by ethnic group was expected given the recognized geographic variation in ethnic distribution existing in Karakalpakstan (Frost,1997), and the relative location of the three sites to Turkmenistan and Kazakhstan. The sample profile is similar to official data with regards to ethnic composition with one exception: due to the selection for study of a predominately Turkmen FAP in Shumanay, Turkmens are over represented in the sample and Uzbeks are slightly underrepresented. Sample profiles with regards to age and gender are very similar to UNDP population

profiles for Uzbekistan (in Frost,1997).

More Shumanay respondents reported to have less than an intermediate level of education and more Kungrad respondents reported to have an intermediate level of education or higher[6]. Respondents in Shumanay more frequently reported working full-time than in either of the other two sites. Conversely unemployment was lowest in the Shumanay sample and highest in Muynak, where almost one third of respondents reported being unemployed. The low level of full-time employment and the high rates of unemployment in Muynak are explained by the disappearance of the Aral Sea and the subsequent decimation of the region's fishing industry. The high employment rates reported in Shumanay likely reflect the labour intensive nature of Karakalpak cotton farming. The main source of family income in Shumanay was overwhelmingly reported as agriculture/fishing (90%) where 'other' sources were most commonly reported in Kungrad (93%) and Muynak (91%) (Table 4.4). Muynak respondents most frequently reported being 'not always able' to make ends meet while Kungrad respondents most frequently reported being 'always able'. Unofficial incomes coming from privately growing and selling produce, fishing *et cetera* are believed to represent a large proportion of many family's total household incomes. Because of this, and because it was suspected that individuals would frequently be unwilling to report any unofficial incomes, a proxy income variable, 'always able to make ends meet' was used in the analysis instead of 'total household income'.

[6] Intermediate level corresponds to secondary or high school education in Canada.

Table 4.4.
Sample characteristics

Characteristics	**Shumanay** *(n=301)*	**Kungrad** *(n=273)*	**Muynak** *(n=307)*	**All Sites**[1] *(n=881)*
Mean age (years)	38.6	39.1	38.0	38.5
Mean # / household	7.5	6.7	6.5	6.7
Mean # years living in area	29.3	29.9	30.4	29.9
	# (%)	*# (%)*	*# (%)*	*# (%)*
Female	155 *(52)*	149 *(55)*	173 *(56)*	477 *(54)*
Married	217 *(73)*	195 *(71)*	213 *(71)*	625 *(71)*
Individuals in households with children <5 years	149 *(50)*	138 *(51)*	181 *(59)*	468 *(53)*
Ethnicity				
Karakalpak	79 *(26)*	59 *(22)*	159 *(52)*	297 *(34)*
Uzbek	74 *(25)*	92 *(34)*	2 *(1)*	168 *(19)*
Kazakh	21 *(7)*	112 *(42)*	144 *(47)*	277 *(32)*
Turkmen	123 *(41)*	0 *(0)*	0 *(0)*	123 *(14)*
Other	4 *(1)*	9 *(3)*	1 *(0)*	14 *(2)*
Level of Education				
Less than intermediate	89 *(29)*	45 *(17)*	63 *(21)*	197 *(22)*
Intermediate or higher	212 *(70)*	227 *(84)*	224 *(80)*	683 *(78)*
Employment Type				
Full time	151 *(50)*	100 *(37)*	112 *(37)*	363 *(41)*
Unemployed	20 *(7)*	72 *(26)*	101 *(33)*	193 *(22)*
Retired	54 *(18)*	51 *(19)*	52 *(17)*	157 *(18)*
Homemaker	20 *(7)*	17 *(6)*	19 *(6)*	56 *(6)*
Other	55 *(18)*	33 *(12)*	23 *(8)*	111 *(13)*
Individuals reporting being 'always able to make ends meet'	56 *(19)*	70 *(26)*	31 *(10)*	157 *(18)*
Main Source of Income				
Agriculture/Fishing	271 *(90)*	18 *(7)*	27 *(9)*	316 *(36)*
Other	30 *(10)*	250 *(93)*	273 *(91)*	553 *(64)*

[1] deviations from the total (n=881) caused by the exclusion from analysis of cases with missing data on characteristics concerned

4.9. SUMMARY

This chapter has described the design of the research undertaken for this thesis. An exploratory cross-sectional research design, has been used to examine populations samples of three study sites (Section 4.2) living at varying distances from the Aral Sea in the Republic of Karakalpakstan. The questionnaire used for this survey was originally designed by Susan Elliott (1992), however, with the involvement of MSF, the Karakalpak Academy of Science and McMaster University, the questionnaire was modified to suit the Karakalpak context. The questionnaire (Appendix 1) consisted of essentially five sections: (1) individual perceptions and attitudes of the region and its environmental status; (2) the relative role of social support networks (friends, families, neighbours, institutions etc.) in coping with everyday life in the face of serious environmental problems; (3) standardized measures of psychosocial health and well being including a portion of the General Health Questionnaire (GHQ-20) (Goldberg,1972), the somatic symptom checklist from the Symptom Check List-90 (SCL-90) (Derogatis, *et al.*,1973), and a subset of items from the Critical Life Events Scale (Holmes and Rahe,1967); (4) open-ended questions regarding individual's concerns, health experiences, and perceptions of attribution (i.e. links between environment and health status) and; (5) socio-demographic questions about gender, life cycle (age, marital status, number and ages of children), socio-economic status (income, occupation, education) and residential status (length of residence, housing type, housing tenure). The survey was administered over a period of just under 4 weeks in the spring/summer of 1999 with a completion rate of 79% (Table 4.2).

CHAPTER 5

RESULTS OF DESCRIPTIVE ANALYSIS

5.1. INTRODUCTION

The next two chapters present the results of the analysis of the survey data. Using descriptive statistics, this chapter addresses the four objectives:

1. to determine people's perceptions (health and environmental) associated with the environmental disaster;
2. to examine the links between health and environment made by individuals;
3. to determine the prevalence of psychosocial impacts amongst local residents; and,
4. to investigate the determinants of psychosocial impacts.

Six indicators of locational perceptions of the local area and environmental concerns were used in the survey instrument (see Section 4.3). The first indicator determined respondents' likes about their local area. The second and third indicators documented local area concerns by asking about local area dislikes and aspects of the area they would change, if they could. These indicators were unsolicited and derived from open-ended questions thus allowing respondents to report perceptions and experiences in the context of their everyday lives. The other three indicators of concern were based on solicited, closed questions about the presence, nature and intensity (slight, moderate, extreme) of specific environmental concerns. Questions related to the nature and intensity of concern were only asked of those individuals who reported to have environmental concerns in the previous questions.

Three indicators of general health and well-being were used in the survey (see Section 4.3). These indicators are self-reported health, satisfaction with health, and reported diseases for which treatment has been recently given. Two psychosocial health scales were also used in the survey: these are the General Health Questionnaire, 20 item version (GHQ-20) (Goldberg,1972), used to measure probable cases of emotional distress; and the somatic symptoms checklist from the Symptoms Checklist-90 (SCL-90) (Derogatis, *et al.*1973), used to measure emotional distress as manifest in somatic complaints.

To examine the relationships between social and community networks and reported psychosocial impacts several measures were used. These include: 'satisfaction with social activities', 'frequency of talking with neighbours', and 'the number of community activities involved in' cross-tabulated with measures of psychosocial health and well-being.

Indicators used to determine perceived links between environmental problems and health include: the perceived cause of reported somatic complaints; perceptions of attribution of the environment on health, and perceptions of attribution of the environment on self–reported health and family member health problems.

5.2. LOCAL AREA PERCEPTIONS

Several indicators of local area perceptions and concern, both solicited and unsolicited, were employed in the survey (Appendix 1). These include local area likes, unsolicited measures of environmental concern including local area dislikes and desired

changes to their local area, and solicited measures of environmental concern including the presence, nature and intensity of environmental concern.

5.2.1. Unsolicited Local Area Perceptions and Environmental Concern

Respondents were asked what they like and dislike about where they live. In both cases, respondents were allowed up to three mentions. Open-ended responses were recorded and coded for subsequent analysis. Environment ranks first over all other major likes (first mention only), followed closely by social factors and attachment to place (Table 5.1). Environmental likes mentioned included "can grow food here", "clean air" and "open spaces". The number of environmental likes by site was highest in the two rural sites, Shumanay (39%) and Muynak (35%), and lowest in the urban site, Kungrad (11%). Social factors included responses such as "many friends live here", "family lives here" and "nice people". Other frequently reported likes were 'attachment to place' which included responses such as "born here" and "hometown"; 'location' which included responses such as "close to market"; and, 'economic' which mainly included the response "have a job here". The relative ranking for first mention and all mention 'likes' were very similar (data not shown).

Table 5.1
Major 'likes' about the place where you live

	Shumanay (n= 236)	*Kungrad (n=214)*	*Muynak (n=259)*	*Total (n=709)*[1]
Likes	*# (%)*	*# (%)*	*# (%)*	*# (%)*
Environment	93 *(39)*	23 *(11)*	91 *(35)*	207 *(29)*
Social	61 *(26)*	67 *(31)*	48 *(19)*	176 *(25)*
Emotional attachment to place	30 *(13)*	53 *(25)*	60 *(23)*	143 *(20)*
Location	22 *(9)*	26 *(12)*	23 *(9)*	71 *(10)*
Place in general	7 *(3)*	15 *(7)*	18 *(7)*	40 *(6)*
Economic	15 *(6)*	5 *(2)*	7 *(3)*	27 *(4)*
Other	8 *(3)*	25 *(12)*	12 *(5)*	45 *(6)*
Total mentions	236*(100)*	214*(100)*	259*(100)*	709*(100)*

[1]deviations from the total (n=881) caused by the exclusion from analysis of cases with missing data on characteristics concerned

The environment was also the most frequently reported dislike about the local area (Table 5.2). Environmental dislikes commonly reported include "salty wind", "dirty water" and "dying trees". In the total sample, 40% of respondents reported the environment as the major dislike followed by economic conditions (11%) (i.e. "no jobs" and "can't afford necessities"), and services (11%) (i.e. "no piped water", and "no gas in winter"). Environmental dislikes ranked first in each study site with Shumanay respondents reporting the fewest environmental dislikes (36%) and Muynak the most (43%). Also notable is the high proportion of respondents reporting 'don't know' or no mention (25%).

Table 5.2
Major 'dislikes' about the 'place where you live'

Dislikes	*Shumanay (n=297)*	*Kungrad (n=269)*	*Muynak (n=305)*	*Total (n=871)*
	# (%)	*# (%)*	*# (%)*	*# (%)*
Environment	107*(36)*	113 *(42)*	130 *(43)*	350*(40)*
Economic	29 *(10)*	20 *(7)*	45 *(15)*	94 *(11)*
Services	43 *(14)*	14 *(3)*	37 *(12)*	94 *(11)*
Climate	19 *(6)*	31*(12)*	28 *(9)*	78 *(9)*
Other	18 *(6)*	10 *(4)*	11 *(4)*	39 *(4)*
No mention / don't know	81*(27)*	81*(30)*	54 *(18)*	216*(25)*
Total mentions	297*(100)*	269*(100)*	305*(100)*	871*(100)*

[1]deviations from the total (n=881) caused by the exclusion from analysis of cases with missing data on characteristics concerned

Table 5.3. presents a ranking of environmental dislikes and other dislikes (first mention and all mentions). In the total sample, 40% of respondents reported environmental dislikes in the first mention, and 55% of respondents reported environmental dislikes at least once out of all three mentions. This finding indicates that a greater proportion of the sample is concerned about the environment than was indicated by the first response. No statistically significant differences were found between sites with regards to first or all mentions of environmental dislikes.

Table 5.3
Frequency of environmental 'dislikes' about the place where you live

	Shumanay (n= 297)		*Kungrad (n=269)*		*Muynak (n=305)*		*Total (n=871)*	
	First mention	***All Mentions***	***First mention***	***All Mentions***	***First mention***	***All Mentions***	***First mention***	***All Mentions***
Dislikes	# *(%)*	# *(%)*	# *(%)*	# *(%)*	# *(%)*	# *(%)*	# *(%)*	# *(%)*
Environment	107 *(36)*	158 *(53)*	113 *(42)*	145 *(54)*	130 *(43)*	173 *(57)*	350 *(40)*	476 *(55)*
Other	190 *(64)*	139 *(47)*	156 *(58)*	124 *(46)*	175 *(57)*	132 *(43)*	521 *(60)*	395 *(45)*
Total	297 *(100)*	297 *(100)*	269 *(100)*	269 *(100)*	305 *(100)*	305 *(100)*	871 *(100)*	871 *(100)*

[1]deviations from the total (n=881) caused by the exclusion from analysis of cases with missing data on characteristics concerned

An unsolicited measure of concern was derived from the question: "If you could change one thing about the place where you live, what would it be?" (Table 5.4). Again, these open-ended responses were coded. In Muynak the environmental problem, 'water quality', ranked number one and 'quantity and quality of trees and crops' ranked number two in Kungrad. Other environmental problems such as the 'Aral Sea problem' and 'polluted land' all ranked very low in the three sites. In Shumanay, only two environmental problems were ranked in the top ten: 'quantity and quality of trees and crops' at number six and 'polluted land' at number eight.

Table 5.4
If you could change one thing about the place where you live

Rank	***Shumanay* (n= 301)**		***Kungrad* (n=273)**		***Muynak* (n=305)[1]**	
1	Gas supply	10%	Local economic problems	16%	Water quality	17%
2	Local economic problems	10%	Quantity and quality of trees and crops	11%	Unemployment	10%
3	Water supply service	9%	Unemployment	6%	Local economic problems	9%
4	Housing	8%	Education and community services	6%	Gas supply	7%
5	Other economic problems	6%	Other services	5%	Other services	4%
6	Quantity and quality of trees and crops	6%	Housing	4 %	Water supply service	3%
7	Roads and transportation	4%	Water quality	4 %	Other	3%
8	Polluted land	4%	Other	4 %	Aral Sea problems	3%
9	Education and community services	3%	Aral Sea problems	3%	Quantity and quality of trees and crops	2%
10	Employment	2%	Other environmental problems	2%	Housing	2%

[1] deviations from the Muynak total (n=307) caused by the exclusion from analysis of cases with missing data on characteristics concerned

5.2.2. Solicited Environmental Concern

Respondents were asked if they were concerned about the regions environmental problems whereby 41% of respondents reported that they were (Table 5.5). 39% of Shumanay respondents reported environmental concerns compared to 42% in both Kungrad and Muynak, however, the differences between sites are not statistically significant.

Table 5.5
Solicited environmental concern

Environmental concerns	**Shumanay** ***(n=295)***	**Kungrad** ***(n=271)***	**Muynak** ***(n=304)***	**Total** ***(n=870)*** [1]
	# (%)	*# (%)*	*# (%)*	*# (%)*
Yes	116 *(39)*	114 *(42)*	129 *(42)*	359 *(41)*
No	179 *(61)*	157 *(58)*	175 *(58)*	511 *(59)*
Total	295 *(100)*	271 *(100)*	304 *(100)*	870 *(100)*

[1] deviations from the total (n=881) caused by the exclusion from analysis of cases with missing data on characteristics concerned.

Individuals who reported having environmental concerns were asked to specify the nature of these concerns (Table 5.6). Responses were open-ended and coded for subsequent analysis. The environmental concern ranked first is water quality (e.g. salty water, dirty drinking water) followed by land/soil quality (e.g. salty land, crops won't grow) and air quality (e.g. dusty wind, salty wind). Between sites variation is seen with regards to environmental concerns. The top ranking environmental concern in Shumanay is land/soil quality (18%) which is consistent with fact that Shumanay Rayon is

economically very dependent on agriculture (see Section 3.7). In Muynak, where clean sources of drinking water are being severely threatened, water quality is ranked first (18%). In Kungrad, reported frequencies of concerns are relatively equally distributed across the top ranked concerns.

Table 5.6
Environmental concerns[1]

Rank	**Shumanay (n= 91)**		**Kungrad (n=93)**		**Muynak (n=118)**		**All Sites (n=302)[3]**	
	# *(%)*[2]		# *(%)*		# *(%)*		# *(%)*	
1	Land/Soil quality	53 *(18)*	Water quality	37 *(14)*	Water quality	64 *(21)*	Water quality	134 *(17)*
2	Water quality	33 *(11)*	Land/Soil quality	29 *(11)*	Air quality	26 *(9)*	Land/Soil quality	93 *(12)*
3	Air quality	18 *(6)*	Air quality	26 *(10)*	Environment – other	29 *(9)*	Air quality	70 *(9)*
4	Environment – general	15 *(5)*	Environment – general	26 *(10)*	Environment – general	22 *(7)*	Environment – general	70 *(9)*
5	Environment – other	4 *(1)*	Environment – other	11 *(4)*	Land/Soil quality	11 *(4)*	Environment – other	37 *(5)*

[1] Note that this question was only asked to those who reported having an environmental concern.
[2] Percentages are derived from number of responses not the number of respondents.
[3] 52 mentions of climate (not climate change) were made. As this is not an environmental problem per se, it was removed from analysis

Those reporting a major environmental concern (n=344) were asked to rate the intensity of concern (slight, moderate, extreme) as it related to both environmental problems and potential health impacts. In the first mention, 59% of respondents reported being 'extremely' concerned, 36% 'moderately' concerned and 5% 'slightly' concerned. Between the three study communities, 64% of Muynak respondents rated their intensity of

concern as 'extreme' as compared to 50% of Shumanay respondents, however, these differences were not statistically significant.

5.2.3. Major Source of Information About the Environment

Respondents were asked to report their main source of information about the region's environmental problems. Approximately 76% reported television to be their major source of information followed by friends and neighbours (11%), newspapers (5%) and radio (5%). Substantial urban/rural differences were found, whereby 85% of Kungrad (urban) respondents reported television to be their major source of information as compared to 68% of Muynak (rural) respondents and 76% of Shumanay (rural) respondents. The importance of television as a major source of information reflects the high rate of household television ownership (91%) across the whole of Uzbekistan as reported by DHS (1996). When respondents were asked if they had heard about the environmental problems from specific sources (i.e. newspapers, books, radio etc.), 87% reported hearing about them on television and 76% reported discussing them with friends. Few respondents reported having read about environmental problems in books or newspapers and only 15% had attended meetings about the environment.

5.2.4. Summary of Local Area Perceptions and Concerns

The environment was reported to be both the most frequently liked and disliked aspect of respondents' local area, with the exception being Kungrad where few environmental likes were reported (Tables 5.1 and 5.2). When respondents were asked

what one aspect they would change about the place where they live, it was not environmental conditions that were most frequently mentioned but rather various services and economic problems (Table 5.4). Although one might expect environmental problems to rank higher, the findings here are in keeping with the literature which points out the seriousness of many economic problems (e.g. loss of jobs in the fishing industry) faced by the region's population, problems which can be linked directly to the disaster itself (see Section 3.5). The exception to this finding is Muynak where water quality was ranked first as something they would change. This is significant given that water quality problems in the Muynak region have been described by key informants and various authors as particularly severe (Elpiner,1999; see also Section 3.7).

