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EFFECTIVENESS OF OUTREACH PRIMARY HEALTH CARE IN KARACHI, PAKISTAN

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ABSTRACT

This study evaluated the Aga Khan University Urban Primary Health Care Program's effectiveness, six years after implementation in lower-middle class Karachi. The study supplemented surveillance data which showed two-fold improvements in health indicators.

One Program and one Comparison area were successfully matched post hoc on ethnicity and socioeconomic status. Study participants included women in both areas who had been pregnant in the last 5 years and resident for over 1 year. A total of 1361 mothers with 1731 children under 5 years of age were surveyed, representing a 94% response rate. For each GOBI-F Program component (growth monitoring, oral rehydration therapy, breast feeding, immunization, and fertility control) indicators of Program exposure (coverage), and outcomes (knowledge, behaviours, and impacts) were collected.

The Program achieved 88% community coverage: 85% with outreach visits and 65% with clinic-based services. Factors which potentially confounded the surveillance estimates included secular improvements in water, sanitation, and socioeconomic status, along with the utilization of other health-care providers and health education resources. The Program's unique services were community health worker outreach (home visits and educational meetings) and growth monitoring.

Adjustment for confounding factors, by calculating the risk differences between Program and Comparison areas, diminished the surveillance estimates of Program effectiveness by 50 to 90 percent. The Program was found to be effective in improving most knowledge scores, some healthy behaviours, and no impacts. Positive results included: increased immunization and family planning knowledge scores by 5-10%, higher maternal-child immunization rates by 10-20%, and greater colostrum feeding practice by 10%. Negative results included: no additional diarrhea knowledge; no change in healthy behaviours towards diarrhea treatment, breast feeding, family planning or maternity care; and no health impact on fertility or childhood nutritional status.

Therefore, over and above significant background PHC exposure, the Program's outreach home visits were only minimally effective. The Program was unsuccessful in growth promotion despite very active growth monitoring and nutritional education.

This study demonstrates the necessity for comparison studies in PHC evaluation to adjust for confounding secular trends in other determinants of health. Inappropriate attribution of crude changes in health status to specific interventions can thus be avoided.

RÉSUMÉ

Cette étude a évalué l'efficacité du Programme urbain de soins primaires de l'université d'Aga Khan, six ans après sa mise sur pied dans une population de Karachi de classe moyenne inférieure. L'étude est un complément aux données de surveillance du programme suggérant une amélioration de 100% des indicateurs de santé. Le secteur desservi par le programme était semblable à un secteur de comparaison pour l'ethnicité et le statut socio-économique des résidents.

Étaient candidates pour l'étude toutes les femmes résidentes des secteurs depuis au moins un an et ayant été enceintes au cours des 5 dernières années. Un total de 1,361 mères et de 1,731 enfants de moins de cinq ans ont participé, pour un taux de réponse de 94%. Pour chacune des composantes du programme (surveillance de la croissance, réhydratation orale, allaitement maternel, immunisation, contrôle des naissances) des indicateurs de couverture, de connaissance, de comportement et d'impact furent recueillis. Le programme a rejoint 88% des candidates: 85% avec les visites à domicile et 65% avec les services offerts en clinique.

Des changements dans le temps au niveau de déterminants de santé autres que le programme pouvaient expliquer une amélioration des indicateurs de santé: toute amélioration au niveau de l'eau, des services sanitaires, du statut socio-économique et de l'utilisation des autres ressources en santé (seul le programme offrait les visites à domicile, les rencontres éducatives et la surveillance de la croissance).

L'évaluation d'impact du programme exigeaient de tenir compte de l'effet de ces autres déterminants. Nous l'avons fait en calculant les différences dans les taux entre le secteur desservi et le secteur de comparaison. Ceci a mené à une réduction de 50 à 90% dans l'amélioration estimée par la surveillance des indicateurs. L'efficacité du programme se limite à une amélioration de 5-10% des connaissances concernant les immunisations et le contrôle des naissances, à une augmentation du taux d'immunisation de 10 à 15% et à une hausse du taux d'alimentation au colostrum de 10%. Le programme s'est avéré inefficace au niveau des connaissances concernant la diarrhée, le traitement de la diarrhée, l'allaitement maternel, la planification familiale, les soins maternels, la fertilité et l'état nutritionnel des enfants..

En s'ajoutant à des services de première lignes déjà présents, le programme n'a eu qu'un impact minime. Malgré un effort important de surveillance de la croissance et d'éducation nutritionnelle, le programme n'a pas eu d'impact sur la croissance des enfants.

Cette étude démontre l'utilité d'études avec groupe de comparaison pour contrôler l'effet confondant des déterminants de la santé autres que l'intervention. Ceci évite l'attribution inappropriée de l'effet de ces déterminants à l'intervention.

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LIST OF ABBREVIATIONS

AKU	The Aga Khan University (the organization which implemented, supported and monitored the studied Program, located in Karachi Pakistan)
APWA	All Pakistan Women's Association
BF	Breast Feeding
CHS	The Aga Khan University Department of Community Health Sciences (the Program implementor, and research collaborator)
EPI	Expanded Program of Immunization
FP	Family Planning
GNP	Gross National Product (measure of a country's relative economic strength)
GOBI-F	Growth Monitoring, Oral Rehydration Therapy, Breast Feeding, Immunization and Family Spacing (the predominant selective Primary Health Care approach)
GOBI-FFF	The extended GOBI-F to include Female literacy and Food supplementation
IMR	Infant Mortality Rate (the proportion of liveborn children dying before their first birthday), per 1000 live births
MIMS	Maternal and Infant Mortality Survey (carried out by AKU in all Program sites in 1989)
MIS	Management Information System (the Aga Khan University Primary Health Care Program's Surveillance System)
MMR	Maternal Mortality Ratio (the number of deaths from maternal causes per 100,000 live births)
NGO	Non-Governmental Organization
ORS	Oral Rehydration Solution (clean and optimal fluid-based diarrhea treatment, either packaged or homemade)