Just under half of respondents mentioned having environmental concerns when asked, which is consistent with the finding for first mention environmental dislikes. The most frequently reported environmental concern was water quality, however, variation between sites was seen. In Shumanay, respondents most frequently reported land/soil quality as a concern. In both Muynak and Kungrad water quality was ranked first, however, almost twice as many reported it as a concern in the former than in the latter. Television was reported to be the main source of information about the region's environmental problems which is not surprising given that DHS (1997) found that over 90% of Uzbek households possess televisions.

5.3. PSYCHOSOCIAL HEALTH AND WELL-BEING

This section will examine both the psychosocial impacts associated with the Aral Sea disaster as well as local perceptions of health and well-being. Perceptions of health were determined using measures of perceived general health as well as satisfaction with health. Questions about recently treated health problems were also asked. Psychosocial impacts were measured using the General Health Questionnaire, 20 item version (GHQ-20) (Goldberg,1972) and the somatic symptoms checklist from the Symptom Checklist-90 (SCL-90) (Derogatis, *et al.*,1973)

5.3.1. Perceptions of General Health

Respondents were asked two questions regarding their perceptions of their own general health. First, respondents were asked to rate their health compared to people their own age (Table 5.7). The majority of respondents reported their health to be either fair (43%) or poor (12%); 44% rated their health as good and only 1% rated their health as very good. No one reported excellent health. In a Canadian national health survey, 25% of respondents rated their health as 'excellent', 63% rated it as 'very good or good' and only 12% rated it as 'fair or poor' (Health and Welfare Canada,1987). Findings from a Russian national survey indicate that Russians perceive their health to be worse than the sample population in Karakalpakstan. Using slightly different categories, approximately 70% of Russian respondents reported their health to be 'average' or 'very poor' and only 30% reported it to be 'very good' or 'good' (Bobak *et al.*,1998). The Russian findings are

comparable to those of the findings for the Uzbek ethnic group in this study among whom 63% reported their health to be either fair or poor.

Table 5.7
Perceived health status

Rating	Shumanay *(n= 301)*	Kungrad *(n=272)*	Muynak *(n=307)*	All Sites *(n=880)* [1]
	# *(%)*	# *(%)*	# *(%)*	# *(%)*
Excellent	0 *(0)*	0 *(0)*	0 *(0)*	0 *(0)*
Very Good	8 *(3)*	3 *(1)*	1 *(0)*	12 *(1)*
Good	127 *(42)*	126 *(46)*	138 *(45)*	391 *(44)*
Fair	140 *(47)*	111 *(41)*	125 *(41)*	376 *(43)*
Poor	26 *(9)*	32 *(12)*	43 *(14)*	101 *(12)*
Total	301*(100)*	272*(100)*	307*(100)*	880*(100)*

[1] deviations from the total (n=881) caused by the exclusion from analysis of cases with missing data on characteristics concerned

Second, when respondents were asked about their satisfaction with their own health, over half reported to be 'very satisfied' or 'somewhat satisfied' and 45% reported to be 'not too satisfied' or 'not at all satisfied' (Table 5.8). In a study done by Elliott (1992) of people living near solid waste facilities in Canada, 92% reported being 'very satisfied' or 'somewhat satisfied' with their health. Although health satisfaction is much lower in this study, there is a relatively high proportion of individuals reporting to be 'very satisfied' given the many health problems that the region's population is facing (see Section 3.6), and the low perceived health reported by respondents (Table 5.7).

Table 5.8
Satisfaction with health

Rating	*Shumanay (n= 301)*	*Kungrad (n=273)*	*Muynak (n=306)*	*All Sites (n=880)*[1]
	# (%)	*# (%)*	*# (%)*	*# (%)*
Not at all satisfied	12 *(4)*	19 *(7)*	24 *(8)*	55 *(6)*
Not too satisfied	121 *(40)*	111 *(41)*	112 *(37)*	344 *(39)*
Somewhat satisfied	56 *(19)*	38 *(14)*	56 *(18)*	150 *(17)*
Very satisfied	112 *(37)*	105 *(39)*	114 *(37)*	331*(38)*
Total	301*(100)*	273*(100)*	306*(100)*	880*(100)*

[1] deviations from the total (n=881) caused by the exclusion from analysis of cases with missing data on characteristics concerned

5.3.2. Reported Health Problems

In order to develop a better understanding of the health problems that exist in the region, respondents were asked to report any health problems for which they received treatment by a doctor, felchar, nurse, healer or family member in the past twelve months. It was found that 26% of all respondents reported to be anemic (Table 5.9.). By comparison, a previous study by Morse (1994) diagnosed 52.2% of a sample (all ages) from Muynak as anemic. Differences between these findings can be attributed in part to the fact that in Morse's study, children, who were found to have some of the highest rates of anemia, were included in the sample. In this study, only people over 18 years old were included. Over 10% of respondents in this study reported various respiratory illnesses, and of these 8% specifically reported chronic bronchitis. This finding is considerably

higher than those of previous studies done in Karakalpakstan: a study carried out by DHS International (1997) found incidences of ARI (Acute Respiratory Infections) at 3.8%, and in a study done by Frost (1997), it was reported that, in three communities in Karakalpakstan, incidences of ARI ranged from 1.4% to 2.1% . In this study, reported rates of chronic bronchitis in Muynak are low (3.9%) by comparison to Kungrad and Shumanay where this problem was reported by approximately 10% of respondents. This is a surprising finding considering that Muynak is located beside the former Aral Sea bed which is believed to be a major source of airborne salt, contaminated dust and many of the regions dust storms (see Section 3.5).

Table 5.9
Reported health problems for which treatment by a doctor, felchar, nurse, healer or family member has occurred within the last 12 months

	Shumanay (n= 301)	*Kungrad (n=273)*	*Muynak (n=307)*	*Total (n=881)*
Reported Problems	*# (%)*	*# (%)*	*# (%)*	*# (%)*
Anemia	73 *(25)*	68 *(25)*	88 *(29)*	229 *(26)*
Kidney	48 *(16)*	50 *(18)*	58 *(19)*	156 *(18)*
Eye	43 *(14)*	37 *(14)*	40 *(13)*	120 *(14)*
Hypertension or high blood pressure	43 *(14)*	35 *(13)*	41 *(13)*	119 *(14)*
Respiratory	41 *(14)*	31 *(11)*	15 *(5)*	87 *(10)*
Heart disease	17 *(6)*	28 *(10)*	11 *(4)*	56 *(6)*
Goiter	13 *(4)*	19 *(7)*	19 *(6)*	51 *(6)*
Arthritis, swollen, red or painful joints	14 *(5)*	16 *(6)*	14 *(5)*	44 *(5)*
Skin	18 *(6)*	10 *(4)*	3 *(1)*	31 *(4)*
Jaundice	7 *(2)*	7 *(3)*	6 *(2)*	20 *(2)*
Tuberculosis	5 *(2)*	7 (3)	5 *(2)*	17 *(2)*
Cancer	3 *(1)*	0 *(0)*	1 *(0)*	4 *(1)*

5.3.3. Emotional Distress

Emotional distress was measured using the General Health Questionnaire, 20 item version (GHQ-20). The response categories on the GHQ items (better than usual, same as usual, worse than usual, much worse than usual, over the past two weeks prior to the survey) were firstly scored 0-0-1-1 as recommended by Goldberg (1972), and secondly, 0-

1-1-1 for the negative items and 0-0-1-1 for the positive items as recommended by Goodchild and Duncan-Jones (1985) in cases where chronic distress has occurred. The GHQ, using this scoring method is referred to by Goodchild and Duncan-Jones (1985) as the CGHQ. The alpha reliability coefficient for the GHQ was 0.74. The original published reliability coefficient for the self-administered GHQ-20 is 0.90. A cut-point score of 4 or more on the GHQ-20 (Goldberg,1972; Ford *et al.*,1989; Shapiro, *et al.*,1985) and 12 or more on the CGHQ (Goodchild and Duncan-Jones, 1985) indicates a probable case of emotional distress. The percentage of the samples for all sites scoring above the 4+ GHQ cut-point was 7% with the highest percentage found at Shumanay (8%) followed by Kungrad and Muynak (7%) (Table 5.10). The percentage scoring above the 12+ CGHQ cut-point is less than 1% for all three sites.

Table 5.10
GHQ-20 cut-point (4+)[1]

	***Shumanay* (n= 301)**	***Kungrad* (n=273)**	***Muynak* (n=307)**	***All Sites* (n=881)**
	# (%)	*# (%)*	*# (%)*	*# (%)*
Below cut-point	278 *(92)*	253 *(93)*	286 *(93)*	817 *(93)*
At or above the cut-point	23 *(8)*	20 *(7)*	21 *(7)*	64 *(7)*
Total	301 *(100)*	273 *(100)*	307 *(100)*	881*(100)*

[1] cut-point signifies a score of 4 or more indicating a 'probable case of emotional distress' (Goldberg,1972).

North American studies have found prevalence rates of emotional distress to range from 16% in a general population in Baltimore (Shapiro *et al.*,1985) to 24% in a similar

population (Ford *et al.*,1989). Prevalence rates using a version of the GHQ in a general population in England were 10% (Stanley and Gibson,1985) and 30% using the CGHQ (Huppert *et al.*,1988). Havenaar *et al.* (1996) in a study of a population in Belarus exposed to radiation from the Chernobyl nuclear accident found that 65% of respondents scored above the cut-point. In a general Taiwanese population, prevalence rates were reported to be 26% (Cheng,1985) and in a sample of Singaporean office workers prevalence rates were found to be 28% (Lim and Chew, 1991). Many validity studies done in other countries such as China (Chan,1985), Japan (Iwata, *et al.*,1988) South Africa (Spangenberg and Pieterse, 1995) and Brazil (Jesus Mari and Williams,1985) have demonstrated that various versions of the GHQ all have a high level of validity. Prevalence rates of emotional distress in the studies were, however, not published.

These comparisons with other studies suggest that the results for the GHQ and particularly the CGHQ in this study are well below the range reported for general populations in a variety of cultural contexts.

5.3.4. Somatic Complaints

The 12-item symptom checklist taken from the SCL-90 was used to measure distress as manifest in somatic symptoms. Based on the method used by Elliott (1993), four items relating to sleeping and eating disorders along with rashes and other skin conditions were added to this sub-scale. Respondents rated how bothered they had felt by a symptom on a 5 point scale from 0, 'not at all bothered' to 4, 'extremely bothered'. The alpha reliability coefficient for this scale was 0.81 for the original 12-item scale and 0.85

for the 16 item expanded scale. The original alpha reliability coefficient as reported by Derogatis *et al.* (1973) was 0.86.

Mean scores were calculated on the 16-item version for the purposes of comparison with population norms. Derogatis (1973) generated a normalized mean score of 0.36 for non-patient normals on the somatic sub-scale. Table 5.11 indicates the total and by site proportions of respondents scoring above the 0.36 cut-point, indicating a probable case of emotional distress manifest in somatic symptoms (Derogatis, 1973).

The mean SCL score for all respondents is 0.47 with the highest mean score reported in Shumanay (0.50) followed by Kungrad (0.49) and Muynak (0.40). The means for each site are above the 0.36 cut-point. 48% of all respondents scored above the 0.36 cut-point (Table 5.11). By site, Shumanay was found to have the highest percentage of respondents scoring above the cut-point (54%) followed by Kungrad (49%) and Muynak (41%). A test of association showed that the differences between sites is statistically significant ($p<0.01$) whereby distress increases as the distance from the sea increases.

Table 5.11
SCL cut-point (.36)[1]

	Shumanay (n= 301)	*Kungrad (n=273)*	*Muynak (n=307)*	*All Sites (n=881)*
	# (%)	*# (%)*	*# (%)*	*# (%)*
Below cut-point	138 *(46)*	139 *(51)*	180 *(59)*	457 *(52)*
Above the cut-point	163 *(54)*	134 *(49)*	127 *(41)*	424 *(48)*
Total	301 *(100)*	273 *(100)*	307 *(100)*	881 *(100)*

[1]cut-point refers to a mean score above the population norm signifying a probable case of emotional distress manifested in somatic symptoms (0.36; Derogatis, *et al.* 1973)

Uses of the somatic sub-scale of the SCL-90 in the general population are rare in the published literature. Buckelew *et al.* (1986) in a study of emotional distress in alternative population sub-groups, reported mean scores for pain patients (1.44), psychiatric in-patients (.92) and hospital employees (.47). Even more rare are studies of general populations in a non-Western contexts. In a large scale Chinese study (n=4054), Zheng and Lin (1994) found that a normal population sampled in 24 sites across mainland China reported mean scores of 0.39 for 'young' respondents, 0.47 for 'middle age' respondents, and 0.54 for 'elderly' respondents.

Uses of the somatic sub-scale within the psychosocial literature are also rare. When the SCL-90 is used, findings are often reported as a global symptom measure for all of the 9 sub-scales (e.g. Aroian, *et al.*,1995 and Prince-Embury,1989). Furthermore, when the somatic sub-scale is used, the raw data are often not reported (e.g. Horowitz and Stefanko, 1989). Exceptions to this include a study done by Elliott (1992) on the impacts of living near solid waste facilities. In this study, residents were found to have a mean

score of 0.34 and 34% scored above the 0.36 cut-point. Baum, *et al.* (1983a) in a study on the impacts of the Three Mile Island nuclear power plant accident, found that residents living in close proximity to the reactor had a mean score of 0.55. This is compared to several control groups including people living 20 miles away from TMI who had a mean score of 0.24, people living near a coal-fired power plant (0.29), and people living near an undamaged nuclear plant (0.30). In this study mean scores are considerably higher than those of individuals living close to solid waste facilities, and comparable to the sub-group living in close proximity to TMI (Table 5.11).

To further investigate the somatic sub-scale findings, bivariate analysis was done at each site with sociodemographic variables which, based on the literature, were seen to be plausibly related to this emotional distress construct. A number of significant relationships emerged from this analysis (Tables 5.12, 5.13 and 5.14). In Kungrad and Muynak, significant relationships were found between both measures of the SCL-90 (Mean Raw Score (MRS) and the cut-point measure) and gender, whereby scores for women were higher than for men and more women scored above the cut-point. This finding is consistent with both Horrowitz and Steffanko's (1989) study of a population exposed to a toxic waste landfill in California, and Elliott's (1992) study of populations living near non-toxic solid waste facilities. Age was found to be significantly related to both SCL-90 measures at Kungrad and Muynak such that as age increases, the SCL scores increases. Again this finding is consistent with the findings of Horrowitz and Steffanko (1989) and also with the findings of Zheng and Lin (1994) in a general population in China.

Marital status was found to be significantly related to both SCL-90 measures at Shumanay (Table 5.12), whereby married individuals had higher scores than non-married individuals. Living in a household with children less than 5 years old was related with both SCL-90 measures in Muynak (Table 5.14) whereby respondents with no children less than 5 years old had higher scores than respondents who had children less than five years old. Employment status was found to be significantly related to both SCL-90 measures at Kungrad and Muynak (Table 5.13 and 5.14), whereby retired respondents had the highest scores at both sites, followed by homemakers. The lowest scores at the two sites were reported by full-time workers and the unemployed. Length of residence was also found to be related to SCL-90 scores in Kungrad and Muynak, whereby the likelihood of higher SCL scores increased with increased length of residence. A contrary finding was reported by Elliott (1992) in her study of living near non-toxic solid waste facilities. A significant relationship was between ethnicity and both SCL measures in Shumanay (Table 5.12). Uzbeks had the highest SCL scores followed by Karakalpaks, Kazakhs and Turkmen. The final significant relationship was between the total number of stressful life events[7] reported by respondents and both SCL-90 measures in all three sites (Table 5.12, 5.13 and 5.14), whereby the likelihood of higher SCL scores increases with the increased number of stressful life events reported. This finding is consistent with Zheng and Lin (1994) who found stressful life events to be positively correlated with SCL scores in a normal Chinese population.

[7] Stressful life events were recorded using selected items from Holmes and Rahe's (1967) Critical Life Events Scale. Items include loss of job, divorce, serious illness and death of spouse.

Table 5.12
Relationship between sociodemographic characteristics and SCL-90 (mean raw score (MRS) and above/below the cut-point): Shumanay

Variables	*MRS*	*Cut-Point (.36)*	*Comments*
Sex	K.S. = 1.19[2]	$X^2 = 2.673$	
Age	tau = .168***[3]	t = 1.768	As age increases, the SCL score increases
Marital Status	K.S. = 1.445*	$X^2 = 4.808$*	MRS, married > not married % above cut-point: married = 58% not married = 44%
Children <5	K.S. =.469	$X^2 = .092$	
Able to make ends meet	K.S. = .433	$X^2 = .005$	
Education	tau = .005	U = 9361.5	
Employment status	K.W. = 5.244[4]	$X^2 = 2.111$	
Main source of family income: Agriculture vs. Other	K.S. = .898	$X^2 = .459$	
Length of Residence in the Area	tau = .051	t = -.283	
Ethnicity	K.W. = 21.395***	$X^2 = 21.743$***	MRS, Uzbek > Karakalpak > Kazakh >Turkmen % above cut-point: Uzbek = 74% Karakalpak = 57% Kazakh = 48% Turkmen = 41%
Sum of stressful life events	tau = .295***	t = 6.055***	As number of stressful life events increases, SCL score increases

notes:
[1] * $p < 0.05$
** $p < 0.01$
*** $p < 0.001$
[2] when the sociodemographic variable was dichotomous (e.g. sex: male/female), the Kolmogorov Smirnov test was used (as opposed to the t-test) given that the distribution of the MRS for the SCL-90 was significantly skewed toward the lower end.
[3] when the sociodemographic variable was continuous (e.g. age), tau was selected as the test statistic (over a Pearson Correlation) for the reason cited in note 2, above.
[4] when the sociodemographic variable was polychotomous (e.g. employment type), the Kruskal-Wallis test statistic was used (as opposed to an F statistic) for the reason cited in note 2, above.