ORT	Oral Rehydration Therapy (the strategy of providing optimal rehydration through the use of both fluid-based and cereal-based diarrhea treatment)
PHC	Primary Health Care
PDHS	The Pakistan Demographic and Health Survey of 1990-1991 (performed by the National Institute of Population Studies, Islamabad, Pakistan)
The Program	The Aga Khan University Urban Primary Health Care Program (the studied Program)
Rs	Rupees, the Pakistan currency (Rs 30 = US$1 in early 1994)
SSS	Sugar Salt Solution (as part of oral rehydration therapy)
TFR	Total Fertility Rate (the number of children that would be born per woman, if she were to live to the end of her child-bearing years and bear children at each age in accordance with the current age-specific fertility rates).
TTBA	Trained Traditional Birth Attendant
U5MR	Under Five Mortality Rate (the proportion of liveborn children dying before reaching their fifth birthday)
UNDP	The United Nations Development Program
UNICEF	The United Nations Children's and Emergency Fund
WHO	The World Health Organization

PREFACE

In 1983, the Aga Khan University (AKU) opened in Karachi, Pakistan with the objective of providing medical and nursing education with a community health focus. The AKU Department of Community Health Sciences (CHS) was charged with actualizing this objective. In 1984, Dr Pierre Tousignant of McGill University became the first CHS chairman as part of the fledgling McGill-AKU collaboration.

This research project was first conceived of by myself and Dr. Yves Bergevin of the McGill University Faculty Program in International Health in the Spring of 1992, after he returned from a visit to enhance McGill links with AKU. In Karachi, the need for an evaluation of the AKU Urban Primary Health Care Program (the Program) had been identified as a priority.

The initial protocol proposed to study the secondary care referral system from the AKU community health centers, under the hypothesis that there was a deficiency of health care options between small primary care clinics and large tertiary care institutions. To test the feasibility of the project, I travelled to Karachi over Christmas of 1992.

Through collaboration with many members of the CHS, it soon became apparent that a more pressing issue, the lack of comparison data for the extensive Program surveillance data, was a higher research priority. Moreover, there were insufficient referrals from the community health centers for a longitudinal study to fit within my time restrictions. The protocol was, therefore, reoriented to an examination of the effectiveness of the Program.

Potential methods for evaluating process and impact indicators and for matching communities were investigated upon my return to Montreal. The final study method reflects input from my thesis committee and other members of the McGill University Department of Epidemiology and Biostatistics, the Canadian International Development Agency (who supported both my studies and the research through a CIDA Award for Canadians), and AKU. The research was conducted in Karachi during an eight month period from November of 1993 through June of 1994, with extensive collaboration and logistic support from AKU.

This thesis is dedicated to

my wife Catherine Hagen

and to our first child, Edward Jan Schokking.

ACKNOWLEDGEMENTS

The study involved extensive collaboration within the faculty at McGill University and the Aga Khan University Department of Community Health Sciences. I am very grateful to Yves Bergevin for the many hours he spent with me revising the study protocol, and for his practical insights on managing research in developing countries. Without his initial encouragement, the study would certainly not have taken place.

I am deeply indebted to the members of my thesis committee for their wisdom, encouragement, and for generously sharing their time. I am especially appreciative of my thesis supervisor, Pierre Tousignant, for his ability to direct my lateral thinking, bringing conceptual clarity to the murkiest problems, and for his supportive visit to Pakistan. I am very thankful to Joyce Pickering, for her exceptional judgement and ability to keep me in perspective. I will not forget the joy of working with James Hanley, his humour, insight and ability to simplify the interpretation of data.

I wish very much to acknowledge the extensive collaboration and support afforded me by senior faculty of the Aga Khan University Department of Community Health Sciences. I thank Fozia Qureshi, my main contact, for her beautiful laugh and ability to make things happen when all seemed lost. I am indebted to Noor Allah Noorani for his intelligence and drive, and for sharing his home. I will always remember the ability of Steven Luby to be clear and present in a discussion. He is a role model for me as an epidemiologist, teacher and friend. I thank Joseph McCormick for his constant reassurance. To the other AKU faculty members, Mumtaz Hussain, Melvin Lobo, Salim Sohani, David Marsh, Afsal Mehamud, Bazmi Inam, Parvez Nayani, Inam Ul-Haq, and Janet Burns I am deeply grateful for their time and support in pulling together a useful and feasible project.

I am indebted to the two computer wizards, Noor Allah Noorani and Firasat Ali Hashmi, who spend many long nights with me sharing their skills. I sincerely thank the

support staff at AKU, Sammy Rae, Salim Gulam-Ali, Iqbal, the drivers and others to numerous to mention here.

I am appreciative of the entire Azam Basti field team for their meaningful contribution to the design and implementation of the survey, and for sharing their tight quarters with me. I would especially like to thank Sarah Jamil, the community physician for her enthusiasm and interest, Shamim Sohil for her community insight, and Aslam Allouddin for his support above and beyond the call of duty.

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I am sincerely grateful for the Canadian International Development Agency (CIDA) Awards for Canadians grant which supported both my academic training and field research. I appreciated CIDA pre- and post- departure briefings which helped me adjust during and after the research.

To my loving parents Jan and Johanna Schokking who have always supported me wherever I have gone. May I be half the parent that they have been.

Last, but certainly not least, I would like to thank my life partner, Catherine Hagen, for her constant love and support through the mountains and valleys of our journey over the last eight years. I hope some of her youthful empiricism rubs off on our son, who was conceived in Pakistan, and who thankfully remained *in utero* until the completion of our two theses.