Table 5.13
Relationship between sociodemographic characteristics and SCL-90 (mean raw score (MRS) and above/below the cut-point): Kungrad

Variables	*MRS*	*Cut-Point (.36)*	*Comments*
Sex	K.S. = 2.170***[2]	X^2 = 14.880***	MRS, female > male % above cut-point: male = 36% female = 60%
Age	tau = .265***[3]	t = 4.850***	As age increases, the SCL score increases
Marital Status	K.S. = .938	X^2 = 2.007	
Children <5	K.S. = .588	X^2 = .439	
Able to make ends meet	K.S. = .924	X^2 = 1.461	
Education	tau = -.098	U = -1.919	
Employment status	K.W. = 6.585***[4]	X^2 = 24.013***	% above cut-point: retired = 69% homemaker = 59% other = 55% full-time = 52% unemployed = 26%
Main source of family income: Agriculture vs. Other	K.S. = 1.049	X^2 = .179	
Length of Residence in the Area	tau = .137**	t = 3.914***	As length of residence increases, SCL score increases
Ethnicity	K.W. = 1.561	X^2 = 1.945	
Sum of stressful life events	tau = .266***	t = 5.979***	As number of stressful life events increases, SCL score increases

notes:
[1] * p < 0.05
** p < 0.01
*** p< 0.001
[2] when the sociodemographic variable was dichotomous (e.g. sex: male/female), the Kolmogorov Smirnov test was used (as opposed to the t-test) given that the distribution of the MRS for the SCL-90 was significantly skewed toward the lower end.
[3] when the sociodemographic variable was continuous (e.g. age), tau was selected as the test statistic (over a Pearson Correlation) for the reason cited in note 2, above.
[4] when the sociodemographic variable was polychotomous (e.g. employment type), the Kruskal-Wallis test statistic was used (as opposed to an F statistic) for the reason cited in note 2, above.

Table 5.14
Relationship between sociodemographic characteristics and SCL-90 (mean raw score (MRS) and above/below the cut-point): Muynak

Variables	*MRS*	*Cut-Point (.36)*	*Comments*
Sex	K.S. = 1.710**[2]	X^2 = 7.675**	MRS, female > male % above cut-point: male = 33% female = 49%
Age	tau = .240***[3]	t = 4.886***	As age increases, SCL score increases
Marital Status	K.S. = .611	X^2 = .303	
Children <5	K.S. = 1.562*	X^2 = 10.041**	MRS, no children > 1 or more % above cut-point: no children = 52% 1 or more = 34%
Able to make ends meet	K.S. = .445	X^2 = .163	
Education	tau = -.118*	U = 6652.5	As education increases, MRS increases
Employment status	K.W. = 18.388**[4]	X^2 = 12.191*	% above cut-point: retired = 60% other = 57% homemaker = 42% unemployed = 37% full-time = 35%
Main source of family income: Agriculture vs. Other	K.S. = .686	X^2 = 1.101	
Length of Residence in the Area	tau = .126**	t = 2.330*	As length of residence increases, SCL score increases
Ethnicity	K.S. = .580	X^2 = .193	
Sum of stressful life events	tau = .150**	t = 2.739**	As number of stressful life events increases, SCL score increases

notes:
[1] * p < 0.05
** p < 0.01
*** p< 0.001
[2] when the sociodemographic variable was dichotomous (e.g. sex: male/female), the Kolmogorov Smirnov test was used (as opposed to the t-test) given that the distribution of the MRS for the SCL-90 was significantly skewed toward the lower end.
[3] when the sociodemographic variable was continuous (e.g. age), tau was selected as the test statistic (over a Pearson Correlation) for the reason cited in note 2, above.
[4] when the sociodemographic variable was polychotomous (e.g. employment type), the Kruskal-Wallis test statistic was used (as opposed to an F statistic) for the reason cited in note 2, above.

5.3.5 Stressful Life Events

A potential confounder for the measurement of psychosocial health and well-being as impacted by environmental exposure is stressful live events (e.g. job loss, recent illness, divorce, death in family, financial concerns, etc.). Spangenberg and Pieterse (1995) found stressful life events to be positively correlated with GHQ scores in a South African population, and as previously mentioned, Zheng and Lin (1994) found stressful life events to be positively correlated with SCL scores in a normal Chinese population (see Section 5.3.4). Therefore, the experience of stressful life events was included in the survey in order to control for this potential confounder. In this study, stressful life events were recorded using selected items from Holmes and Rahe's (1967) Critical Life Events Scale.

Respondents were asked if they had experienced any of the stressful life events listed in Table 5.15 in the 12 months prior to the survey administration. The most commonly reported events are related to economic problems. Clearly, the most frequently reported event is greater than normal financial concerns followed by job loss of someone in the household and personal job loss (Table 5.15). Personal illness and illness of someone in the household were also frequently reported, however, no significant differences between sites were seen. In general, of the events where statistically significant differences between sites were found, the highest percentages of occurrence of events was in Muynak. Given the high percentages of stressful life events reported across all three sites, and the strong positive relationships found between stressful life events and SCL scores (Table 5.12, 5.13 and 5.14), one must therefore be cautious about attempting

to link reported levels of emotional distress directly to the Aral Sea region's environmental problems.

Table 5.15
Stressful life events

	Shumanay (n= 301)	*Kungrad (n=273)*	*Muynak (n=307)*	*All Sites (n=881)*
	# *(%)*	# *(%)*	# *(%)*	# *(%)*
Greater than normal financial concerns*	230*(76)*	203 *(74)*	260 *(85)*	693 *(79)*
Job loss of anyone else in household***	62 *(21)*	92 *(34)*	134 *(44)*	288 *(33)*
Job Loss***	68 *(23)*	79 *(29)*	117 *(38)*	264 *(30)*
Serious illness of anyone else in household	81 *(27)*	74 *(27)*	75 *(25)*	230 *(26)*
Serious illness	50 *(17)*	53 *(19)*	45 *(15)*	148 *(17)*
Death of anyone else in household**	34 *(11)*	14 *(5)*	36 *(12)*	84 *(10)*
Divorced	12 *(4)*	16 *(6)*	16 *(5)*	44 *(5)*
Death of spouse	14 *(5)*	14 *(5)*	10 *(3)*	38 *(4)*

* $p<0.05$ ** $p<0.01$ *** $p<0.001$

5.3.6. Summary Of Psychosocial Health And Well-Being

Reported perceptions of health at the three sites were low with over half of respondents reporting their health to be between fair and poor (see Table 5.7). These findings are considerably lower than findings from a Canadian health study (Health Canada, 1987) and much higher than findings from a Russian study (Bobak,1998). In contrast, over half of respondents reported being somewhat to very satisfied with their health. The types of health problems for which respondents have reported to have received treatment over the past twelve months include anemia, kidney problems, eye

problems, hypertension or high blood pressure and respiratory problems, all of which are problems commonly reported in the literature on this region (Frost,1997; see also Section 3.6). Self-reported prevalence rates of anemia are, however, well below rates reported in the literature (Frost,1997; Morse,1994).

Overall, scores for the General Health Questionnaire (GHQ) were much lower than those reported for a Belarus population exposed to the Chernobyl nuclear accident and also well below even the lowest scores for 'normal' populations in North America, Europe and Taiwan. Rather than suggesting that levels of emotional distress are particularly low in this sample, these findings indicate that perhaps the GHQ was perhaps not the most suitable instrument to use in this cultural context. The results from somatic sub-scale of the SCL-90 were more in keeping with the severity of the region's environmental problems. Results indicated that, overall, 48% of respondents scored above the 0.36 cut-point suggesting a probable case of emotional distress as manifested in somatic symptoms. This finding is comparable to the findings of a study done by Baum *et al.* (1983a), which found that, three years after the TMI nuclear accident, 48% of respondents living in close proximity to TMI, scored above the cut-point. The highest proportion above the cut-point was in Shumanay and the lowest in Muynak, a finding contrary to the initial hypothesis that psychosocial impacts would decrease as the distance from the Aral Sea increased.

Across the three sites, relatively high occurrences of stressful life events were reported (Table 5.15) and of these, economic related stressful life events (i.e. loss of job, greater than normal financial concern) were most frequently reported. Economic related stressful life events were reported most frequently in Muynak. This finding is consistent

with the reported high rates of unemployment in Muynak (Table 4.4) and the collapse of the area's once thriving fishing industry which has been documented in the literature (Glantz,1999; Glazovsky,1995; Micklin,1994; Bortnik *et al.*, 1992).

5.4. SOCIAL NETWORKS AND PSYCHOSOCIAL HEALTH

Social and community networks are commonly reported to play an important role in determining levels of psychosocial health (see Section 2.6). For example, Bertazzi (1989), in a study of a major toxic exposure in Italy, and Edelstein (1989) in a study of a toxic exposure in the U.S.A., both found that the support of friends and neighbours had an important moderating effect on psychosocial impacts. And Cramer (1991), in a study of a general population in England found a positive association between the quality of family support and psychological distress.

A total of twelve indicators were used to measure levels of social support and community involvement. These indicators included: involvement in community activities, frequency of talking with neighbours, community group involvement (e.g. sports, religious, youth or community service group), number of close friends, and satisfaction with social activities.

Overall, it was found that there is a high degree of informal community involvement/support among respondents as indicated by, for example, the finding that 79% reported to talk with their neighbours on a daily basis. This point is further demonstrated by the mean number of 'close' friends (9) and the mean number of 'close' relatives (14) reported. Conversely, little involvement in any type of formal community

group was reported. Between sites, only slight variation was found with regards to either formal or informal community involvement. Exceptions to this finding are seen with the measure of community group involvement, where in Shumanay it was reported that 38% of respondents were involved in one or more groups compared to approximately 20% in the other two sites. Also, in Muynak it was found that 86% of respondents talk to neighbours daily, compared to approximately 75% in Shumanay and Kungrad.

Tests of association between these indicators and the somatic symptom checklist (SCL-90) revealed few significant associations. This indicates that either social and community networks either do not have an important effect on psychosocial impacts in this cultural context or the relatively uniform high level of support that was reported masks its relative importance. A stronger test for social and community network effects comes from the multivariate analysis reported in Chapter Six.

5.5. PERCEPTIONS OF ENVIRONMENT AND HEALTH RELATIONSHIPS

Several indicators were employed to determine respondents' perceived links between local environmental problems and health problems. These included perceived causes of somatic complaints, the perceived existence of a relationship between local environmental problems and health, and specific self-reported health problems believed to be caused by environmental problems. The prevalence of each measure will be reported in turn.

5.5.1. Perceived Cause of Reported Somatic Complaints

Following the completion of the somatic complaints sub-scale of the SCL-90, respondents were asked to report on the factors they felt might be contributing to their symptoms. The question was open-ended, thus for analysis purposes, responses were coded into common themes (Table 5.16).

Of those respondents who scored above the SCL cut-point, the most frequently mentioned cause of somatic symptoms was specific health problems (37%) (Table 5.16). Specific problems mentioned range from 'old age' and 'pregnancy' to 'poor general health' and 'sick with tuberculosis'. The second most frequently mentioned cause of somatic symptoms was environmental problems (21%), problems which include responses such as 'dirty air', 'dirty water' and 'salty water'. Weather (14%) and lack of necessities (14%) were also reported to be important causes of somatic symptoms. Of those respondents who reported at least one somatic symptom (i.e. including individuals who scored below the cut-point), symptoms were again blamed predominately on specific health problems (37%) followed by environmental problems (22%), weather (12%) and a lack of necessities (11%).

Table 5.16
Perceived cause of somatic symptoms reported in the Somatic Symptom Checklist of the (SCL-90)

Perceived cause of somatic complaints	*People above SCL cut-point*[1]
	No. *(%)*
Specific health problems	131 *(37)*
Environmental problems	75 *(21)*
Weather	48 *(14)*
Lack of necessities	48 *(14)*
Emotional or stressful event	*23 (7)*
Other	*26 (7)*
Total[2]	351 *(100)*

[1] cut-point refers to a mean score above the population norm signifying a probable case of emotional distress manifested in somatic symptoms (0.36; Derogatis, *et al.* 1973)

[2] deviation from the total respondents above the SCL cut-point (n=424) is caused by the exclusion from analysis of 'no mention' (n=14), 'don't know' (n=56) and refused (n=2) responses, and missing data on the perceived cause of health problems mentioned

5.5.2. Perceived Relationship Between Environmental Problems and Health

Respondents reporting to have concerns about specific environmental problems (Table 5.5) were asked to, firstly, report whether or not they perceived that these environmental problems might affect their or their family's health and, secondly, if they have affected their or their family's health. The two questions were asked up to three times each following the mention of a specific environmental concern. Table 5.17 presents the findings for all mentions. A respondent was included in the analysis if one of the three mentions was affirmative (i.e. yes, it may affect my or my family's health; or yes, it has affected my or my families health).

In the sample, 30% of respondents reporting concerns about environmental problems reported that these problems might affect their or their families health. No significant differences were found between sites for this measure. 22% mentioned that

environmental problems have affected their or their family's health and again, no significant differences were found between sites.

Table 5.17
Perceived relationship between environmental problems and health

	Shumanay (n=301)	*Kungrad (n=273)*	*Muynak (n=307)*	*Total (n=881)*
	# (%)	*# (%)*	*# (%)*	*# (%)*
May affect health/ family's health	85 *(28)*	84 *(31)*	96 *(31)*	265 *(30)*
Has Affected health/ family's health	64 *(21)*	68 *(25)*	63 *(21)*	195 *(22)*

[1] Note that this question was only asked to those who reported having an environmental concern

5.5.3. Self-Reported Health Problems Attributed to Environmental Problems

Respondents who reported that their or their family's health had been affected by a specific environmental problem (see Section 5.4.2) were asked how it had been affected. This was asked up to three times for each respondent and each time they were asked to mention the health problems of up to five family members. Thus the maximum number of mentions was 15 per respondent. The findings in Table 5.18 represent all responses not respondents. Responses were open-ended and later coded for analysis.

A wide range of both physical and psychological (i.e. stress) health problems were reported. The most commonly reported health problems were malnutrition/anemia (14%) and stomach/intestinal problems (14%) (Table 5.18). By site, Shumanay respondents most frequently mentioned stomach/intestinal problems (17%) followed by bone/muscle problems (12%); Kungrad respondents most frequently mentioned stomach/intestinal

Table 5.18
Self-Reported Health Problems Attributed to the Environment

	Shumanay	*Kungrad*	*Muynak*	*Total*
Reported Problems	*# (%)*	*# (%)*	*# (%)*	*# (%)*
Malnutrition/ anemia	15 *(11)*	8 *(5)*	33 *(30)*	56 *(14)*
Stomach/ intestinal	23 *(17)*	18 *(12)*	14 *(12)*	55 *(14)*
Bone/muscle	17 *(12)*	9 *(6)*	7 *(6)*	33 *(8)*
Kidney	10 *(7)*	12 *(8)*	10 *(9)*	32 *(8)*
Headaches	10 *(7)*	13 *(9)*	8 *(7)*	31 *(8)*
Respiratory	10 *(7)*	15 *(10)*	5 *(4)*	30 *(8)*
Immune system	14 *(10)*	7 *(5)*	4 *(4)*	25 *(6)*
Circulatory	6 *(4)*	11 *(7)*	7 *(6)*	24 *(6)*
Skin	8 *(6)*	8 *(5)*	3 *(3)*	19 *(5)*
Eyes	3 *(2)*	7 *(5)*	8 *(7)*	18 *(5)*
Allergies	4 *(3)*	11 *(7)*	1 *(1)*	16 *(4)*
General weakness	8 *(6)*	2 *(1)*	1 *(1)*	11 *(3)*
Stress/worry	3 *(2)*	4 *(3)*	1 *(1)*	8 *(2)*
Liver	1 *(1)*	3 *(2)*	4 *(4)*	8 *(2)*
Other problems	7 *(5)*	22 *(15)*	7 *(6)*	36 *(9)*
Total	139 *(100)*	150 *(100)*	113 *(100)*	402 *(100)*[1]

[1] Respondents were allowed several mentions and responded on behalf of all family members. Thus the total n represents the number of responses as opposed to respondents.

problems (12%) followed by respiratory problems (10%); and, Muynak respondents most frequently mentioned malnutrition/anemia (30%) followed by stomach/ intestinal problems (12%).

With regards to anemia/malnutrition, the findings here were considerably lower than reported in Table 5.9 (recently treated health problems), with the exception of Muynak where they were slightly higher. The findings here were also lower than the prevalence rates reported for Muynak by Morse (1997). Other self-reported health problem rates which can be compared to previous findings (Table 5.9) are kidney and respiratory disease, as well as eye problems, all of which were lower here.

5.5.4. Summary of Perceived Environment and Health Links

A relatively large proportion of respondents (21%) who scored above the SCL cut-point reported that they perceived environmental problems to be the cause of their somatic symptoms (Table 5.15). Similarly, just under one quarter of the respondents who reported environmental concerns said that they believed environmental problems have affected their or their family's health and approximately a third feel that they may affect their or their family's health (Table 5.16). Although a significant proportion of the environmentally concerned population blames their and their family's health problems on environmental problems, it was expected that this proportion would have been larger.

Of those who reported that the environmental problems have affected their or their family's health, health problems such as stomach/intestinal problems, kidney disease and respiratory problems were commonly mentioned. This finding concurs with various authors who suggest that the health problems mentioned above are closely linked to the region's water and air pollution problems (Glazovsky, 1995; see also Section 3.6)

5.6. ACTIONS

Respondents were asked several questions about actions that they had taken, or had considered taking, because of environmental concerns. These included moving and measures taken to protect the local environment. Only those respondents who reported to have environmental concerns were asked these questions.

When respondents were asked if they had considered moving because of the local environmental problems, 42% said 'yes'. By site, 49% of Muynak respondents reported

that they had considered moving followed by 39% and 36% in Shumanay and Kungrad, respectively. To investigate potential determinants of these results, bivariate analysis was done using various sociodemographic variables which, based on the literature, were seen to be plausibly related to this measure. Only two out of ten relationships emerged from this analysis as significant: education and ethnicity. That is, as education increases the propensity to consider moving also increases. This is contrary to the findings of a study done by Elliott (1992), where it was found that, in a North American context, education decreases the propensity to consider moving. With regards to ethnicity, 52% of Kazakhs reported to have considered moving followed by 38% of Uzbeks and 35% of both Karakalpaks and Turkmen. When these respondents were asked where they would move to, 66% reported that they would move outside of Karakalpakstan. Although Kungrad had the smallest proportion of respondents reporting that they would consider moving because of environmental concerns (37% in Kungrad vs. 49% in Muynak), 92% of Kungrad respondents reported that they would move outside Karakalpakstan as compared to 50% and 57% in Muynak and Shumanay respectively.

Less than one third of respondents reporting environmental concerns reported that they had taken actions to protect the environment, and of these, the majority of actions involved planting trees or other vegetation (90%).

5.7. SUMMARY OF DESCRIPTIVE ANALYSIS

This chapter used descriptive statistics to address the first four research objectives:

1. to determine people's perceptions (health and environmental) associated with the environmental disaster;
2. to examine the links between health and environment made by individuals;
3. to determine the prevalence of psychosocial impacts amongst local residents; and,
4. to investigate the determinants of psychosocial impacts.

In order determine levels of environmental concern several solicited and unsolicited measures were used including major local area dislikes, things that respondents would change, the presence of environmental concern, types of environmental concern and intensity of concern. Some mixed messages emerged from the results of the survey with regards to levels of both solicited and unsolicited environmental concern. For example, the environment was reported to be both the most disliked aspect of respondents' local areas and the most liked (with the exception of Kungrad) (Table 5.1 and 5.2). And when respondents were asked about the one thing that they would change in their local area, with the exception of water quality in Muynak, environmental problems typically ranked low, below issues such as unemployment, the economy and essential service provision (Table 5.4)

With regards to solicited environmental concerns, approximately half of the respondents reported to have environmental concerns, consistent across sites (Table 5.5). Of those reporting to be concerned, the intensity of concern was high. The types of environmental problems most frequently mentioned as causing concern include water quality, air quality and land/soil quality (Table 5.6), all problems which have been reported in the literature to be particularly severe in the region (see Section 3.5). Variation

by site was seen in this case with water quality eliciting particular concern in Muynak and land/soil quality in Shumanay.

The differences between sites with regards to the types of environmental concerns mentioned (i.e. air quality, water quality and land/soil quality) and the things that respondents would change in their local area (i.e. reduce unemployment, improve gas supply etc.) demonstrates the relative importance of community characteristics and thereby the need to consider the local situation before any attempts to address community concerns are taken.

Perceptions of health were determined using measures of perceived general health as well as satisfaction with health. Overall, respondents in the three sites reported their health status as being either fair or poor (Table 5.7) and yet at the same time a high proportion of respondents reported to be very satisfied with their health (Table 5.8). The most frequently self-reported health problems for which respondents have received recent treatment are anemia, kidney problems, eye problems, hypertension or high blood pressure, and respiratory problems (Table 5.9). These health problems are consistent with those reported in the literature to be serious in the region, however, the rates of anemia, for example, found in this study are lower than found in other studies (e.g. Morse, 1994; see also Section 3.6).

Overall, levels of emotional distress measured by the GHQ-20 were well below the findings of other studies where this instrument has been used in general populations and in various cultural contexts (Table 5.10). The prevalence of somatic symptoms, however, at all three study sites (Table 5.11) were above normalized scores and comparable to the

findings of individuals living close by TMI following a nuclear incident (Baum, *et al.*, 1983a). In addition, there is a gradient of increasing prevalence away from the former Aral Sea coast reinforcing the findings that environmental concerns are no more severe in Muynak than in Kungrad or Shumanay (Table 5.5). Various sociodemographic variables including gender, age, marital status, length of residence in area, having children under 5 years old, employment status and ethnicity (Tables 5.12, 5.13 and 5.14), were found to be significantly related to levels of emotional distress as manifest in somatic symptoms.

Several measures to determine people's perceptions of the link between health and environmental problems were used. The data from these measures indicate that amongst respondents reporting somatic symptoms and those reporting to have environmental concerns, a relatively large proportion perceive that environmental problems are linked to health problems (Tables 5.15 and 5.16).

Thus, in summary, it has been demonstrated through the evidence from the quantitative survey that a significant proportion of the sample population are concerned about environmental problems, perceive their health as only fair or poor, are experiencing emotional distress as manifest in somatic symptoms, and frequently blame their or their family's health problems on the environment. The next step is to examine in more detail objective four:

4. to investigate the determinants of psychosocial impacts.

This will be done in the following chapter where logistic regression modeling is used to profile the characteristics of respondents who are more likely to report psychosocial impacts.

CHAPTER 6:

DETERMINANTS OF PSYCHOSOCIAL IMPACTS

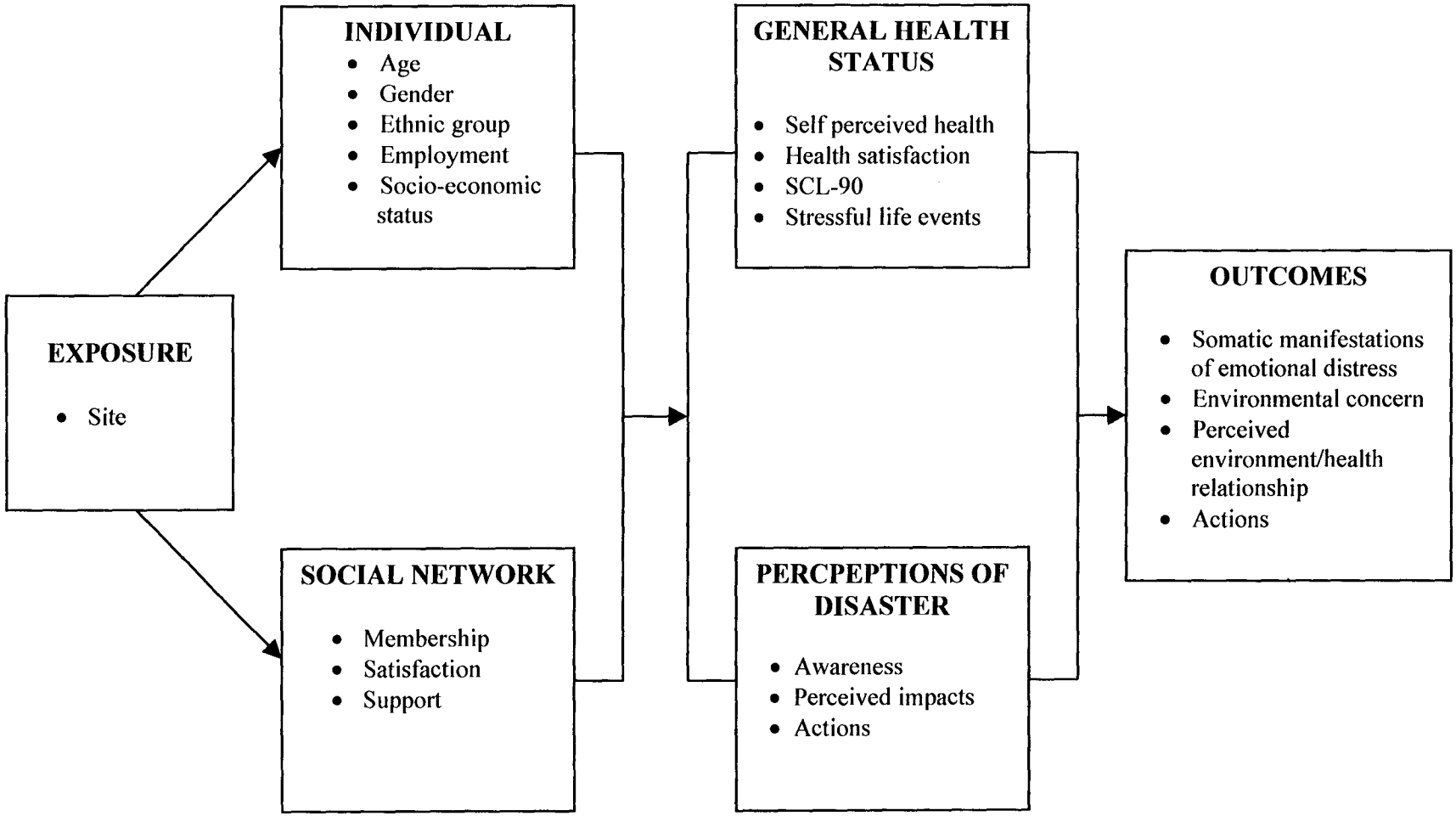
6.1. INTRODUCTION

The previous chapter examined perceptions of health and environment, links between environment and health, prevalence of psychosocial impacts, and correlates of psychosocial impacts, in three communities of Karakalpakstan in the Aral Sea region. This chapter examines the determinants of psychosocial impacts by using logistic regression analysis to profile the characteristics of respondents more likely to report impacts.

6.2. LOGISTIC REGRESSION ANALYSIS

The framework used to guide this analysis contains six components (Figure 6.1): exposure (as determined by distance from the Aral Sea), individual characteristics, social network characteristics, health and well-being variables, perceptions of the disaster, and psychosocial outcomes. The structure of the analytical model is informed by the conceptual framework (Figure 2.1) which asserts that psychosocial health impacts are influenced by a number of factors which interact not only with psychosocial health but also with each other. However, unlike the multidirectional relationships between these variables shown in the conceptual framework, the analytical model could only accommodate unidirectional relationships between dependent and independent variables.

FIGURE 6.1 ANALYTICAL MODEL



This apparent inconsistency between models highlights the difficulty of translating a complex conceptual framework into a tractable analytical framework (Elliott *et al.*,1993). This difficulty in turn has implications for the interpretation of results (Section 6.3) in that, although the results reveal the variables hypothesized to be mediating the relationships between exposure and psychosocial impacts, in some cases the question of the direction of these relationships remains unanswered; indeed, unanswerable, given the cross-sectional study design employed.

Logistic regression was selected as the method of analysis for several reasons: firstly, the outcomes of interest were dichotomous; secondly, the potential explanatory variables were both continuous and categorical (Table 6.1); and finally, the relationships between the explanatory variables and outcome variables were sensibly described with a logistic function (Elliott, *et al.*,1993).

Logistic regressions were calculated for five outcome variables: *environmental concern, Somatic Symptom Checklist (SCL-90) above or below cut-point, environmental problems might affect health or family's health, environmental problems have affected health or family's health* and *considered moving because of environmental problems*. For each outcome, both by site models and models combining the data from all three sites were constructed. These models were constructed sequentially whereby each block of explanatory variables seen in the analytical model (Figure 6.1) was entered (first the 'exposure' block followed by the 'individual' block and so on). Only the variables which made a contribution to the model were kept before the next block was added. Models were run using a forward stepwise selection algorithm. Variables were determined to

Table 6.1
Explanatory variables in logistic regression models

Variable	Type	Coding (reference category underlined)
Individual characteristics		
Age	continuous	older vs. younger
Gender	categorical	female vs. male
Marital status	categorical	single vs. married
Education	categorical	intermediate or higher vs. less than intermediate
Ethnic group	categorical	Karakalpak vs. Uzbek vs. Kazakh vs. Turkmen
Main income	categorical	agriculture or fishing vs. other
Employment status	categorical	full time vs. other
Able to make ends meet	categorical	no vs. yes
Trouble keeping employment	categorical	no vs. yes
Years living in area	categorical	more vs. less
Children under 5 years	categorical	no vs. yes
Exposure		
Site (combined models only)	categorical	Shumanay vs. Kungrad vs. Muynak
Social network		
Frequency talking with neighbours	categorical	less than 2/week vs. 2/week or more
Frequency helping neighbours	categorical	less than 2/week vs. 2/week or more
Satisfaction with place	categorical	not too to not at all vs. somewhat to very
Satisfaction with social activities	categorical	not too to not at all vs. somewhat to very
Have someone to confide in	categorical	no vs. yes
Have someone to help you	categorical	no vs. yes
# of local groups	continuous	more vs. less
# of local activities	continuous	more vs. less
# of friends	continuous	more vs. less
# of relatives	continuous	more vs. less
Health and well-being		
SCL-90 score	categorical	below vs. above cut-point
Health satisfaction	categorical	not too to not at all vs. somewhat to very
Perceived health status	categorical	fair to poor vs. very good to good
Stressful life events	continuous	more vs. less
Perceptions of the disaster		
Specific environmental concerns	categorical	no vs. yes
Major local area dislike	categorical	environment vs. other
Change 1 thing about local area	categorical	environment vs. other
Considered moving (because of environmental problems)	categorical	no vs. yes
(Environmental problem) might influence your/family's health	categorical	no vs. yes
(Environmental problem) has influenced your/family's health	categorical	no vs. yes
Level of environment related health concerns	categorical	moderate to extreme vs. none to slight

contribute to the model if the significance level for the Wald inclusion test statistic was 0.05. Due to its *a priori* importance, the *site* variable (proxy measure of exposure) was forced into every combined site model regardless of its contribution. Given the differing findings by various authors of the importance of gender and age in determining psychosocial impacts (e.g. Elliott,1998; Dalgard and Haheim,1998; Havenaar,1996; Evans *et al.*,1994; Edelstein,1988) these variables were not classified as *a priori* but were instead subjected to the same inclusion criteria as all other explanatory variables. Once all explanatory variables were identified, their first-order interaction terms were entered into a second model and run using forward stepwise selection. Interaction terms were made up of all remaining independent variables by all other remaining independent variables. All explanatory variables and interaction terms remaining were then entered into a third model and again run using a forward stepwise selection. Variables which did not turn up significant in the final model but were present as variables in interaction terms were forced into the model regardless of their contribution.

6.3. RESULTS

The results of the analysis for the site-specific models and models combining the data from all three sites are reported for five outcomes variables: *Somatic Symptom Checklist (SCL-90) - above or below cut-point, concern about the environment, environmental problems might affect health/family's health, environmental problems have affected health/family's health* and *considered moving because of environmental problems.*

6.3.1. By Site Models

The logistic regression model of SCL-90 scores at Shumanay (Table 6.2) had a rho square (ρ^2) of .28. ρ^2 measures goodness of fit of the model. ρ^2 values of between .2 and .4 indicate a good fit of the model (McFadden 1979, as cited in Wrigley 1985). The positive predictive value of this model (i.e. the percentage of respondents who were predicted to be above the SCL cut-point who actually scored above the cut-point) was high (80%) and the negative predictive value (i.e. the percentage of those respondents who were predicted to be below the SCL cut-point who scored below the cut-point) was lower (68%). The model had good specificity (i.e. the percentage below the SCL cut-point who were correctly predicted) at 74% and good sensitivity (i.e. the percentage above the SCL cut-point who were correctly predicted) at 74%. The model correctly classified 74% of respondents.

The significant explanatory variables in the model (the shaded cells in Table 6.2) included those from the individual and health and well-being blocks (Figure 6.1). The

Table 6.2
Results of logistic regression for outcome: Somatic Symptom Checklist (SCL-90) – above or below normal cut-point

SHUMANAY		*KUNGRAD*		*MUYNAK*	
VARIABLE	***R.O. (C.I.)***	*VARIABLE*	***R.O. (C.I.)***	*VARIABLE*	***R.O. (C.I.)***
Gender**	2.53 (1.40;4.57)	Gender**	17.38 (3.03; 99.76)	Gender*	2.04 (1.16;3.60)
Ethnicity**		Age**	1.03 (1.01;1.05)	Age*	1.02 (1.00;1.04)
Karakalpak	1.83 (.90;3.72)	Perceived health status**	2.75 (1.50; 5.05)	Children under 5 years*	.49 (.28;.86)
Uzbek	4.60 (2.14;9.89)	Stressful life events***	1.78 (1.38; 2.29)	Perceived health status***	8.18 (4.44; 15.07)
Kazakh	1.32 (.42;4.10)	Might influence your/family's health*	2.01 (1.01; 4.01)	Has influenced your/family's health**	3.48(1.71; 7.08)
Perceived health status*	2.21 (1.15;4.26)	Considered moving**	4.03 (1.54; 10.51)		
Satisfaction with health***	4.77 (2.43; 9.35)	Gender X Age*	.96 (.92;.99)		
Stressful life events***	1.54 (1.20;1.98)				
ρ^2	.28	ρ^2	.28	ρ^2	.25
Sensitivity	74%	Sensitivity	75%	Sensitivity	70%
Specificity	74%	Specificity	76%	Specificity	82%
% correctly classified	74%	% correctly classified	76%	% correctly classified	77%

* $p<0.05$ ** $p<0.01$ *** $p<0.001$

Relative Odds (R.O.) and Confidence Intervals (C.I.) associated with each variable are reported in the table. Relative odds (exponent β) expresses the odds of an outcome variable changing with the change in a continuous variable by one unit, or with the change in a categorical variable from one category to another (Norusis/SPSS Inc.,1996). If β is negative, the relative odds are less than one indicating that the odds are decreased and if β is positive, the relative odds are more than one indicating that the odds are increased. If β is zero, the odds remain the same. Using gender at Shumanay as an example, the relative odds indicate that women are 2.53 times more likely to score above the SCL cut-point than men (reference category). The 95% confidence interval shows that the estimate of the relative odds was between 1.40 and 4.57. Based on the significant effects in the model (Table 6.2), Shumanay respondents were more likely to score above the SCL-90 normal cut-point (i.e. report emotional distress as manifest in somatic symptoms) if they were: female, Uzbek (vs. Turkmen), perceived their health to be either fair to poor as opposed to good to very good, were not too or not at all satisfied with their health, and had experienced more stressful life events over the past year. The results here regarding gender differences and SCL-90 scores support the findings of several previous studies which indicate that women experience greater psychosocial impacts than men when exposed to environmentally stressful situations (Section 2.2.3). The higher propensity for Uzbeks as compared to other ethnic groups to score above the SCL-90 cut-point also supports the literature which suggests that cultural characteristics mediate psychosocial impacts (Section 2.2.3). The significant relationship between stressful life events measured using the Stressful Life Events Scale (Holmes and Rahe,1967) and SCL-90

scores suggests that life stresses other than environmental stresses may be contributing to higher SCL scores. A significant positive relationship was also found between SCL-90 scores and stressful life events in the bivariate analysis discussed previously (Section 5.3.4).

The model of SCL-90 scores at Kungrad (Table 6.2) had a ρ^2 of .28. The positive predictive value of this model was 75% and the negative predictive value was 76%. The model had good specificity at 76% with similarly good sensitivity at 75%. The model correctly classified 76% of respondents.

The significant explanatory variables in this model (the shaded cells in Table 6.2) included those from the individual characteristics, health and well-being, and perceptions of disaster blocks of the analytical framework (Figure 6.1). Based on the significant single effects in the model, Kungrad respondents were more likely to score above the SCL-90 normal cut-point if they: were women, were older, perceived their health to be fair to poor as opposed to good to very good, had experienced more stressful life events over the past year, perceived that environmental problems might influence their or their family's health, and had considered moving because of environmental problems. The influence of age on levels of psychosocial impacts is inconsistent with the literature. In this case, increased age is positively associated with emotional distress (SCL-90) whereas the literature suggests that increased age is either negatively associated with emotional distress or has no significant effect (Section 2.2.3). The finding that the propensity to score above the SCL-90 cut-point increases if individuals perceive that environmental problems might affect their or their family's health **or** have considered moving because of

environmental concerns, indicates the important relationship between perceptions of the environmental disaster and psychosocial impacts. The significant interaction effects in the model indicate that women who were older were less likely to score above the Somatic Symptoms Checklist (SCL-90) cut-point.

The SCL-90 model at Muynak (Table 6.2) had a ρ^2 of .25. The positive predictive value of this model was 77% and the negative predictive value was 76%. The model had good specificity at 82% however the sensitivity was lower at 70%. The model correctly classified 77% of respondents.