1. INTRODUCTION

In 1978, delegates to the International Conference on Primary Health Care at Alma Ata identified Primary Health Care (PHC) as the multidisciplinary strategy most likely to achieve 'Health for All by the Year 2000'.[174] The PHC strategy has evolved into many approaches in many diverse places, all aimed at improving health within the constraints of limited resources.[20,160] The Aga Khan University Urban Primary Health Care Program (the Program) began in 1983 with an objective of developing effective and affordable PHC prototypes.[75]

From 1984 to 1987 the Program was first implemented in five urban squatter settlements of Karachi Pakistan, each comprising roughly 10,000 people. The Program continued through 1994, including outreach community health workers, trained traditional birth attendants and a community health center.[75] The Program was based on UNICEF's 'Child Survival Strategy', GOBI-F (growth monitoring, oral rehydration, breast feeding, immunization, and family spacing).[155,156]

The Program was one of few model urban PHC programs in Pakistan, or Asia. There were plans for Program replication locally and nationally.[25] There were even suggestions that the Program should be replicated internationally. After five years of the Program, Husein et al reported:

> "Here, then, is the evidence of effectiveness and affordability of these (the Aga Khan University's Urban) PHC systems."[75](page 592)

For just $2.32 per person-year the Aga Khan University (AKU) reported improved infant mortality rates from an average of 126 to 64 deaths per 1000 live births.[75] In each of five Program sites, the AKU reported parallel 20-600% improvements in other targeted health indicators over the first 4 years of Program implementation. These consistent 'time-trends' in AKU surveillance data represented the available AKU evidence to infer 'effectiveness' on the Program.

Unfortunately, the AKU time-trend data were limited in assessing effectiveness. Information on concurrent secular trends which might have caused health improvement was unavailable, nor were there corroborating community-based data. This study was designed and implemented in collaboration with the AKU Department of Community Health Sciences to procure as much of the missing information as possible given the *post hoc* situation and practical constraints.

The thesis is divided into seven chapters. The background information describes the Primary Health Care strategy, the Program, its environment and objectives. The literature review examines AKU's surveillance data in light of the literature, from both methodologic and substantive perspectives. The study problem and questions are then described, followed by the methods used to address them. The study results are categorized by the GOBI-F Program components, as is the discussion. The conclusion synthesizes the GOBI-F results into assessments of Program effectiveness, and study implications.

2. BACKGROUND INFORMATION

The following chapter situates the Aga Khan University Urban Primary Health Care Program (the Program) into a global and local context. What is Primary Health Care (PHC), its origins, strategies, and implementation? How are Pakistan and Karachi situated with respect to health and development? How has the PHC strategy been implemented in Pakistan? What are the specifics of the Program and its objectives? What evidence was available for the Program's effectiveness prior to undertaking this study?

2.1 Primary Health Care (PHC)

2.1.1 The Primary Health Care Strategy

The world's population first began to boom in the late 1600's (1640-1700), and has been attributed to improved water and sanitation, homogeneity of disease, and improved nutrition with colonial trade and plantations.[111] The Industrial Revolution followed a century later (1750-1830) adding occupational health problems to the list of public health problems which were mostly infectious diseases. However, high infant and childhood mortality remained the norm until the turn of the century (1890-1920) when Europe went through 'the Epidemiologic Transition', in which childhood became healthy and the health of populations in cities improved.[13] With an increasing proportion of people with chronic disease, the elderly rather than children became those seen as diseased. This led to 'the Demographic Transition' with reduced fertility and squaring of the population pyramid.[91] Industrialized countries have all gone through both transitions, and similar patterns have begun in many developing countries over the last half century.[116,175]

Determinants of the health improvements which accompanied the epidemiologic and demographic transitions are diverse, and have been shown to include socioeconomic

status, education, water, sanitation, the status of women, the quality and production of food, and political stability.[13,135,160] Interventions aimed at improving these determinants have fallen into two main categories: economic and health interventions. Health interventions can be further subdivided into public health or personal health services interventions, the relative advantage of each having been debated in the literature. The bulk of the evidence to prioritize public health interventions came from McKeown's study of developed countries since the early 1800's.[110] He argued that economic development caused improved socioeconomic status which then led to better nutrition and hygiene, water, sanitation, and thus the control of communicable diseases. Proponents of personal health services cite Kohn and White's industrialized country health system review for evidence.[37,91]

In developing countries the pattern has not been uniform from economic development to health.[116,117,175] China, Bangladesh, Egypt, Vietnam and Sri Lanka are cases in point of much better health status than their socioeconomic status would suggest, Algeria and Iraq are among countries with the opposite trend.[161,173] Ecologic evaluations of the differential development patterns have added female literacy and the status of women to the list of health determinants.[26]

The Primary Health Care Strategy grew out of efforts by the World Health Organization (WHO) and the United Nation's Children's Fund (UNICEF) to facilitate the epidemiologic and demographic transitions in developing countries. The WHO was formed in 1948, following World War II and the discovery of antibiotics beginning with chloroquin (for malaria), streptomycin (for tuberculosis), and penicillin. The early years of WHO were devoted to helping governments in developing countries build health centers. By the mid 1960's it became apparent that such clinic-based interventions were having little impact on the health of populations farther than 3-5 kilometers from the health center.[20] The reported success of China's 'barefoot doctors' provided impetus for the training of rural community health workers (CHWs).[116]

A CHW is a local person who is given basic training to deal in a pragmatic way with simple health problems and health education, hence taking medical tasks and pushing them down the health service pyramid to the humblest and least expensive cadre of health worker capable of doing them satisfactorily.[167,168,174,177] Health workers remain in the community, working part-time usually as volunteers or on a small stipend.[20]

Through the late 1960's and early 1970's many small-scale Community Health Worker training schemes were implemented, with widely reported success in improving health status and reaching under serviced populations.[116] This reported success led the way to the 1978 'International Conference on Primary Health Care' in Alma Ata. The conference was attended by members of 143 countries and 67 organizations leading to *The Declaration of Alma Ata*,[174] which called for equity in health [defined as "a state of complete physical, mental and social wellbeing, and not merely the absence of disease and infirmity"[174](page 3)] and to reach the goal of 'Health for All by the Year 2000'. The declaration outlined the Primary Health Care (PHC) strategy to attain this goal:

> "Primary Health Care is essential health care based on practical, scientifically sound and socially acceptable methods and technology made universally accessible to individuals and families in the community through their full participation and at a cost that the community and country can afford to maintain at every stage of their development in a spirit of self-reliance and self-determination. It forms an integral part of both the country's health system, of which it is the central function and main focus, and of the overall social and economic development of the community. It is the first level of contact of individuals, the family and the community with the national health system bringing health care as close as possible to where people live and work, and constitutes the first element of a continuing health care process."[174](pages 3-4)

Primary Health Care is meant to be integrated into the greater health system to provide promotive, preventive, curative and rehabilitative care in addressing at least eight program components: health education, promotion of food supply and nutrition, water and sanitation, maternal and child health care including family planning, immunization, control of locally endemic diseases, the treatment of common diseases, the provision of essential drugs, dental care, mental health, and traditional medicine. PHC is an inter-

sectoral effort, which requires community participation to correct gross inequalities in health status in order to attain economic and social development.[174]

2.1.2 Implementation of Primary Health Care: The GOBI-F Strategy

Though the components of the PHC Strategy were initially defined shortly after Alma-Ata,[175,177] a debate has emerged on how to best implement the PHC strategy.[125,152] The debate is philosophical, as to whether PHC should be a 'comprehensive' strategy to empower communities to take charge of their health problems,[119,180] or whether PHC should be a 'selective' effort to implement the most cost-efficient, effective, and efficacious technical interventions.[115,117,166] Proponents of selective PHC argue that comprehensive PHC is too idealistic to be implemented by most governments, highlighting the selective approach's advantages of measurable results, encouragement of private sector participation, appeals to donor agencies, promotion of more advanced technologies, and maintenance of the current financial and institutional status quo for industry and investment.[165] Proponents of comprehensive PHC point to the failures of the vertical programs undertaken in the name of selective PHC, as quick-fix solutions not integrated with existing services and long term development,[118,135,140,171] going on to claim that PHC needs to be implemented *in-toto* to cause the sociopolitical changes required to empower the dis-empowered.[95,104,117,151] In practice, comprehensive PHC has not been easy to implement. Given the diversity of health determinants, and the practical problems in funding and implementing multi sectoral interventions, a selective approach to PHC became the predominant paradigm used by development agencies.

However, by the mid 1980's it was obvious that the PHC strategy would fail to attain 'health for all by the year 2000'.[155,179] In his opening address to the 1988 WHO *Reflections at Midpoint Conference*, Mahler highlighted a number of factors in the failure:

> "the unsettled economic situation, the population explosion, the increasing numbers of elderly and the very young, indebtedness and increasing poverty in the developing countries, urbanization and the migration of people from rural areas, political turbulence, the refugee problem, illiteracy, and unemployment.[105](page 79)

UNICEF's efforts to develop a world strategy to deal with these problems led to the 1990 World Summit for Children where over 180 nations committed (by the year 2000) to reduce child deaths by one third, improve health and nutrition, and provide basic education, clean water and sanitation, plus ensure the rights of children, girls and women.[159] In general, there are at least three levels of intervention in PHC programs: public health measures through mass media and environmental control; preventive health care through community health workers providing education, early identification and treatment of common problems; and the provision of facility-based curative services.[144] Health service programs (including the AKU Program studied here) usually do not include mass media or environmental interventions, but rather focus on the last two levels.

The main selective PHC strategy to be implemented by the health sector was defined by UNICEF in the early 1980's.[154] Initially called 'GOBI' (growth monitoring, oral rehydration therapy for diarrhea, breast feeding, and immunization) the strategy has been expanded, one 'F' at a time, to GOBI-FFF[88,155,157,160] (GOBI-F plus family spacing, female education, and food supplementation). This strategy is meant to lead the 'Child Survival Revolution'[155] by implementing UNICEF's 'Facts-for-Life'[156] in a world effort to improve the health of children. Though the strategy is not without its critics,[115,135,171] GOBI has become the basis for the implementation of most health-sector PHC interventions, including the AKU Program studied here. After some background information on Pakistan, I will describe the Program and its objectives.

2.2 Pakistan

2.2.1 Pakistan in the World Context

Pakistan became independent in 1947 along with what is now Bangladesh as the Muslim majority area with the partitioning of the Indian subcontinent Situated both geographically and culturally between the Middle East and South Asia, Pakistan has attracted migrants and traders for over 5000 years.[50] In 1900, the population of Pakistan was estimated at 16 million, which doubled by partition in 1947 to 32 million, and more than quadrupled by 1981 to 84 million according to the last official government census.[50] With a currently estimated population of over 115 million, Pakistan is the eighth most populous country in the world, projected to be fifth by the year 2025.[173] The average annual population growth rate is estimated to have been 3.1% over the last 20 years, which is well over the 2-2.2% average growth of low-income countries. This rapid growth rate is not projected to slow down until well into the twenty-first century.[173]

In terms of development, Pakistan is below the twenty-fifth percentile of countries worldwide by most ranking systems: well within the least-developed countries category. (Pakistan ranks 136 out of 173 countries (21.4%ile)[161] by per capita gross national product, 132 out of 173 countries (23.7%ile) by the Human Development Index[161], and 110 out of 146 countries (24.7%ile) by child mortality[160].

Pakistan's relative economic position worldwide has changed minimally over the last 40 years (real per capita gross domestic product was 12% of the average for industrial countries in 1960, and in 1990 was 13%, or just below average for all developing countries). Though the gap in health status between Pakistan and industrialized countries narrowed somewhat from 1960 to 1990 (the differential in life expectancy decreased from 37 to 18%, and in infant mortality decreased from 80% to 60%),[173] Pakistan has fallen behind other developing countries of similar wealth in terms of the degree of social and health status improvements.[26]

Some of the disparities in Pakistan's relative development have been attributed to the allocation of government funds.[133,158] Though proportional spending on health and education increased markedly in the 1960's and 1970's it has remained rather static since 1980.[50] In 1990, Pakistan's health expenditure and education expenditures were similar to other developing countries (4.5% and 3.4 % of GNP respectively), however military spending was twice that of other developing countries (6.6% of GNP).[161] Furthermore, the health budget has been focused on curative services in tertiary care institutions, and only 14% was spent on preventive or promotive programs.[185] Despite its apparent low priority, there have been a number of PHC interventions in Pakistan.