The significant explanatory variables in this model (the shaded cells in Table 6.2) include those from the individual characteristics, health and well-being and perceptions of the disaster blocks (Figure 6.1). Based on the significant effects in the model, Muynak residents were more likely to score above the SCL-90 normal cut-point if they: were women, were older, perceived their health as fair to poor, or perceived that the region's environmental disaster has affected their or their family's health. The model demonstrates that perceived health status had a particularly strong influence on SCL-90 scores in Muynak (R.O. = 8.18). Residents here were less likely to score above the cut-point if they had one or more children less than 5 years of age in their household. This relationship is inconsistent with the literature which suggests that having young children increases psychosocial impacts on an individual due to the additional concern which they may carry for the child's well-being (Section 2.2.3).

There are several major points which come out of these models which should be highlighted. Firstly, considerable homogeneity between the three models was found with

regards to the explanatory variables which were significant. Gender and perceived health status were significant in all three models, and age, stressful life events and has influenced or might influence your or your family's health were significant in two models. This homogeneity is further seen in the equally good fit of the three models. Despite locational differences, significant population characteristic differences (see Section 4.4), and significant SCL-90 score differences between the three study sites (see Section 5.3.4), the models indicate that comparable relationships exist between somatic symptoms (SCL-90) and mediating factors (e.g. gender, age, perceived health status). Secondly, due to the linear nature of the analytical model, the direction of the cause-and-effect linkages between measures of self-perceived health or health satisfaction, and emotional distress are left in question. Although strong relationships exists between these variables at all three sites, it is unclear whether poor health (perceptions) leads to emotional distress or emotional distress leads poor health. Finally, it is worth noting the importance of the relationship between stressful life events and SCL-90 scores in Shumanay and Kungrad. This finding suggests that somatic symptoms may be partly due to stressful factors other than those *directly* related to environmental problems. This finding is reinforced by the results from the bivariate analysis (Section 5.3.4).

Respondents were asked to report if they were concerned about the region's environmental problems (see Section 5.2.2). The logistic regression model for this outcome variable at Kungrad (Table 6.3) had a ρ^2 of only .08. The positive predictive value of this model was 41% and the negative predictive value was 75%. The model had

Table 6.3
Results of logistic regression for outcome: Environmental concern

SHUMANAY		*KUNGRAD*		*MUYNAK*	
VARIABLE	***R.O. (C.I.)***	***VARIABLE***	***R.O. (C.I.)***	***VARIABLE***	***R.O. (C.I.)***
Trouble keeping employment**	2.79 (1.36; 5.74)	SCL-90 score***	2.55 (1.50;4.32)	Main income*	.36 (.14; .95)
# of relatives*	.98 (.97; .99)	# of local activities**	1.33 (1.12;1.58)	# of relatives**	.96 (.94;.99)
Perceived health status***	2.65 (1.57; 4.48)	# of friends*	.97 (.93;.99)	# of local groups involved in**	1.67(1.20; 2.33)
		Major local area dislike**	2.29 (1.34; 3.93)	Satisfaction with social activities*	2.39 (1.16; 4.94)
				Change 1 thing about local area*	2.09 (1.10; 3.97)
ρ^2	.08	ρ^2	.11	ρ^2	.10
Sensitivity	51%	Sensitivity	64%	Sensitivity	59%
Specificity	66%	Specificity	71%	Specificity	64%
% correctly classified	62%	% correctly classified	68%	% correctly classified	62%

* $p<0.05$ ** $p<0.01$ *** $p<0.001$

low specificity at 66% and low sensitivity at 51%. The model correctly classified 62% of respondents.

The significant explanatory variables in this model (the shaded cells in Table 6.3) included those from the individual characteristics, social network, and health and well-being blocks. Shumanay respondents were more likely to report environmental concern if they reported that they had had trouble keeping employment and perceived their health status to be fair to poor (vs. good to very good). Respondents were less likely to have environmental concerns if they had more close relatives. This is the first indication of a significant role for the social network as a mediating factor for psychosocial impacts in this population. Much of the literature indicates that social support plays an important role in determining the type of coping technique an individual adopts and the effect it has in buffering impacts (see Section 2.2.3).

The logistic regression model of environmental concern at Kungrad (Table 6.3) had a ρ^2 of only .11. The positive predictive value of this model was low at 58%; the negative predictive value was 75%. Specificity was 71% and sensitivity was 64%. The model correctly classified 68% of respondents. The significant explanatory variables in this model (the shaded cells in Table 6.3) included those from the individual characteristic, social network, and perceptions of the disaster blocks (Figure 6.1). Based on the significant single effects in the model, Kungrad respondents were more likely to report environmental concerns if they: scored above the SCL-90 normal cut-point, were involved in more local activities, and the environment was reported as the characteristic

that they most disliked about their local area. Respondents were less likely to have environmental concerns if they had more close friends. In this model two types of social network variables are significant: formal network variables (i.e. # *of local activities*) and informal network variables (i.e. # *of friends and* # *of relatives*). Increased involvement in formal networks is positively associated with environmental concern whereas informal involvement is negatively associated.

The model of environmental concern at Muynak (Table 6.3) had a ρ^2 of only .10. The positive predictive value of this model was low (54%) with a negative predictive value slightly higher at 68%. The model had low specificity (64%) and a lower sensitivity (59%). The model correctly classified 62% of respondents.

The significant explanatory variables in this model (the shaded cells in Table 6.3) included those from the individual characteristics, social network, and perceptions of the disaster blocks (Figure 6.1). Based on the significant single effects in the model, Muynak respondents were more likely to have environmental concerns if they: were involved in more local groups, were not satisfied with their social activities and reported 'the environment' as the factor they would change if they could change one thing about their local area. Respondents were less likely to have environmental concerns if they had a main income coming from farming or fishing and had more close relatives. The decreased propensity for fishers and farmers to experience lower environmental concern suggests that dependence on the environment for earning a living is not as important a factor in determining environmental concern in Muynak as might have been expected.

With regards to environmental concern, social network variables (number of relatives, number of social activities, etc.) were found to be significant mediators of environmental concern at all three sites indicating the importance of the social support/psychosocial impact relationship presented in the conceptual framework (see Figure 2.1) and in the literature (Section 2.2.3). The Kungrad and Muynak models however indicate that differing mediating effects exist between informal and formal social networks whereby increased involvement in formal networks is positively associated with environmental concern and informal involvement is negatively associated.

Respondents reporting environmental concern were asked if they felt that the region's environmental problems might have affected their or their family's health. This outcome variable is an indicator of perceptions of environment and health relationships, as well as an indicator of health concern. The logistic regression model for this outcome variable at Shumanay (Table 6.4) had a ρ^2 of .22. The positive predictive value of this model was low (40%) and the negative predictive value was high (95%). The model had good specificity at 81% and a slightly lower sensitivity at 74%. The model correctly classified 79% of respondents.

The significant explanatory variables in this model (the shaded cells in Table 6.4) included those from all blocks (Figure 6.1). Based on the significant single effects in the model, Shumanay respondents were more likely to perceive that environmental problems might affect their or their family's health if they: had SCL-90 scores above the normal cut-point and had considered moving because of environmental problems. Individuals who are not married were less likely to feel that environmental problems might affect their or their

Table 6.4
Results of logistic regression for outcome: Might affect health or family's health

SHUMANAY		*KUNGRAD*		*MUYNAK*	
VARIABLE	***R.O. (C.I.)***	***VARIABLE***	***R.O. (C.I.)***	***VARIABLE***	***R.O. (C.I.)***
Marital status**	.29 (.13;.68)	Children under 5 years*	.55 (.31; 1.00)	# of local activities***	1.62 (1.32;1.99)
Satisfaction with social activities	1.67 (.83; 3.34)	# of local activities**	1.29 (1.07; 1.55)	# of relatives**	.94 (.91;.98)
Satisfaction with place	1.23 (.55; 2.30)	SCL-90 score**	2.40 (1.31; 4.37)	Considered moving***	29.06 (12.65; 66.75)
SCL-90 score*	1.95 (1.20; 3.73)	Considered moving***	8.32 (3.69; 18.73)		
Considered moving***	11.98 (5.45; 26.35)				
Satisfaction with social activities X satisfaction with place*	6.05 (1.50; 24.37)				
ρ^2	.22	ρ^2	.19	ρ^2	.35
Sensitivity	74%	Sensitivity	74%	Sensitivity	82%
Specificity	81%	Specificity	77%	Specificity	85%
% correctly classified	79%	% correctly classified	77%	% correctly classified	84%

* $p<0.05$ ** $p<0.01$ *** $p<0.001$

family's health. The significant interaction effects in the model indicates that those who were not satisfied with their social activities **and** were not satisfied with place (the local area where they live) were more likely to perceive that environmental problems might affect their or their family's health.

The model of *might affect health/family's health* at Kungrad (Table 6.4) had a ρ^2 of .19. The positive predictive value of this model was low (37%) and the negative predictive value was high (94%). The model had a specificity at 77% and a slightly lower sensitivity at 74%. The model correctly classified 77% of respondents.

The significant explanatory variables in this model (the shaded cells in Table 6.4) included those from all blocks (Figure 6.1). Based on the significant single effects in the model, Kungrad respondents were more likely to perceive that environmental problems might affect their or their family's health if they were: involved in more local activities, scored above the SCL-90 normal cut-point and had considered moving because of the region's environmental problems. These significant variables echo those of the previous model with respect to the importance of reported somatic symptoms (SCL-90) and a potential willingness to take action (i.e. consider moving) as a result of the environmental problems. Respondents were less likely to perceive that environmental problems might affect their or their family's health if they had children under 5 years of age in their household. This relationship is inconsistent with the literature which suggests that having young children increases the psychosocial impacts experienced by an individual due to the added concern they may carry for the young child's well-being (see Section 2.2.3).

The model of *might affect health/family's health* at Muynak (Table 6.4) had a ρ^2 of .35. The positive predictive value of this model was 62% and the negative predictive value was 94%. The model had a specificity of 85% and a slightly lower sensitivity at 82%. The model correctly classified 84% of respondents.

The significant explanatory variables in this model (the shaded cells in Table 6.4) include those from the social network and perceptions of the disaster blocks (Figure 6.1). Based on the significant single effects in the model, Muynak respondents were more likely to perceive that environmental problems might affect their or their family's health if they were: involved in more local activities and, as in the previous two models, had considered moving because of the regions environmental problems. Respondents were less likely to perceive that environmental problems might affect their or their family's health if they had more close relatives.

There are two points to be made from this analysis. First, the explanatory variable *considered moving* had a particularly strong influence in all three sites indicating a strong relationship between concern (as demonstrated by the variable *considered moving*) and perceived environment/health links. Secondly, social network characteristics played an important role in each of the three models again demonstrating the importance of social network factors as mediators of psychosocial impacts as has been frequently reported in the literature (see Section 2.2.3)

Respondents reporting environmental concern were asked if they felt that a local environmental problem *has* affected their or their family's health. Again, this outcome variable functions as both an indicator of perceptions of environment and health

relationships, as well as an indicator of health concern. The logistic regression model for this outcome variable at Shumanay (Table 6.5) had a ρ^2 of .20. The positive predictive value of this model was low (32%) while the negative predictive value was high (97%). The model had a high specificity at 84% and a lower sensitivity at 71%. The model correctly classified 83% of respondents.

The significant explanatory variables in this model (the shaded cells in Table 6.5) included those from social network, health and well-being and perceptions of disaster blocks (Figure 6.1). Based on the significant single effects in the model, Shumanay respondents were more likely to perceive that environmental problems have affected their or their family's health if they: had SCL-90 scores above the normal cut-point and had considered moving because of environmental problems. Individuals who had more close friends were less likely to feel that environmental problems might affect their or their family's health.

The model of *has affected health/family's health* at Kungrad (Table 6.5) had a ρ^2 of .26. The positive predictive value of this model was low (43%) and the negative predictive value was high (95%). The model had a specificity at 84% and a slightly lower sensitivity at 71%. The model correctly classified 82% of respondents.

The significant explanatory variables in this model (the shaded cells in Table 6.5) included those from all blocks (Figure 6.1). Based on the significant single effects in the model, Kungrad respondents were more likely to perceive that environmental problems have affected their or their family's health if they: were not always able to make ends meet, scored above the SCL-90 cut-point, were not satisfied with place (local area) and

Table 6.5
Results of logistic regression for outcome: Has affected health or family's health

SHUMANAY		*KUNGRAD*		*MUYNAK*	
VARIABLE	***R.O. (C.I.)***	*VARIABLE*	***R.O. (C.I.)***	*VARIABLE*	***R.O. (C.I.)***
# of friends*	.95 (.90; .99)	Children under 5 years**	.39 (.20;.80)	# of local activities***	1.61 (1.28; 2.05)
SCL-90 score***	3.89 (1.93;7.87)	Always able to make ends meet**	4.23 (1.56;11.44)	Stressful life events**	1.52 (1.13; 2.04)
Considered moving***	8.34 (3.88;17.92)	SCL-90 score***	3.42 (1.66;7.06)	Considered moving***	20.05 (9.21;43.64)
		Have someone to help you*	.22 (.05;.94)		
		Satisfaction with place**	2.96 (1.45; 6.04)		
		Considered moving***	5.71 (2.47; 13.22)		
ρ^2	.20	ρ^2	.26	ρ^2	.32
Sensitivity	71%	Sensitivity	71%	Sensitivity	71%
Specificity	84%	Specificity	84%	Specificity	90%
% correctly classified	82%	% correctly classified	82%	% correctly classified	87%

* $p<0.05$ ** $p<0.01$ *** $p<0.001$

had considered moving because of environmental problems. Respondents were less likely to report that their or their family's health has been affected by environmental problems if they had children under 5 years old in the household and had someone to help them if they need it.

The model of *has affected health/family's health* at Muynak (Table 6.5) had a ρ^2 of .32. The positive predictive value of this model was low (54%) and the negative predictive value was high (95%). The model had a specificity at 90% and a lower sensitivity at 71%. The model correctly classified 87% of respondents.

The significant explanatory variables in this model (the shaded cells in Table 6.5) included those from social network, health and well-being and perceptions of the disaster blocks (Figure 6.1). Based on the significant single effects in the model, Muynak respondents were more likely to perceive that environmental problems have affected their or their family's health if they: were involved in more local activities, had experienced more stressful life events and had considered moving because of the environmental problems.

Several points can be made from these models. Firstly, the findings from the logistic regression analysis for the outcome variables *has affected health/family's health* (Table 6.5) and *might affect health/family's health* (Table 6.4) are, like the variables themselves, very similar. This is demonstrated in both the fit of the models as well as the explanatory variables found to be significant (i.e. *considered moving*, *SCL-90 score* and social network variables). Secondly, the explanatory variable *considered moving* has a particularly strong influence across the three sites for both outcomes, indicating a strong

relationship between possible action and concern. Thirdly, social network variables were found to have strong mediating effects. In all sites, greater involvement in local activities increased the propensity for individuals to perceive that the environment might have or has had health effects, and more close friends or relatives along with dissatisfaction with place decreased the propensity. Finally, increased levels of emotional distress as measured by the SCL-90, was found to increase the likelihood that individuals in Shumanay and Kungrad would report to perceive an environment/health relationship (Table 6.4 and Table 6.5). As previously discussed, due to the linear nature of the analytical model, the direction of the cause-and-effect linkages between this outcome and psychosocial impacts cannot be verified.

Respondents were asked to report if they had considered moving because of environmental concerns (see Section 5.6). The logistic regression model of *considered moving* at Shumanay (Table 6.6) had a ρ^2 of .29. The positive predictive value of this model was low (30%) and the negative predictive value was high (98%). The model had high specificity (89%) but lower sensitivity (68%). The model correctly classified 87% of respondents.

The significant explanatory variables in this model (the shaded cells in Table 6.6) included those from the individual characteristics and environmental concern blocks. Based on the significant single effects in the model, Shumanay respondents were more likely to have considered moving if they: had an intermediate or higher level of education, had trouble keeping employment, or had a moderate to extreme level of concern about

Table 6.6
Results of logistic regression for outcome: Considered moving because of environmental problems

SHUMANAY		*KUNGRAD*		*MUYNAK*	
VARIABLE	***R.O. (C.I.)***	***VARIABLE***	***R.O. (C.I.)***	***VARIABLE***	***R.O. (C.I.)***
Education*	3.43 (1.09; 10.79)	SCL-90 score**	3.71 (1.54; 8.93)	Level of environment related health concern	2.58 (.66; 10.01)
Trouble keeping employment*	2.33 (1.14; 6.57)	Change one thing about local area*	2.56 (1.09; 5.98)	might influence your/family's health***	38.65 (9.95;150.13)
Level of environment related health concern***	14.82 (6.39;34.38)	Level of environment related health concern***	11.33 (4.44;28.88)	might influence your/family's health X level of environment related health concern**	.01 (.00; .11)
ρ^2	.29	ρ^2	.27	ρ^2	.40
Sensitivity	68%	Sensitivity	65%	Sensitivity	55%
Specificity	89%	Specificity	88%	Specificity	93%
% correctly classified	87%	% correctly classified	87%	% correctly classified	83%

* $p<0.05$ ** $p<0.01$ *** $p<0.001$

environment related health problems. Relative to the other explanatory variables, the variable *level of concern* has a particularly strong relationship with the outcome variable.

The model of *considered moving* at Kungrad (Table 6.6) had a ρ^2 of .27 The positive predictive value of this model was low at 27% and the negative predictive value was high at 97%. The model had high specificity (88%) but lower sensitivity (65%). The model correctly classified 87% of respondents.

The significant explanatory variables in this model (the shaded cells in Table 6.6) included those from the health and well-being and perceptions of the disaster blocks. Based on the significant single effects in the model, Kungrad respondents were more likely to have considered moving if they: had scored above the SCL-90 general cut-point, would improve the environmental situation if they could change one thing about their local area, and had a moderate to extreme level of concern about environment related health problems. Again, a particularly strong relationship can be seen between the explanatory variable *level of concern* and the outcome variable.

The logistic regression model of considered moving at Muynak (Table 6.6) had a ρ^2 of .40 The positive predictive value of this model was 84% and the negative predictive value was 82%. The model had high specificity (93%) but much lower sensitivity (55%). The model correctly classified 83% of respondents.

There were few significant explanatory variables in this model (the shaded cells in Table 6.6). Significant variables included those from the health and well-being and environmental concern blocks. Based on the significant single effects in the model, Muynak respondents were much more likely to have considered moving if they perceived

that the area's environmental problems might have an effect on their or their family's health. However, the significant interaction effects in the model indicates that individuals who perceived that their or their family's health might be affected **and** had a moderate to extreme level of concern about environment related health problems, were much less likely to consider moving.

For the outcome variable *considered moving*, the models were very different for the three sites. However, one common feature of the three models is the consistent significant positive effect that the variable *level of environment related health concern* had on the likelihood that individuals would consider moving.