2.2.2 Primary Health Care Interventions in Pakistan

After Alma Ata in 1978,[174] the number of PHC interventions increased markedly. Further impetus was added in 1990 when Pakistan joined 180 nations at the World Summit for Children. The PHC interventions are described in UNICEF's *Situation Analysis of Women and Children in Pakistan*,[158] and *The Demographic and Health Survey*.[50] Supplementary information was obtained by the author while in Pakistan.

In terms of the traditional health sector, Pakistan has limited health manpower with almost 3,000 population per doctor, and over 5,000 population per nurse (making Pakistan one of the only countries with less nurses than doctors). Concomitant with an urban bias in resource allocation,[185] (70% of allopathic providers and hospital beds are located in urban areas where only 30% of the population resides),[161] most government health facilities, are under-staffed, under-supplied, and under-utilized.[161] All three levels of government (federal, provincial, and municipal) maintain health centers. The federal Basic Health Services Program focuses mostly on rural areas, but recent plans call for PHC centers in urban areas as well.[109,158] Urban health centers are mostly run by the provinces. In Karachi's province of Sindh the centers are called Family Welfare Centers or dispensaries. These centers have minimal staff and support, though they do have

outreach family planning motivators, trained traditional birth attendants and usually nurses for consultation. Municipal health centers were not found in the Program's squatter settlements. Therefore, most of the health care services in Pakistan comes from the private sector,[185] especially in urban areas where 40-80 % of urban residents utilize the private sector for acute care.[80]

In terms of non health-sector development, the government's focus has been on rural areas.[60] In urban areas, government efforts consist of mostly loans and capital grants,[60] leaving the implementation of programs, such as water and sanitation, primarily to the non-governmental sector. [50] With over 8,000 non-governmental organizations (NGOs) listed in Pakistan[158] this is perhaps not surprising. Most NGOs implement their programs on a limited scale, and many water and sanitation projects are modelled after the highly successful *Orangi Pilot Project* in Karachi.[84,123]

Governmental preventive PHC interventions have been modelled on the GOBI-FFF strategy. In terms of food supplementation, since 1979 the government has provided wheat, dried skimmed milk and edible oils to pregnant and lactating women, under the auspices of the World Food Program. A national nutrition program began in the late 1980's, recently reoriented to promoting breast feeding, along with the training of medical and paramedical staff in nutrition, and nutritional surveillance through growth monitoring.[60] In 1994, growth monitoring was rare in Pakistan.[149,158]

Pakistan has had a Diarrheal Disease Control program since the early 1970's which has provided oral rehydration solution (ORS), increased awareness of Oral Rehydration Therapy (ORT), and education for all health workers in clinical case management. Packaged sugar-salt-solutions (SSS, or *Nimkol* in Pakistan) have been widely promoted and distributed. The program has been successful, with knowledge and utilization of ORT increasing from 10% in 1980[155] to 50-90% by 1990.[2,158]

Since 1982 the government has trained over 40,000 traditional birth attendants (TTBA's or *dais*), with at least one trained per rural village and urban slum.[158] Training relates to safe delivery, identification of high risk pregnancies and referral, motivation for

tetanus toxoid, breast feeding and weaning food practices. Though data were unavailable on the overall success of the program,[133] breast feeding rates are high in Pakistan.[2,50]

The Expanded Program of Immunization (EPI) was initiated following Alma Ata in 1978. The EPI covers six childhood diseases (polio, diphtheria, pertussis, tetanus, tuberculosis, and measles). Subsequent to WHO and UNICEF support for accelerating the EPI in 1982, marked success has been reported with immunization rates increasing from less than 5% in 1980 to over 75% in 1986.[155] Current childhood coverage is reported at 76-90% (depending on the disease) and maternal tetanus toxoid coverage at 42%.[160] The government has targeted universal coverage by the year 2000.[7]

Though the government's family planning program began in the 1950's, it has suffered from fluctuating commitment and financing.[158] Only since 1991 have family planning services been officially offered at all government health outlets. The main government activities include stipends (Rs 500 [Pakistan Rupees], or US$20) for people to be sterilized, free intrauterine devices, and extensive social marketing and subsidization of condoms. However, a number of NGOs have been actively promoting family planning, such as the Family Planning Association of Pakistan (which offers television and radio programs on safe motherhood and the importance of small families). Despite these efforts, family planning is under-utilized in Pakistan compared to other developing countries or Asia.[160] Contraceptive prevalence has increased from below 3% in 1980 to only 10-15% in 1992.[158]

Pakistan has one of the lowest literacy rates in the world with a wide male-female gap.[50,163] The government's literacy initiative has been through primary education, recently with a push to build new girls schools. Adult literacy is left to the non-governmental sector. There was a National Task Force on Literacy in 1990 with 40% NGO representation. Much education also comes from the private sector with 4% of all national schools being private, 25% of which are in Karachi. Despite these efforts, in 1990 the adult literacy rate was only 35% (male 47% and female 21%), though both were

better than the 1970 overall rate of 20%.[161] Mean years of schooling were three for males and 0.7 for females.[158]

In summary, there have been a number of health-related interventions in Pakistan, with accelerated activity beginning five years prior to the studied Program's implementation. Since the early 1980's, immunization and oral rehydration therapy have been extensively promoted. Literacy, breast feeding, family planning and nutritional support (in terms of growth monitoring and food supplementation) were less well implemented. In urban settings, PHC exposure has been mostly through the mass media and the private health sector. In 1994, the average urban resident was reported to have 100% access to health services, 84% access to water, and 56% access to modern sanitation services.[50] I will now examine the extent to which there have been parallel improvements in health status.