6.3.2. Models Combining Data From All Three Sites

Given the importance of the contaminate source in the conceptual framework (Figure 2.1), models were combined in order to explore the direct effects of site (exposure) on psychosocial impacts. To this end, five combined models were developed for the outcome variables: *Somatic Symptom Checklist (SCL-90): above or below cut-point, environmental concern, environmental problems might affect health or family's health, environmental problems have affected health or family's health* and *considered moving because of environmental problems.* These models use data from all three sites simultaneously, and include *site* as a three category independent variable.

The combined logistic regression model of *Somatic Symptoms Checklist (SCL-90): above or below cut-point* (Table 6.7) had a ρ^2 of .28 The positive predictive value of this model was 72% and the negative predictive value was 78%. The model had a moderate

specificity (75%) and sensitivity (75%). The model correctly classified 75% of respondents.

Table 6.7
Results of logistic regression for outcome:
Somatic Symptom Checklist (SCL-90) – above or below cut-point

VARIABLE		R.O.	C.I.
Site***	Shumanay	2.78	1.64; 4.69
	Kungrad	1.29	.82; 2.04
Gender***		2.25	1.59; 3.19
Age***		1.03	1.01; 1.04
Ethnicity**	Karakalpak	2.19	1.15; 4.17
	Uzbek	3.80	1.95; 7.40
	Kazakh	2.15	1.07; 4.33
Satisfaction with place		.43	.17; 1.10
Perceived health status		1.24	.63; 2.45
Satisfaction with health***		3.03	2.03; 4.54
Stressful Life Event***		1.36	1.18; 1.57
Has influenced your/families health***		2.55	1.64; 3.96
INTERACTION TERMS			
Age X satisfaction with place**		1.03	1.01; 1.05
Self perceived health X stressful life events*		1.44	1.09; 1.90
ρ^2			.28
Sensitivity			75%
Specificity			75%
% correctly classified			75%

Significant explanatory variables in this model (the shaded cells in Table 6.7) included those from all blocks (Figure 6.1). Based on the significant single effects in the model, respondents were more likely to score above the normal SCL-90 cut-point if they were: from Shumanay rather than Muynak, female, older, Uzbek, Karakalpak or Kazakh (vs. Turkmen), not too or not at all satisfied with their health, had more stressful life events or reported that the environmental problems had influenced their or their family's health. These findings indicate that *site* is indeed an important determinant of

psychosocial impacts, although perhaps not as expected. That is, Shumanay respondents who live furthest away from the Aral Sea (the area believed to be the focal point of the region's environmental problems) were less likely to score above the SCL-90 cut-point as compared to Muynak respondents who live closest to the Sea. As was found in the by-site models for this outcome variable, gender, age and ethnicity are important determinants of psychosocial impacts as is health satisfaction. The significant interaction effects in the model indicate that respondents were more likely to score above the SCL-90 normal cut-point if they: were older **and** not too to not at all satisfied with their local area, and perceived their health to be fair to poor **and** had more stressful life events.

The combined model of *environmental concern* (Table 6.8) had a ρ^2 of .12. The positive predictive value of this model was 59% and the negative predictive value was 79%. The model had a specificity of 68% with lower sensitivity (64%). The model correctly classified 66% of respondents.

Significant explanatory variables in this model (the shaded cells in Table 6.8) included those from all but the exposure block (Figure 6.1). Respondents were more likely to report environmental concern if they: had an intermediate or higher level of education, were not always able to make ends meet, were involved in more local activities, were not satisfied with their local area, scored above the SCL-90 cut-point, wanted to change the environmental problems (vs. other problems) and their major local area dislike was the environment. Respondents were less likely to report environmental concern if they: had a main source of income from fishing or farming, had more close friends, and had more close relatives. Unlike the previous model, *site* proved not to be a significant

determinant of environmental concern. The finding that the social network played an important role in mediating psychosocial impacts supports the psychosocial literature (2.2.3), the mediating relationships between the social network and psychosocial impacts hypothesized in the conceptual framework (Figure 2.1), and the findings from the by-site models of environmental concern presented previously (Table 6.3). The significant results for the *SCL-90 score* explanatory variable in the model suggests that a strong causal relationship between psychosocial impacts and environmental concern exists. However, as previously discussed, due to the nature of this analysis the direction of the relationship is unknown.

Table 6.8
Results of logistic regression for outcome:
Environmental Concern

VARIABLE	R.O.	C.I.
Site Shumanay	1.83	1.00; 3.33
Kungrad	1.20	.81; 1.79
Education**	1.75	1.64; 2.64
Main source of income*	.51	.29; .91
Always able to make ends meet*	1.77	1.14; 2.73
# of local activities***	1.30	1.17; 1.44
# of relatives***	.98	.97; .99
# of friends*	.98	.96; .99
Satisfaction with place***	1.81	1.30; 2.51
SCL-90 score***	1.85	1.34; 2.55
Change 1 thing about local area**	1.84	1.23; 2.77
major local area dislike*	1.52	1.09; 2.13
ρ^2		.12
Sensitivity		64%
Specificity		68%
% correctly classified		66%

The combined model of *might affect health/family's health* (Table 6.9) had a ρ^2 of .25. The positive predictive value of this model was low at 47% and the negative predictive value was high at 94%. The model had a high specificity (68%) but a slightly lower sensitivity (76%). The model correctly classified 80% of respondents.

Table 6.9
Results of logistic regression for outcome:
Environmental problems might affect your or family's health

VARIABLE		R.O.	C.I.
Site	Shumanay	1.06	.69; 1.64
	Kungrad	1.44	.92; 2.24
Always able to make ends meet**		2.13	1.27; 3.56
# of local activities***		1.44	1.28; 1.61
Frequency talking with neighbours*		.27	.08; .90
# of relatives***		.98	.96; .99
Satisfaction with place*		1.57	1.09; 2.26
SCL-90 score***		1.90	1.33; 2.72
Considered moving***		13.17	8.29; 20.93
ρ^2			.25
Sensitivity			76%
Specificity			81%
% correctly classified			80%

Significant explanatory variables in this model (the shaded cells in Table 6.9) included those from all blocks other than the exposure block (Figure 6.1). Based on the significant single effects in the model, respondents were more likely to perceive that environmental problems might affect their or their family's health if they: were not always able to make ends meet, were involved in more local activities, were not satisfied with place (local area), scored above the SCL-90 normal cut-point and had considered moving because of the environmental problems. Respondents were less likely to perceive that

environmental problems might affect their or their family's health if they: more frequently talked with neighbours and had more close relatives with which they could confide. *Site* did not have an important influence on whether individuals perceive that environmental problems might affect their or their family's health. Social network explanatory variables, on the other hand, played an important role in the model whereby formal social network variables (i.e. # *of local activities*) had a positive effect on the outcome and the informal social network variables (i.e. # of friends) had a negative effect. The explanatory variable *considered moving* had a particularly strong effect on an individual's propensity to report perceived environmental related health impacts. This finding is consistent with the by-site models (Table 6.4).

The combined model of *have affected health or family's health* (Table 6.10) had a ρ^2 of .26. The positive predictive value of this model was low at 42% and the negative predictive value was high at 96%. The model had a had specificity (86%) and moderate sensitivity (74%). The model correctly classified 85% of respondents.

Significant explanatory variables in this model (the shaded cells in Table 6.10) included those from all blocks (Figure 6.1). Respondents were more likely to perceive that environmental problems have affected their or their family's health if they: were from Kungrad (vs. Muynak), were involved in more local activities, were not too or not at all satisfied with their local area, scored above the SCL-90 cut-point, experienced more stressful life events and had considered moving because of environmental problems. The significant interaction effects in the model indicated that respondents were more likely to perceive that environmental problems have affected their or their family's health if they

had more friends **and** had considered moving because of environmental problems; and less likely if they were from Kungrad **and** involved in more local activities, and involved in more local activities **and** had considered moving. Unlike the previous model (Table 6.9), this model indicates that the *site* variable is an important determinant of the individual's perceptions of environment/health links whereby living in Kungrad is the greatest determinant. Similar results to the previous model (Table 6.9) are seen with regards to the importance of social network variables, SCL-90 score and the considered moving variables as mediators of perceptions of environment related health impacts.

Table 6.10
Results of logistic regression for outcome:
Environmental problems have affected your or family's health

VARIABLE		R.O.	C.I.
Site**	Shumanay	3.07	1.25; 7.56
	Kungrad	5.00	2.02; 12.39
# of friends		1.01	.97; 1.05
# of local activities involved in*		1.16	1.01; 1.34
Satisfaction with place***		2.28	1.49; 3.48
SCL-90 score***		2.39	1.57; 3.65
Stressful Life Events**		1.22	1.06; 1.42
Consider moving ***		11.09	4.79; 25.66
INTERACTION TERMS			
Site X # of local activities involved in*	Shumanay	.75	.56; 1.01
	Kungrad	.66	.49; .90
# of local activities X consider moving**		.67	.51; .89
# of friends X considered moving**		1.12	1.03; 1.21
ρ^2			.26
Sensitivity			74%
Specificity			86%
% correctly classified			85%

The combined model of *considered moving because of environmental problems* (Table 6.11) had a ρ^2 of .32. The positive predictive value of this model was 53% and the

negative predictive value was 91%. The model had a high specificity (90%) and low sensitivity (56%). The model correctly classified 85% of respondents.

Table 6.11
Results of logistic regression for outcome:
Considered moving because of environmental problems

VARIABLE	R.O.	C.I.
Site Shumanay	.99	.59; 1.67
Kungrad	.66	.40; 1.11
Education*	1.90	1.00; 3.62
Satisfaction with place**	2.02	1.28; 3.18
Change one thing about local area**	1.99	1.21; 3.28
Might affect your/family's health***	8.80	4.52; 17.13
Level of environment related health concern**	2.88	1.48; 5.62
INTERACTION TERMS		
Might affect your/family's health* level of environment related health concern***	.05	.01; .19
ρ^2		.32
Sensitivity		56%
Specificity		90%
% correctly classified		85%

Significant explanatory variables in this model (the shaded cells in Table 6.11) included those from individual, social network and perceptions of the disaster blocks (Figure 6.1). Respondents were more likely to consider moving because of the environmental problems if they: had an intermediate or above level of education, were not too or not at all satisfied with their local area, wanted to improve the environmental situation (vs. other) if they could change one thing about their local area, felt that environmental problems might affect their or their family's health and had moderate to extreme environment related health concerns. The *site* variable in this model is not significant. The most important feature of the model is the strong relationship between

the *consider moving* outcome variable and the perceptions of the disaster explanatory variables (i.e. desire to improve the environmental problems, perceived environment/health links etc.) illustrating the straightforward point that those who are concerned about the environment are more likely to consider moving because of them.

6.4. SUMMARY AND DISCUSSION

In this section, an attempt was made to ascertain the determinants of the psychosocial effects of the Aral Sea environmental disaster in Karakalpakstan. A summary of the results are presented below. From these results, both substantive and theoretical issues arise: the variables which were found to be significant (or not significant) in the models, and the utility of the conceptual framework and analytical model.

6.4.1. Summary of Results

The major findings of the logistic regression analysis can be summarized in the following points: Firstly, *site* (i.e. distance from the Aral Sea) rarely emerged as a significant explanatory variable. Specifically, *site* was significant in the SCL-90 combined site model whereby Shumanay respondents were more likely to report psychosocial impacts than Muynak respondents. Secondly, in the SCL-90 models, gender and age emerged as significant determinants of emotional distress such that individuals who were women or older were more likely to score above the SCL-90 cut-point. Few other individual characteristic variables (Figure 6.1) were significant more than once or

twice in any of the by-site or combined site models. Thirdly, social network variables were found to play an important role in the *environmental concern* and *might* or *has affected health/family's health* models whereby strong informal social networks (i.e. many close friends and relatives) decreased the likelihood of reporting environmental concern or perceived links between health problems and the environment, and strong formal networks (i.e. involved in many local community groups) increased the likelihood. Fourthly, health and well-being variables were found to play an important role in many models such that individuals reporting low levels of health satisfaction or poor perceptions of health were more likely to experience psychosocial impacts. Finally, variables from the environmental perceptions block emerged as significant in most models indicating the importance of the association between negative perceptions of the environment and psychosocial impacts.

6.4.2. Discussion of Results

Several substantive issues warrant discussion. Firstly, exposure (i.e. distance from the Aral Sea) as measured by the explanatory variable *site* was only found to be significant in two of the five combined models: *SCL-90 scores* and *environmental problems have affected health/family's health*. This finding is contrary to several previous studies which have demonstrated that distance is a significant determinant of psychosocial impacts (i.e. impacts decrease as distance increases) (Section 2.2.3). Given the close proximity of Muynak to the former Sea coast and its past economic and social dependence on the sea, it was expected that psychosocial impacts would be greatest here. The data did not reveal

this, possibly as a result of the mass out-migration which occurred in the Muynak region between 1960 and 1970, the period when the sea began receding from the Muynak shores (Table 3.6). As an action such as moving is believed to be an important indicator of psychosocial impacts (Elliott,1992), it can be hypothesized that those who were most affected by the environmental problems left, leaving a population experiencing impacts at a level close to those of the rest of Karakalpakstan. Also, given that the sea has not been seen in Muynak for over three decades, it could be expected that the impacts associated with its disappearance have diminished and the population is now 'only' faced with the same environmental problems as the rest of Karakalpakstan. Environmental problems such as contaminated drinking water, air pollution and soil salinization are problems present throughout the region, not just in the areas closest to the sea. Although the sea itself may once have played an important role in determining psychosocial impacts, findings indicate that this is no longer the case. In fact, the findings for the SCL-90 combined model suggest that psychosocial impacts increase as a result of living further (Shumanay) as opposed to closer (Muynak) to the Aral Sea (Table 5.11). This either suggests that environmental problems are worse in Shumanay than in Muynak, or more likely that the influence of *site* on SCL-90 scores is due to *site* differences being a factor of something other than environmental problems (i.e. ethnicity) (Table 6.2 and 5.12).

Secondly, based on the conflicting findings in the literature regarding the significance of gender and age as determinants of psychosocial impacts (Section 2.2.3), these variables were not deemed to be of *a priori* importance and were thus not forced into the models. The finding that age and gender rarely emerged as significant justifies this

decision. Only in the SCL-90 models were age and gender found to be significant whereby older respondents and women were more likely to score above the normal SCL-90 cut-point. The only other individual characteristic to emerge in several models was the variable *children under 5 years* whereby individuals with children in Muynak were less likely to score above the SCL-90 cut-point, and individuals in Kungrad were less likely to perceive that their health *might* or *has* been affected by environmental problems. These findings are not supported in the literature which suggest instead that having young children increases psychosocial impacts given the additional concern that a parent carries for the child's well-being (Section 2.2.3). This discrepancy may be due to cultural differences as evidenced by the extended nature of households in Karakalpakstan (Table 4.4) as compared to those of typical European or North American households (where most of the psychosocial literature is focused). Given that many of the reported children would not necessarily be those of the respondents, they may not be a source of concern in the same way as if they were the respondent's own. Few other individual variables emerged as significant from the analysis.

Thirdly, social network variables were found to be significant in many models and were particularly strong in the *environmental concern* and *might* and *has affected health/family's health* models. This finding is consistent with the literature which suggests that social support alters the techniques individuals use to adapt to stress and acts as a buffer (Section 2.2.3). The findings in this study suggest that a difference between formal and informal social support exists whereby having many close friends and family (informal) reduces impacts and being involved in many community activities (formal)

increases impacts. The consistently significant positive effect of community activity involvement on psychosocial impacts may be explained by the increased awareness active individuals are likely to have of local environmental, economic and social problems. These findings add rationale to the investigation of social capital as a determinate of health (see Wilkinson,1996; Putnam, *et al.*,1993), particularly in the context of non-Western cultures.

Fourthly, health and well-being variables (Figure 6.1) frequently emerged as significant in by-site and combined models. Particularly strong positive relationships were found between perceived health status and health satisfaction, and somatic manifestations of emotional distress as indicated by SCL-90 scores (Table 6.2 and 6.7). These findings suggest that individuals may be experiencing greater physical health problems as a result of psychosocial impacts; however, as previously discussed, the direction of this relationship cannot be confirmed.

Finally, variables from the perceptions of the disaster block (Figure 6.1) were found to be significant in almost every model. Of particular importance was the relationship between the variable *considered moving* and the outcomes *has affected health/family's health* and *might affect health/family's health.* These findings indicate the important positive relationship that exists between psychosocial impacts and negative environmental perceptions (i.e. environmental awareness, perceived health impacts).

This analysis has demonstrated the utility of the conceptual framework in identifying determinants of psychosocial impacts. This is seen by the finding that all of the models contain explanatory variables from several if not all of the blocks from the

conceptual framework. This is particularly telling of the model's utility given that it was not originally designed for a Central Asian, developing nation or CEP context like that of the Aral Sea region. Problems did arise, however, in the translation of the conceptual model to an analytical model. Where reciprocal or multidirectional relationships exist in the conceptual model, due to the nature of logistic regression analysis, only unidirectional relationships could be employed in the analytical model (Figure 2.1 and Figure 6.1). The implication of this translation issue is that the direction of many of the relationships are left in question. Examples of this include the role of the SCL-90 in determining perceptions of environment/health links, and the role of general health status in determining levels of emotional distress (SCL-90 scores). However, on the basis of the links to the literature, the qualitative findings and our knowledge of the area, we can speculate that the direction of these relationships is consistent with the directions indicated in the analytical model (Figure 6.1).

This chapter has addressed the final objective of this research by investigating the determinants of psychosocial impacts by profiling the characteristics of respondents more likely to report impacts. In doing so, it has demonstrated the importance of gender and age, along with social networks, perceptions of health and perceptions of the environment, as determinants of psychosocial impacts. The implications and applications of these results, and a discussion of future research directions are presented in the next chapter (Chapter 7: Conclusions).

CHAPTER 7:

CONCLUSIONS

7.1. INTRODUCTION

This research has described a geographic analysis of the impacts of an environmental disaster on psychosocial health and well-being on a population living in three communities in the Aral Sea region of Karakalpakstan. The scope of this research was based on the suspected prevalence of psychosocial impacts in the area (Upshur,1998), the absence of research and understanding about the psychosocial impacts of multi-sourced CEP's, particularly in developing world contexts, and uncertainty as to ways to intervene to reduce their adverse effects on human health and well-being. Four objectives were addressed in this research:

1. to determine people's perceptions (health and environmental) associated with the environmental disaster;
2. to examine the links between health and environment made by individuals;
3. to determine the prevalence of psychosocial impacts amongst local residents; and,
4. to investigate the determinants of psychosocial impacts.

This chapter will summarize the research findings in the context of the above objectives, followed by a discussion of the theoretical, methodological and substantive contributions which have been made. Recommendations for future research will also be discussed.

7.2. SUMMARY OF FINDINGS

To address the first three objectives, descriptive analysis was used. Findings regarding individual's perceptions of the environment indicate that unsolicited concern (i.e. local area dislikes) was high (Tables 5.2 and 5.3). However, when individuals were asked about the one thing they would change in their local area, environmental problems were typically ranked below other concerns such as unemployment, the economy and essential service provision (Table 5.4). Solicited responses regarding environmental concerns revealed that approximately half of respondents were concerned (Table 5.5). The types of environmental problems most frequently mentioned as causing concern include water quality, air quality and land/soil quality (Table 5.6), all problems commonly reported in the literature to be particularly severe in the region (see Section 3.5). In this case, variation by site was seen whereby water quality elicited particular concern in Muynak and land/soil quality in Shumanay.

The majority of respondents in the three sites reported to perceive their health status as either fair or poor (Table 5.7). Despite this, a relatively high proportion of respondents reported to be satisfied with their health (Table 5.8). The most frequently self-reported health problems for which respondents reported having received recent treatment are anemia, kidney problems, eye problems, hypertension or high blood pressure, and respiratory problems (Table 5.9). These health problems are consistent with those reported in the literature to be serious in the region, however, the rates of anemia, for example, reported in this study are lower than those found in other studies (e.g. Morse, 1994; see also Section 3.6). With respect to people's perceptions of the link between

health and environmental problems, findings indicate that amongst respondents reporting somatic symptoms and those reporting to have environmental concerns, a large proportion perceive that environmental problems are linked to health problems (Tables 5.15 and 5.16).

Overall, levels of emotional distress measured by the GHQ-20 were well below those of general populations in a variety of cultural contexts (Table 5.10). The level of emotional distress as manifest in somatic symptoms, however, was found to be high at all three study sites (Table 5.11). Findings indicate scores to be well above normalized scores and comparable to the findings of individuals living close by TMI following a nuclear incident (Baum, *et al.*, 1983a). In addition, a gradient of increasing prevalence away from the former Aral Sea coast was found, reinforcing the finding that environmental concerns are no more severe in Muynak than in Kungrad or Shumanay (Table 5.5).

To address the final research objective (determinates of psychosocial impacts), bivariate and logistic regression analysis was used. Bivariate analysis revealed that various sociodemographic variables including gender, age, marital status, having children under 5 years old and ethnicity (Tables 5.12, 5.13 and 5.14), were found to be significantly related to levels of emotional distress as manifest in somatic symptoms. Findings from the logistic regression analysis (Chapter 6) can be summarized in the following points: Firstly, *site* (i.e. distance from the Aral Sea) rarely emerged as a significant explanatory variable except in the SCL-90 combined site model whereby Shumanay respondents were found to be more likely to report psychosocial impacts than

Muynak respondents (Table 6.7). Secondly, gender and age were found to be significant determinants of emotional distress such that individuals who were women or older were more likely to score above the SCL-90 cut-point (Tables 6.2 and 6.7). Few other individual characteristic variables were significant more than once or twice in any of the by-site or combined site models. Thirdly, social network variables were found to play an important role in several models (e.g. Tables 6.3, 6.4 and 6.5), whereby strong informal social networks (i.e. many close friends and relatives) decreased the likelihood of reporting psychosocial impacts, and strong formal networks (i.e. involved in many local community groups) increased the likelihood. Fourthly, individuals reporting low levels of health satisfaction or poor perceptions of health were more likely to experience psychosocial impacts (Tables 6.2 and 6.7). Finally, individuals reporting negative environmental perceptions were more likely to experience psychosocial impacts than individuals with more positive environmental perceptions (e.g. Tables 6.3, 6.4 and 6.5).

These results therefore demonstrate that a significant proportion of the study population in the three study communities were concerned about the environment and were experiencing high levels of emotional distress. Respondents also commonly reported to perceive their health to be only fair or poor and felt that their and their family's health was affected by the region's environmental problems. It has further been shown that the occurrence of psychosocial impacts can be successfully explained by a combination of external and mediating factors including individual's location of residence, gender, age, social network characteristics, along with perceptions of the environmental situation.

7.3 RESEARCH CONTRIBUTIONS

7.3.1. Theoretical and Methodological Contributions

The theoretical and methodological contributions of this research are based primarily on the application of a pre-existing theoretical framework (Figure 2.1) and the use of standardized measures of emotional distress (GHQ and SCL-90) in an environmental and cultural context in which they have not previously been used.

This research adopted the conceptual model developed by Elliott *et al.* (1993) (Figure, 2.1), which suggests that there is no direct cause-effect link between psychosocial impacts and actual or perceived exposure, but rather that psychosocial impacts are mediated by a variety of factors: characteristics of the contaminate source, characteristics of the individual, characteristics of the social network and characteristics of the wider community system. The analysis in Chapter 6 has demonstrated the utility of the framework in identifying the determinants of psychosocial impacts given the number and range of explanatory variables which emerged as significant in each of the models. The findings further demonstrate the contextual and cultural transferability of the model. Although originally designed for a North American context, the utility of the framework to explain psychosocial impacts in a Central Asian cultural and environmental context is clear. At the same time, however, the translation of the conceptual framework into an analytical model led to a variety of problems, such that theoretically reciprocal relationships had to be reduced to unidirectional relationships for the purpose of analysis. This issue has clear implications for the interpretation of results with respect to the direction of the cause-effect relationships.

An important methodological contribution of this research is related to the use of the GHQ and SCL-90. Prior to this research, no standardized measures of psychosocial health had been put to use within an environmental or cultural context similar to that of the Aral Sea region. Instruments such as the GHQ and the SCL-90, although translated into many languages, and widely used in dozens of countries and under many circumstances (see Section 4.6), had never been tested in a CEP context or within a Central Asian, or more specifically, Karakalpak cultural context. The results of this research revealed that SCL-90 is a potentially useful instrument in this context as demonstrated by: firstly, the finding that the relatively high SCL-90 scores are consistent with the severe nature of the region's environmental problems; and, secondly, by the fact that scores are comparable to those of a population which faced the potentially very serious environmental exposure following the TMI nuclear accident (Section 5.3.4). In contrast, the extremely low scores from the General Health Questionnaire compared to normal populations suggest that the GHQ may not be an appropriate instrument in this context (Section 5.3.3). Unfortunately, limited time and resources dictated that a control community was not included in the study, to which the results of these scores could be compared. This issue has obvious implications for determining the utility of the standardized measures in this context as well as for future research.

7.3.2. Substantive contributions and Potential Applications

The substantive contributions and potential application of the research findings are linked to the wider goal of this research which was to better understand the extent and

determinants of psychosocial impacts in the region as a step to improve the overall health of the region's population. Three issues can be addressed from the results: the extent of psychosocial impacts and environmental concern at the three sites (Chapter 5); the types of concern (Chapter 5); and the determinants of psychosocial impacts, concern and perceived environment and health links (Chapter 6).

The high percentage of respondents scoring above the SCL-90 cut-point along with the high percentage reporting environmental concern suggests that psychosocial impacts are serious in the region and mitigation measures should therefore be examined. It was also found, however, that many of those reporting local area dislikes (i.e. concerns; Table 5.4) were less likely to report problems directly related to the environment (i.e. dirty water or dirty air) and more likely to report problems indirectly related to the environment (i.e. high unemployment rates and a poor economy). From this finding it becomes clear that any mitigation efforts must address more than the obvious environmental concerns but also the many problems indirectly associated with the environment.

As previously mentioned, substantial differences between sites exist with regards to the types of environmental concerns and local area concerns reported (Tables 5.2, 5.4 and 5.6). These findings demonstrate the relative importance of community characteristics in determining psychosocial impacts and thereby the need to consider the local situation before any attempts to address community concerns are made. The analysis of the determinants of psychosocial impacts similarly revealed the importance of carefully considering the characteristics of individuals more likely to experience psychosocial impacts. For example, findings indicate that women, individuals who are older and

individuals with weak informal social networks are more likely to experience psychosocial impacts (Chapter 6). Thus it is these individuals who must be the focus of any future mitigation efforts.

7.4. DIRECTIONS FOR FUTURE RESEARCH

The investigation of the impacts of an environmental disaster such as exists in the Aral Sea region on psychosocial health and well-being, has contributed to our knowledge of this field and has addressed several important gaps in the psychosocial impacts literature. However, considerable research in this area remains to be done.

An important area for future theoretical research is based on the need for an analytical model which is capable of addressing the theoretically reciprocal relationships illustrated within the conceptual framework which guided this study (Table 2.1). Due to the nature of logistic regression analysis only unidirectional relationships could be employed in the analytical model (Figure 6.1), the implication being that the direction of many of the relationships are left in question.

A meaningful methodological area for future research stems from the use of the standardized measures of emotional distress (i.e. SCL-90 and GHQ) in a cultural and environmental context in which they have not been previously tested. Although the results from this study suggest that the SCL-90 is an effective tool in this context, normative scores need to be determined for both the GHQ and SCL-90, and tests of the instruments' reliability and validity need to be done. Addressing this need will make a significant contribution to the future study of psychosocial impacts in Central Asia and

will also allow for comparison and a more accurate interpretation of the results from this study. Further testing of the entire survey instrument is also called for in order to establish its validity in environmental and cultural contexts elsewhere.

Another important area for research involves the documentation of the ethnography of the Aral Sea population. The region's environmental problems have had many major direct and indirect social and economic impacts on the region's population for well over 40 years (i.e. loss of jobs and way of life, and in the case of Muynak, out-migration; Section 3.3 and 3.7), beginning when the sea first began to retreat from the former Muynak coastline. However, fewer and fewer of the individuals who remember life as it was prior to the disaster, and who saw the sea and all it represented disappear, are still alive today. Thus, before it is lost, it is important that work be done to document the knowledge of the population that remembers.

Also, there is a need for an expanded longitudinal study that includes control communities. As the findings from this study suggest, impacts and concern about the environmental situation are comparable throughout Karakalpakstan (Table 5.3 and 5.5). Thus to better understand the relative impacts of the environmental problems a baseline study should be conducted in an area of Uzbekistan outside of the Aral Sea region to which these study findings could be compared. There is similarly a need for the collection and analysis of longitudinal data on population health status in the region of the Aral Sea. With this study being a first step, the collection of longitudinal data will allow for the monitoring and evaluation of the effectiveness of any mitigation and other programming initiatives which may be carried out in the future.

Finally, the research findings presented here should be used to help develop an appropriate, culturally sensitive risk communication strategy which will inform and empower individuals and communities with respect to (perceived) health impacts of the environmental disaster. Doing so will help to enhance the community's ability to cope positively with the impacts of the disaster on daily life.

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APPENDIX 1

PSYCHOSOCIAL HEALTH AND WELL-BEING QUESTIONNAIRE

May 1999

INTRODUCTION

Hello, my name is [fill in name and I am conducting a study for Médecins Sans Frontières and the Institute of History and Ethnography of the Karakalpakstan Branch of the Academy of Sciences about the quality of life in communities in Karakalpakstan and you have been selected at random from a list of households in this neighborhood. Any information you provide us with in the interview will be completely confidential and anonymous. Your name will not appear on this questionnaire. Thus others will not be able trace this information back to you. We would greatly appreciate your views on this matter.

Do you presently live at this address? 1 Yes 2 No

Including yourself, how many people live in your household? _____

In order to get a better picture of your household, we would like to ask you a couple of questions about each person in your household. This information will allow us to compare different types of households. Starting with the oldest person in your household (remember to include yourself) what is their relationship to you? What is his/her gender? How old is he/she?

[THIS CONTINUES FOR ALL HOUSEHOLD MEMBERS]

	Sex	Age (Y)	Relationship
1.	M F		
2.	M F		
3.	M F		
4.	M F		
5.	M F		
6.	M F		
7.	M F		
8.	M F		
9.	M F		
10.	M F		
11.	M F		
12.	M F		
13.	M F		
14.	M F		
16.	M F		
17.	M F		
18.	M F		
19.	M F		

SECTION 1 - ATTITUDES TOWARDS THE AREA WHERE YOU LIVE

I'd like to begin by asking you about the things you like/dislike about _____ [FILL IN PLACE NAME].

About the place where you live, what is... [ACCEPT ONLY ONE EXPLANATION]

		Mention	Specify:	No mention	don't know	refused
1.1.1.	the most important thing you LIKE	1		2	8	9
1.1.2.	the second thing you LIKE	1		2	8	9
1.1.3.	the third thing you LIKE	1		2	8	9

About the place where you live, what is... [ACCEPT ONLY ONE EXPLANATION]

			specify:	no mention	don't know	refused
1.2.1	the most important thing you DON'T LIKE	mentions environment mentions other problem		3	8	9
1.2.2	the second thing you DON'T LIKE	mentions environment mentions other problem		3	8	9
1.2.3	the third thing you DON'T LIKE	mentions environment mentions other problem		3	8	9

1.3. In general, how satisfied are you with _____ [PLACE NAME] as a place to live?

1 very satisfied	2 somewhat satisfied	3 not too satisfied	4 not at all satisfied	8 don't know	9 Refused

1.4. If you could change just one thing about _____ [PLACE NAME], what would it be?

1 mention	specify:	2 no mention	8 don't know	9 Refused

1.5.x Would you tell me if you have been involved in any of these local activities in the last two years: (MULTIPLE RESPONSES ARE ALLOWED)

1.5.1 attended a Mahalla meeting	Yes 2 No
1.5.2 attended a meeting at the school of one of your children	1 Yes 2 No
1.5.3 worked with others in your community to do something about some community problem	1 Yes 2 No
1.5.4 spoken or written to an official about some local issue	1 Yes 2 No
1.5.5 community holiday celebrations	1 Yes 2 No
1.5.6 work meetings	1 Yes 2 No
1.5.7 neighbourhood meetings	1 Yes 2 No
1.5.8 collective farm meetings	1 Yes 2 No

About your neighbours, how often do you ...	1.6. TALK with them	1.7. HELP / ASK for HELP from them for such things as borrowing tools or food, or helping each other in home repairs, etc.
Never	1	1
Once a year	2	2
1 or 2 times a month	3	3
1 or 2 times a week	4	4
Daily	5	5
Don't know neighbors	6	6
Don't know how often	7	7
Refused	9	9

1.8.1 Do you help your neighbours in traditional domestic ceremonies?

1 Always	2 often	3 never	8 don't know my neighbours	9 refused

1.8.2. Do your neighbours help you in traditional domestic ceremonies?

1 Always	2 often	3 never	8 don't know my neighbours	9 refused

1.9. In general, how would you describe your neighbours? Would you say they are:

1 very friendly	2 friendly	3 unfriendly	4 very unfriendly	8 don't know	9 refused

SECTION 2 - SOCIAL AND COMMUNITY NETWORKS

2.1. How many relatives do you feel close to, NOT COUNTING the people you live with (by close relatives, we mean for example, people whose homes you visit, relatives that you feel at ease with, can talk to about private matters and can call upon for help)?

0 no relatives	1-97 ___ # of relatives	98 don't know	99 refused

2.2. Not counting the people you live with or your relatives, how many close friends do you have? (by close friends, we mean for example, people whose homes you visit, people that you feel at ease with, can talk to about private matters and can call upon for help).

0 no close friends	1-97 ___ # of friends	98 don't know	99 refused

2.3.x Do you belong to any of the following groups? (MULTIPLE RESPONSES ARE ALLOWED.)

2.3.1 sports group	1 Yes 2 No
2.3.2 labor union, commercial group or professional organization	1 Yes 2 No
2.3.3 religious group	1 Yes 2 No
2.3.4 group concerned with children or youth	1 Yes 2 No
2.3.5 group concerned with community service, charity, or neighborhood improvement	1 Yes 2 No
2.3.6 group concerned with the environment	1 Yes 2 No
2.3.7 any others, specify	1 Yes 2 No

2.4. How satisfied are you with your social activities, such as those mentioned above? Would you say that you are:

1	2	3	4	8	9
very satisfied	somewhat satisfied	not too satisfied	not at all satisfied	don't know	refused

2.5. Is there someone in your family or a close friend that you can confide in or talk to freely about your problems (e.g. personal, family, work or financial problems)?

1 yes	2 no	8 don't know	9 refused

2.6. Is there someone among your friends or in your family who can help you if you need it?
[INTERVIEWER PROVIDE EXAMPLES ONLY IF ASKED. I.E. IS THERE SOMEONE THAT YOU CAN RELY ON FOR HELP DURING TIMES OF ILLNESS OR HARDSHIP]

1 yes	2 no	8 don't know	9 refused

SECTION 3 - GENERAL HEALTH STATUS

To help us understand the quality of life in a community, we like to find out how people have been feeling lately and to ask them about their health in general.