2.2.3 Health Status in Pakistan

Over the last 40 years, world-wide health status has improved more than in the whole previous human history. Three quarters of the total increase in life expectancy has occurred since the turn of the century. Infant mortality in developing countries has fallen at an accelerating rate from an average 2% decrease in the 1960's through 3% in the 1970's to 5% decrease in the 1980's.[173] Have these improved health trends been manifested in Pakistan?

In round figures, the current infant mortality rate (IMR) in Pakistan is estimated at approximately 100 deaths per 1,000 live births, the under 5 mortality rate (U5MR) just under 150 deaths per 1,000 live births, and the maternal mortality ratio (MMR) at 500 deaths per 100,000 live births.[161,173] Socioeconomic and health status indicators for Pakistan are contrasted in TABLE 2.1 with industrialized (or developed countries) and other least-developed (or developing) countries, both prior to Program implementation (1987) and currently (1992).[160,161,173]

Table 2.1: Pakistan's Health Status Before and After Program Implementation

	BEFORE Implementation (1987)[157]			AFTER Implementation (1992)[162]			PAKISTAN
SOCIOECONOMIC INDICATORS	Industrial Countries	Developing Countries	PAKISTAN	Industrial Countries	Developing Countries	PAKISTAN	% CHANGE 1987-92 *
Average Population in millions	44	15	111	31.2	15.3	125	13
Population annual Growth Rate	0.6	2.7	3.1	0.6	2.7	3.2	3
Gross National Product Per Capita (US$)	7295	265	350	18884	240	400	14
% Population Urban	73	23	31	75	21	33	6
Life Expectancy from Birth (years)	75	48	58	76	50	59	2
% Access to safe water (urban areas)	-	61	84	-	64	90	7
Adult Male Literacy (percent)	-	43	40	-	54	47	18
Adult Female Literacy (percent)	-	22	19	-	32	21	11
DEMOGRAPHIC INDICATORS							
% Population below age 5	-	18	19	7	18	17	-11
% Population below age 15	-	48	47	21	46	46	-2
Crude Birth Rate (per 1000 population)	14	46	47	14	44	41	-13
Crude Death Rate (per 1000 population)	10	19	13	9	16	11	-15
HEALTH STATUS INDICATORS							
Infant Mortality Rate (per 1000 Live births)	10	129	110	9	114	95	-14
Under-5 Mortality Rate (per 1000 Live births)	13	209	179	11	179	143	-20
% children age 12-23 mo wasted	-	8	14	-	17	11	-21
% children age 24-59 mo stunted	-	46	60	-	56	42	-30
% children 0-59 mo undernourished	-	30	62	-	43	40	-35
% children 12-23 mo measles immunized	-	33	53	79	51	76	43
% pregnant women tetanus immunized	-	11	27	-	41	42	56
Contraceptive Prevalence (women age 15-49)	71	1	8	71	13	12	50
% Births Attended by trained personnel	99	23	24	98	28	35	46
Maternal Mortality Rate	11	420	600	10	590	500	-17

* Percent difference calculated as 100 X (1992-1987/1987)

Compared to industrialized countries, Pakistan has twice the ill-health for most indicators, with five times the population growth and 10 to 50 times the mortality. Compared to other least-developed countries, Pakistan is wealthier yet has a higher population growth rate. Demographically, Pakistan is comparable to least-developed countries. In terms of health indicators, Pakistan is better than least-developed countries in mortality and immunization rates, equivalent in nutrition, and worse in contraceptive prevalence. The conclusions are similar when urban or rural dis-aggregated data are contrasted with Asia or least-developed countries.[160,161,173]

The changes in Pakistan's health status indicators over the last period of Program implementation are shown in the last column of TABLE 2.1. Socioeconomic status improved by 10-15% as shown by literacy and access to safe water. Health status improved markedly: with 2 years longer life expectancy; 15% decreased maternal-child mortality; 20-30% gains in child nutrition, and 50% increased immunization and contraceptive prevalence. These trends fit the pattern of longer term socioeconomic and health improvements: for example, the infant mortality rate has fallen from approximately 140 in the 1960's and 70's, to 90-110 in the 80's and 90's.[158]

Unfortunately, aggregated statistics mask large disparities in health status. There are marked gender-based, rural-urban, and intra-urban health status differentials in Pakistan. On average, males are healthier than females.[160] Pakistan is one of the few countries where the life expectancy of women is less then that of men, partially a reflection of the extremely high maternal mortality ratio. Pakistan has one of the highest male to female ratios in the world (1.11 men per woman). The gender-based health differential has been attributed to low female literacy, selective care of male children,[158] and a 10% lower infant and child mortality in boys compared to girls.[50]

Aggregated statistics also mask rural-urban differentials in health status. On average, the urban population in developing countries is increasing at a rate of 3-7%.[45] Urbanization in Pakistan has occurred at 4-5% per annum over the last 40 years: leading to an increase from 17% of the population urbanized at partition to 33% in 1991.[173] At

present 30 to 50% of urban residents in developing countries live in squatter settlements,[45] and by the year 2000 the proportion is projected to possibly reach 80%.[45,69]

Intra-urban variations in health status can be marked, with two to three fold increases in morbidity and mortality when populations with poor housing, sanitation and water facilities, are compared to those with basic facilities.[14,70] On average, Pakistan's urban health statistics are much better than rural ones, for example, the IMR is estimated at 70-80 in urban areas, and 120-160 in rural areas. Unfortunately, aggregated data usually over-represent the middle and upper class in urban statistics,[170,184] which holds for Pakistan where residents of squatter settlements are thought to be missed in Pakistan's aggregate data.[50,67,158] Some 32% of Pakistan's urban population are estimated to live in absolute poverty, compared to 29% in rural areas.[158] Consequently, information about developing country's urban squatter health is incomplete and of questionable validity.[5,184] Data for urban Pakistan suffer from the same flaws.[4,61,131]

Karachi, the site of this study is the largest city in Pakistan, situated on the Arabian Sea. It was the seat of the British colonial parliament, the capital of Pakistan until 1961, and remains the major industrial and financial center. Karachi is among the most populated cities in the world with almost 4,000 people per square kilometre.[161] It has an estimated population of over eight million with an annual population growth rate of 6%, or 350,000 new migrants per year, 2/3 of whom settle into squatter settlements.[158] A total of 400 squatter settlements comprise 40% of Karachi's population. The squatters live with a population density of approximating 10,000 people per square kilometre.[6]

The health needs of this urban squatter population, and the limitations in what is known about their health status, have been the focus of the Aga Khan University Urban Primary Health Care Program.

2.3 The Aga Khan University

2.3.1 History of the Aga Khan University

The Aga Khan is the religious leader of the Ismaili sect of Shia Muslims. His Aga Khan Foundation is a large non-governmental organization which uses the 20% time and financial donation required of Ismaili's along with other funding for development projects on four continents. The Aga Khan University was planned by the Aga Khan Foundation to be the 'Harvard of the East' quality medical school for Pakistan.[37] Since being built in 1983, there was a significant shift towards a Primary Health Care Orientation.[25]

Twenty percent of the Aga Khan University's medical and nursing curricula are focused on community health through the Department of Community Health Sciences.[7] The objectives of the Department of Community Health Sciences are:

> "to train young people for leadership in addressing the health problems of the people of Pakistan, particularly those of the more deprived populations through the primary health care approach."[7](page 1) and
>
> "to contribute to improvements in the health services of Pakistan, particularly through the development of prototypes of health services that are effective and affordable."[7](page 1)

These objectives were the driving force for establishment of the Aga Khan University Urban Primary Health Care Program.

2.3.2 The Aga Khan University Urban Primary Health Care Program (the Program)

Since 1985, the Aga Khan University Primary Health Care Program (hereafter known as 'the Program') has become gradually established in five intervention sites situated in Karachi squatter settlements, each with a target population of 8,000-10,000 people.

The goals of the Program mirror AKU's goals: to demonstrate the feasibility of developing model PHC programs in urban slum areas; to provide sites for field-based training of students; and to serve as locations for AKU health services research and health manpower development activities.[7] More specifically the Program aims:

> "to increase the accessibility, acceptability and availability of selective PHC interventions; reduce maternal morbidity and mortality; reduce mortality and morbidity in under-5 children and other high risk groups; promote community participation and ultimately management of disease prevention and health promotion program and project management; and to promote and participate in community development through inter-sectoral collaboration"[6](page 2) and
>
> "to develop teaching/learning opportunities for medical and nursing students including to relate to communities [sic], assess community problems and needs," plus "participate in planning, implementing, managing, and evaluating PHC Systems, particularly for the more deprived populations."[6](page 2)

In reality the sites are used primarily for teaching and research rather than service.[6,25] The Program is modelled on UNICEF's F*acts for Life*[156] and its Child Survival Strategy[135] known as GOBI-F (growth monitoring, oral rehydration therapy, breast-feeding, immunization, and fertility care).[88]

The Program has five main components (or main areas of intervention) which reflect its GOBI-F strategy: home-based growth monitoring, management of diarrhea, encouragement of appropriate breast feeding practices, mother and child immunization, along with family planning and maternity care.

The Program is implemented through a four-level structure of paid health workers:

a) Community Health Workers (CHWs) are locally recruited and trained women responsible for monthly outreach visits to 100-150 registered households. Registration requires no remuneration, but rather is an agreement to allow the CHW to visit. During these visits the CHWs are meant to monitor the health status of women and children, provide health education on diarrhea management (i.e. the use of oral rehydration therapy), personal hygiene, environmental sanitation, breast feeding, supplemental feeding, growth monitoring, birth spacing, and immunization. The CHWs also provide simple curative care, and refer those deemed in need of further primary care to the community health stations. For families with individuals at risk (i.e. moderately or severely malnourished children, incompletely immunized children, etc.) more frequent visits are made. Special trips are made to households with incompletely immunized children on the morning of immunization clinics. The CHWs also organize weekly lane meetings with 10-12 mothers to provide further health education.

b) Lady health visitors staff the community health stations which are open five days a week from 8:00 to 16:00. They also supervise the work of the CHWs. In addition to basic curative services, weekly immunization clinics are provided, along with limited family planning services and appropriate referrals. Health stations have a small sustainable pharmacy, which sells drugs from the World Health Organization's Essential Drug List without profit.

c) Community health nurses, doctors, medical and nursing students support and supervise the program on an ongoing basis. They are present in the community health stations 1-5 days per week.

d) Trained Traditional birth attendants (TTBAs or *dais*) provide prenatal care, and attend home deliveries.

The emphasis of the Program is outreach to registered women in their homes. Unregistered families are not visited, but can avail themselves of the clinical services. Surveys done by medical students in two program sites showed that only 5-10% of the population utilized the PHC clinics for care when ill, and most PHC clinics see fewer than 15 patients per day (not all of whom are from the targeted population).[79] More than 50% of women utilize maternity homes and hospitals rather than the TTBAs, and many others use other traditional birth attendants.[50] There are only 1-2 referrals to secondary or tertiary care institutions per month, less than half of which are to Aga Khan University itself.[6] Therefore, any impact the Program has probably occurs through the CHW outreach activities.

The CHWs recurrently identify a number of obstacles to fully attaining their goals: communities which are more interested in curative than preventive care; the Islamic custom of female seclusion (*purdah*), which is especially common with women of Pathan extraction; limited referral from clinic and none from the TTBAs; trouble motivating women to come to the clinic; social and political instability; plus difficulty obtaining community participation.[6,7,75]

Any Program effectiveness is over-and-above these obstacles, the under-utilization of the community health centers, and the minimal referral within the system.