3.1.1. Compared to other people your age, would you say your health is:

1 excellent
2 very good
3 good
4 fair
5 poor (IF POOR= TO 3.1.2. OTHERWISE TO 3.2.)
8 don't know
9 refused

3.1.2. What do you think caused your current health condition? (DO NOT READ LIST)
1 environment
2 water quality
3 unhygienic conditions
4 absence of traditional nutritional ration
5 living conditions
6 poor food
7 absence of warm clothes
10 lack of money
11 forfathers cult
12 evil spirits cult
13 god's punishment for sins
14 other, specify _____
8 don't know
9 refused

3.2. How satisfied are you with your health in general? Would you say you are:

1 very satisfied	2 somewhat satisfied	3 not too satisfied	4 not at all satisfied	8 don't know	9 refused

SECTION 4 - GENERAL HEALTH QUESTIONNAIRE

Now I'd like to know how you've been feeling over the **past two weeks.**

Over the past two weeks, have you ..						IF YES ... would you say MORE or the SAME AS USUAL for you?			
	yes	no	don't know	refused	Q #	More than Usual	Same as usual	Don't Know	Refused
4.1.1. lost much sleep over worry?	1	2	8	9	4.1.2	1	2	8	9
4.2.1 felt constantly under stress?	1	2	8	9	4.2.2	1	2	8	9
4.3.1. Felt you could not overcome your Difficulties?	1	2	8	9	4.3.2	1	2	8	9
4.4.1. been feeling unhappy and depressed?	1	2	8	9	4.4.2	1	2	8	9
4.5.1. been losing confidence in yourself?	1	2	8	9	4.5.2	1	2	8	9
4.6.1. Been thinking of yourself as a Worthless person?	1	2	8	9	4.6.2	1	2	8	9
4.7.1. been taking things hard?	1	2	8	9	4.7.2	1	2	8	9
4.8.1. Felt unable to complete all of your Daily tasks?	1	2	8	9	4.8.2	1	2	8	9
4.9.1. Been feeling nervous and tense all the time?	1	2	8	9	4.9.2	1	2	8	9
4.10.1. Found that at times you couldn't do Anything because your nerves were too bad?	1	2	8	9	4.10.2	1	2	8	9
4.11.1. Felt that you are playing a useful Part in things?	1	2	8	9	4.11.2	1	2	8	9
					IF NO ... would you've been feeling this way MORE or the SAME AS USUAL for you?				
4.12.1. Felt capable of making decisions About things?	1	2	8	9	4.12.2	1	2	8	9
4.13.1. Been able to enjoy your normal day-to-day activities?	1	2	8	9	4.13.2	1	2	8	9
4.14.1. Been able to face up to your Problems?	1	2	8	9	4.14.2	1	2	8	9
4.15.1. Been feeling reasonably happy, all Things considered?	1	2	8	9	4.15.2	1	2	8	9
4.16.1. Been managing to keep yourself From being idle?	1	2	8	9	4.16.2	1	2	8	9
4.17.1. Been getting out of the house as Much as usual?	1	2	8	9	4.17.2	1	2	8	9
4.18.1. Been satisfied with the way you've Carried out your tasks?	1	2	8	9	4.18.2	1	2	8	9
4.19.1. Been able to concentrate on Whatever you're doing?	1	2	8	9	4.19.2	1	2	8	9
4.20.1. Felt on the whole you were doing Things well?	1	2	8	9	4.20.2	1	2	8	9

IF A RESPONSE HAS BEEN GIVEN TO THE SECOND PART FOR 1 OR MORE OF THE ABOVE, ASK:

4.21. What do you think is causing the problems that you have just mentioned?

1 mention	2 no mention	8 don't know	9 refused

SECTION 5 - SOMATIC COM PLAINTS

I'm going to list some general he ılth problems. For each, please tell me if it has bothered you over the past **two weeks**:

How much in the last 2 weeks h ave you been bothered by	not at all	little bit	moderately	quite a bit	extremely	don't know	refused
5.1. ...headaches	1	2	3	4	5	8	9
5.2. ...faintness or dizziness	1	2	3	4	5	8	9
5.3. ...pains in the heart or ches t	1	2	3	4	5	8	9
5.4. ...pains in the lower back	1	2	3	4	5	8	9
5.5. ...nausea or upset stomach	1	2	3	4	5	8	9
5.6. ...soreness of your muscle	1	2	3	4	5	8	9
5.7. ...trouble getting your brea th	1	2	3	4	5	8	9
5.8. ...hot or cold spells	1	2	3	4	5	8	9
...numbness or tingling in part of your body	1	2	3	4	5	8	9
5.10. ...a lump in your throat	1	2	3	4	5	8	9
5.11. ...weakness in parts of y(ur body	1	2	3	4	5	8	9
5.12. ...heavy feelings in your arms or legs	1	2	3	4	5	8	9
5.13. ...rashes or other skin co ıditions	1	2	3	4	5	8	9
5.14. ...poor appetite	1	2	3	4	5	8	9
5.15. ...fatigue or tiredness	1	2	3	4	5	8	9
5.16. ... trouble getting up in t ıe morning even if you have had enough s eep	1	2	3	4	5	8	9

IF ANSWER HAS BEEN 'LIT ΓLE BIT', 'MODERATELY', 'QUITE A BIT' OR 'EXTREMELY' FOR 1 OR MORE OF THE ABOVE HEALTH PROBLEMS THEN ASK:

5.17. What do you think is caus ng the health problems that you have just mentioned?

1 mention	2 no mention	8 don't know	9 refused

5.18.x. I would also like to ask yc ı something about certain diseases that are reported frequently in this area. During the past 12 months, so sin :e May 1998, have you been treated or controlled by a doctor, nurse, felchar, traditional healer or family memb :r for:

	Yes	No	Don't Know	Refused
5.18.1.Anemia	1	2	8	9
5.18.2.Kidney stones	1	2	8	9
5.18.3.Any other kidney disease	1	2	8	9
5.18.4.Tuberculosis	1	2	8	9
5.18.5.Asthma	1	2	8	9
5.18.6.Chronic bronchitis	1	2	8	9
5.18.7.Jaundice	1	2	8	9
5.18.8.Heart disease	1	2	8	9
5.18.9.Eye infection, a red eye, ɔr pus coming from the eye	1	2	8	9
5.18.10.Skin condition, a rash c · a skin infection	1	2	8	9
5.18.11.Cancer	1	2	8	9
5.18.12.Arthritis, swollen, red c r painful joints	1	2	8	9
5.18.13.Hypertension, or high b lood pressure	1	2	8	9
5.18.14.Goitre	1	2	8	9
5.18.15.Other ? IF OTHER SPI :CIFY BELOW	1	2	8	9

SECTION 6 - HEALTH CARI , PREFERENCES

Now I would just like to ask you a couple of questions regarding your health care preferences.

6.1. If you or someone else in yc ur household is sick, who outside the family would be your preferred source for medical advice?

1 Medical institution and physicians	2 healer	3 sorcerer	4 shejh (a man "selected by saint spirit")	5 Other, specify...

6.2. What is your preferred meth od of treatment for illnesses?

1 Pills, capsules or ointments	2 injections	3 herbal mixtures from the healer	4 minerals from the healer	5 'cleaning by fire'	6 ' cleaning by water'

6.3. When you or someone else n the household is ill, do you visit holy places?

1 yes	2 no	8 don't know	9 refused

SECTION 7 - IMPORTANT LI'E EVENTS

Sometimes major events in our lit e can affect our quality of life, so I'd like to ask you about some of the important things that have happened to you i n the past twelve months, that is since May 1998.

Over the past twelve months, tha is since May 1998, ...	yes	no	don't know	refused
7.1. Did you lose your job?	1	2	8	9
7.2. Did anyone else in your hou ehold lose their job?	1	2	8	9
7.3. Were you divorced or separ ted from your spouse?	1	2	8	9
7.4. Did you have a serious illne s?	1	2	8	9
7.5. Did anyone else in your hou ehold have a serious illness?	1	2	8	9
7.6. Did your husband or wife di ?	1	2	8	9
7.7. Did anyone in your househc d die?	1	2	8	9
7.8. Have you been worried abo t finances more than usual?	1	2	8	9
7.9. Have you been especially w rried about anything else	1	2	8	9
Specify worries:				

SECTION 8 - AWARENESS, C ONCERN, ACTIONS

Now I'd like to ask you a little bi more about _____ [FILL IN PLACE NAME].

When we talked about the things you like and don't like about _____ [FILL IN PLACE NAME] one of the things you mentioned was en ironmental problems. I'd like to ask you more about that.

OR

When we talked to some people a bout the things they like and don't like about your area, one of the things that was mentioned was environmental pr blems. I'd like to ask you about that.

8.1. Do you have any concerns al out the environment?

1 yes	2 no TO 8.8	8 don't know TO 8.8	9 refused TO 8.8

IF YES

8.2.1. What is your major concer n about the environment?

1 mention	2 no mention TO 8.5.1.	8 don't know TO 8.5.1.	9 refused TO 8.5.1

IF MENTION

8.2.2. Do you think that this mig it influence your health or the health of any member of your family?

1 yes	2 no	8 don't know	9 refused

8.2.3. About this, would you say you are:

1 slightly concerned	2 mod rately concerned	3 extremely concerned	8 don't know	9 refused

8.2.4. Has this influenced your h ealth or the health of any member of your family?

1 yes	2 no TO 8.3.1	8 don't know TO 8.3.1	9 refused TO 8.3.1

IF YES

8.2.5 Whose health has been in luenced? [SPECIFY RELATIONSHIP i.e. mother, sister, daughter etc.]

1	2	3	4	5

8.2.6a How has the first person s health been affected?

8.2.6b How has the second pers n's health been affected?

8.2.6c How has the third person's health been affected?

8.2.6d How has the fourth person s health been affected?

8.2.6e How has the fifth person's health been affected?

8.3.1. Do you have any other con erns about the environment?

1 Mention	2 no mention TO 8.5.1	8 don't know TO 8.5.1	9 refused TO 8.5.1

IF MENTION ask :

8.3.2. Do you think that this migl t influence your health or the health of any member of your family?

1 yes	2 r o	8 don't know	9 refused

8.3.3. About this, would you say /ou are ...

1 slightly concerned	2 r ioderately concerned	3 extremely concerned	8 don't know	9 refused

8.3.4. Has this influenced your h ealth or the health of any member of your family?

1 yes	2 r o TO 8.4.1.	8 don't know TO 8.4.1.	9 refused TO 8.4.1.

IF YES

8.3.5 Whose health has been inf uenced? [SPECIFY RELATIONSHIP i.e. mother, sister, daughter etc.]

1	2	3	4	5

8.3.6a How has the first person' health been affected?

8.3.6b How has the second perso n's health been affected?

8.3.6c How has the third person s health been affected?

8.3.6d How has the fourth perso n's health been affected?

8.3.6e How has the fifth person s health been affected?

8.4.1. Any other concerns about the environment?

1 Mention	2 no mention TO 8.5.1.	8 don't know TO 8.5.1	9 refused TO 8.5.1

IF MENTION ask

8.4.2. Do you think that this mig ht influence your health or the health of any member of your family?

1 yes	2 no	8 don't know	9 refused

8.4.3. About this, would you say you are ...:

1 slightly concerned	2 mod erately concerned	3 extremely concerned	8 don't know	9 refused

8.4.4. Has this influenced your h ealth or the health of any member of your family?

1 yes	2 no TO 8.5.1.	8 don't know TO 8.5.1.	9 refused TO 8.5.1.

IF YES

8.4.5 Whose health has been in luenced? [SPECIFY RELATIONSHIP i.e. mother, sister, daughter etc.]

1	2	3	4	5

8.4.6a How has the first person's health been affected?

8.4.6b How has the second perso 's health been affected?

8.4.6c How has the third person' health been affected?

8.4.6d How has the fourth perso 's health been affected?

8.4.6e How has the fifth person': health been affected?

8.5.1. Over the past two years, h ve you considered moving because of the area's environmental problems?

1 Yes	2 No TO 8.5.4.	8 don't know TO 8.5.4.	9 refused TO 8.5.4.

IF YES

8.5.2. Have you taken any steps oward moving such as trying to sell your house, searching for a new house etc.?

1 Yes	2 No TO 8.5.4.	8 don't know TO 8.5.4.	9 refused To 8.5.4.

IF YES

8.5.3. What steps have you taken?

Fill in:

8.5.4. If you were to move, woul l you move:

1 to another neighbourhood	2 to a locat on outside tl is town	3 to a location outside this district	4 to an area outside Karakalpakstan	8 don't know	9 refused

8.5.5. Are there any reasons why it would be difficult for you to move?

1 Yes	2 No TO 8.6.1	8 don't know TO 8.6.1	9 refused TO 8.6.1

IF YES

8.5.6. ...What are the reasons? [I ON'T READ LIST]

1 difficult to find employment elsewhere	2 fa nily is here	3 cost of moving is too high	4 other specify:

8.6.1. Have you taken any mea sures to protect the environment of your living space?	1 Yes	2 No TO 8.6.3	8 don't know TO 8.7	9 refused TO 8.7
8.6.2. IF YES ... What have y u done?				
8.6.3. IF NO... Why not?				

8.7. Have any of the environme tal or health concerns you mentioned affected your daily life in any way?

1 Yes, specify:	2 no	8 don't know	9 refused

8.8. What was your MAIN source of information about the area's environmental problems? [DO NOT READ LIST] [ONLY CHOOSE ONE SOURCE]

1 TV
2 Radio
3 Newspapers
4 Doctor or other health professional
5 Friends or neighbours
6 Local or community government agency
7 Taught to children in school
10 Other specify:
8 Don't know
9 Refused

	yes	no	don't know	Refused
8.9. Have your read about the area's environmental problems in the newspaper?	1	2	8	9
8.10. Have you read books/reports about the area's environmental problem and their potential effects?	1	2	8	9
8.11. Have you discussed your concerns about the area's environmental problems with friends and neighbours?	1	2	8	9
8.12. Have you attended a meeting organized by a local citizen's group at which the area's environmental problems were discussed?	1	2	8	9
8.13. Have you heard about the area's environmental problems by watching TV?	1	2	8	9

SECTION 9 - DIET

Now I'd like to ask you a couple of questions about your eating habits.

9.1.x. Which of the following food items have you eaten over the past week?

9.1.1. Bread	1	Yes 2 No	9.1.9. Vegetable Soup	1	Yes 2 No
9.1.2. Rice	1	Yes 2 No	9.1.10. Biscuits	1	Yes 2 No
9.1.3. Yogurt	1	Yes 2 No	9.1.11. Milk	1	Yes 2 No
9.1.4. Shashlik	1	Yes 2 No	9.1.12. Melon	1	Yes 2 No
9.1.5. Fowl	1	Yes 2 No	9.1.13. Apple	1	Yes 2 No
9.1.6. Egg	1	Yes 2 No	9.1.14. Green Tea	1	Yes 2 No
9.1.7. Fish	1	Yes 2 No	9.1.15. Black Tea	1	Yes 2 No
9.1.8. Other meat	1	Yes 2 No			

9.2.x. What sort of traditional food items have you eaten over the past week?

9.2.1. Jarma	1	Yes 2 No	9.2.7. Borek	1	Yes 2 No
9.2.2. Kespes	1	Yes 2 No	9.2.8. Aksaulak	1	Yes 2 No
9.2.3. Goje	1	Yes 2 No	9.2.9. Sok	1	Yes 2 No
9.2.4. Mashaba	1	Yes 2 No	9.2.10. Nan	1	Yes 2 No
9.2.5. Gosh Sorpa	1	Yes 2 No	9.2.11. Zagara	1	Yes 2 No
9.2.6. Gurtic	1	Yes 2 No	9.2.12. dairy products	1	Yes 2 No

9.3. What fish dishes have you eaten over the past week (i.e. sazan, barbel, sturgen or cat fish)?

1 mention	2 no mention	8 don't know	9 refused

9.4. How often do you drink black tea?

1	2	3	4	5
3 or more times per day	2 times per day	1 time per day	less than 1 time per day	never

9.5. Do you eat vegetables like po atoes, carrots, pumpkin, or onions regularly, for instance 5 times per week?

1 yes	2 no	8 don't know	9 refused

9.6. Do you eat fruits like apples, grapes, apricots, melon, watermelon regularly, for instance 5 times per week?

1 yes	2 no	8 don't know	9 refused

SECTION 10 - SOCIO-DEMO GRAPHIC QUESTIONS

Now I'd just like to ask a few fin l questions about your background.

10.1. In what year were you born In 19___

10.2. What is your highest level c f education?

1 none	2 primary	3 intermediate incomplete	4 intermediate complete	5 specialized intermediate incomplete	6 specialized intermediate complete	7 university incomplete	10 university complete	9 refused

10.3. At present, are you ...?

1 married	2 widov ed	3 divorced	4 Separated	5 never been married

10.4. How many married couple are living in your house? ____ couples

10.5. Are you presently... ?

1 working full-time	2 working part-time	3 unemployed TO 10.11	4 retired TO 10.11	5 homemaker TO 10.11	6 student TO 10.11	7 other, specify...

10.6. What is your main occupat on?

10.7. Is your employment consta it or seasonal? 1 constant 2 seasonal

10.8. How many days a week do you work? _____ days a week

10.9. How long have you been w orking at your present occupation? _____ years **OR** _____ months

10.10 Do you receive cash payn ent for your work? 1 yes 2 no

10.11. What did you do prior to his?

10.12. What is the main source c f income for your family? [DO NOT READ LIST]

1 fishing TO 10.14	2 cattle breeding TO 10.14	3 agriculture	4 a trade, specify TO 10.14	5 commerce (i.e. store or restaurant), specify TO 10.14	6 other, specify TO 10.14
Specify trade, commerce or ot ier:					

[IF INVOLVED IN AGRICUL URE]

10.13. Is the land you farm priv te, state owned, rented or family land?

1 private	2 state wned	3 rented	4 family land	5 other
Specify other:				

10.14. Have you had trouble findi ıg or keeping employment?

1 trouble	2 no trouble

10.15. Have you and your family ılways been able to make ends meet?

1 always able	2 not always able

10.16. Is your spouse for pay...

1 working full-time	2 working pa ɪt-time	3 unemployed	4 retired	5 homemaker	6 student	7 other, specify:

10.17. What is you spouse's occu ɔation?

10.18. Could you please tell me ʻour average 1998 monthly household income, that is your income and the income of all other people living in ɣ our home? Be sure to include income from all sources such as savings, pensions, rent and all wages.

1 less than 1 300	
2 1 300 - 4 999	
3 5 000 - 9 999	
4 10 000 - 24 999	
5 25 000 - 40 000	
6 more than 40 000	
7 don't know	
8 refused	

10.19. What language do you us ıally speak at home?

1 Karakalpak	2 Uzbek	3 Russ an	4 Kazakh	5 Turkmen	6 Tajik	7 Ukrainian	8 Korean	9 Tatar
Other, specify:								

10.20. To what ethnic or cultura group do you belong to?

1 Karakalpak	2 Uzbek	3 Russ an	4 Kazakh	5 Turkmen	6 Tajik	7 Ukrainian	8 Korean	9 Tatar
Other, specify:								

10.21. How long have you lived in _____ (define area) _____ years **OR** _____ months

10.22. How long have you lived in this house? _____ years **OR** _____ months

10.23. Where did you live befor ɛ you lived at this address (i.e. what neighbourhood, town or rayon)?

10.24. Is your dwelling OWNE) or being BOUGHT by you or a member of this household?

1 self owned or bought	2 owned or bought by household member	3 not bought or owned by self or household member

10.25. Was this property owned by another member of your family before you moved here? 1 Yes 2 No

10.26. What type of material w ɛ s used in the construction of your house?

1 wattle and daub	2 carcas house	3 brick	4 Other, specify:

10.27. How many entrances are there in your house? _____ entrances

10.28. How many rooms are there in your house? _____ rooms

Do you have in your house?	YES	NO
10.29. electricity	1	2
10.30. a TV set	1	2
10.31. a telephone	1	2
10.32. a refrigerator	1	2
10.33 a radio	1	2
10.34. a toilet	1	2

10.35. which type of toilet?	1 pit	2 flush	3 both

10.36. What is the material of the floor in your house?

1 cement	2 dirt	3 wood	4 stone	5 other, specify:

10.37. Do you feel that you need a new house?

1 yes	2 no TO 10.40.	9 refused TO 10.40.

10.38. Do you have possibility of building a new house?

1 yes TO 10.40.	2 no	8 don't know TO 10.40.	9 refused TO 10.40.

IF NO

10.39.What is the most important reason why you could not build a new house?[ACCEPT ONLY ONE RESPONSE]

1 ground (soil) worsening	2 absence of construction materials	3 lack of money	4 absence of manpower	5 inadequate source of drinking water	8 don't know	9 refused	10 other, specify:

10.40. Is your house or property used for any business activity?

1 yes	2 no TO 10.43.

IF YES

10.41. What type of business?

10.42. How long has it been used for a business activity? _____ years **OR** _____ months

10.43. Would you like to add anything about this topic that we have not covered?

Fill in:_____

_____

_____