2.3.3 AKU's Time-trend Evidence for Effectiveness of The Program

The Aga Khan University has been very active in monitoring the health status of its registered population. Pre-program estimates were obtained by small sample surveys,[6] and subsequent estimates have been based on reporting by the CHWs.[75]

The baseline surveys were undertaken by successive cohorts of first year medical and nursing students in the year prior to program implementation for each program site (1984-1987). The surveys compiled indicators of socioeconomic status, mortality, morbidity, health behaviour, and health service utilization.

Since 1987 the Aga Khan University has collected extensive service-based surveillance data. The data, since 1989, have been compiled into a computerized 'Management Information System' (MIS),[54,75,83] which has evolved over time. Currently the main records compiled by the CHWs are a family folder for each registered family, a child health card, maternal health card, daily activity register, pregnant woman's register, and death report forms. There are also forms for the traditional birth attendants, daily outpatient registers in the community health center which include morbidity information, and extensive cost documentation. Indicators are tabulated monthly, quarterly or yearly depending on the indicator. Over time, the number of indicators collected has been substantially reduced in efforts to decrease the over 50% proportion of CHW's time presently spent keeping records. The indicators which were included in the MIS at the time of the study are listed in APPENDIX I.

Time trends in key Program health status indicators comparing pre-program (baseline) survey data to 1992 surveillance data are shown in TABLE 2.2. Concurrent estimates in similar indicators for Pakistan as a whole are shown in TABLE 2.3. Pre-program estimates are equivalent in both tables, well within the overlapping confidence intervals. Health status has universally improved, however the Program indicators have consistently improved at least two-fold more than the aggregated Pakistan indicators. The differentials between time-trends in AKU surveillance data, and concurrent trends in aggregated urban Pakistan statistics represented the evidence for Program effectiveness which existed prior to this study.

Table 2.2: 'Time-trends' in Health Status Indicators for AKU Program Areas 1984-92

Health Status Indicator Aggregated for the 5 Program Sites	Pre-Program 1984-7[75]	Present 1992[6,75]	% change
Infant Mortality Rate	126	64	- 50 %
Under-5 Mortality Rate	177	84	- 50 %
% Children Underweight	44 %	41 %	- 7 %
% Children Under-5 Fully Immunized	48 %	85 %	+ 80 %
Contraceptive Prevalence	10 %	26 %	+ 160 %
% Women Age 15-49 Tetanus Immunized	21 %	92 %	+ 340%

Table 2.3: Trends in Pakistan's Health Status Indicators 1985-92 [155,158,161,162,173]

Pakistan's Health Status Indicator	1985	1992	% change
Infant Mortality Rate	120	95	- 20 %
Under-5 Mortality Rate	180	143	- 20 %
% Children Underweight	52 %	40 %	- 23 %
% Children age 12-23 mo Fully Immunized	47 %	76 %	+ 60 %
Contraceptive Prevalence	8 %	12 %	+ 50 %
% Women Age 15-49 Tetanus Immunized	18 %	42 %	+ 130%

3. LITERATURE REVIEW

How can the effectiveness of Primary Health Care programs be measured? Which indicators are important, and how can they be related into a conceptual framework? What evidence exists for the effectiveness of GOBI-F based PHC interventions in general? What were potential limitations of the methods used to obtain the AKU time-trend evidence for effectiveness of the specific Programs studied? Are the results reliable and valid? Are the results credible in view of PHC evaluations elsewhere, and in view of what is known about the many confounding factors and secular trends which influence health status?

3.1 Measuring the Effectiveness of Primary Health Care

Subsequent to Alma-Ata a debate arose as to how progress towards 'Health for All' was to be evaluated and measured. The debate culminated in the 1981 publication of an official list of indicators.[176] Subsequently there have been minor modifications to the list,[19] expanding from mortality and morbidity to include assessments of quality-of-life,[173] disability,[160] occupational health,[157] along with measures of inequalities in health and the distribution of resources (i.e. male-female[161] and rural-urban differentials[155]).

Population estimates of these maternal-child health status indicators can be obtained from existing vital registration, population census, health service records, disease registers and special surveillance systems.[129,132] Health service records provide encounter-based information which often cannot be linked to a true population denominator, and is biased through missing the non-users.[4,131] In Pakistan health service records are inconsistently kept and relatively inaccessible for research.[50] Generally, in developing countries vital registration, disease registers and surveillance systems are poor

to non-existent.[28,150] This is also true of Pakistan which officially has had vital registration for more than a century, yet continues to have incomplete and inaccurate data.[50]

Due to the limitations of other data, population-based data for developing countries, including Pakistan, are based mostly on existing censuses supplemented with surveys. The first round of internationally comparable surveys were the World Fertility Surveys which collected birth histories, fertility, fertility-related-behaviour, child mortality, birth spacing, maternal education and household characteristics in 43 countries from 1974 to 1982.[109] This evolved into the Demographic and Health Survey with the addition of immunization, health care utilization and child health indicators. Since 1984 there have been 39 Demographic and Health Surveys in 30 countries.[173] Recently, internationally comparable economic information is being collected through the Living Standards Measurement Surveys designed by the World Bank.[173]

The main indicators used in international health assessment have evolved from these international surveys. Annual indicator estimates are compiled for each country from local or national surveys with mathematical projections between surveys.[173] Since the mid-1980's these estimates have been compiled annually in the UNICEF's *The State of the World's Children* publication,[154,155,157,159,160,162] which has ranked countries by infant and under-5-mortality. Since 1990, the United Nations Development Program annual publication *The UNDP Human Development Report* ranks countries based on an evolving index of development.[161] The World Bank recently supplemented the health indicators in its annual *World Development Report* for 1993, entitled *Investing in Health,*[173] which ranked countries based on Gross National Product (GNP) per capita.

3.2 Conceptual Framework for PHC Program Effectiveness Evaluation

The diversity of indicators included in the above mentioned publications require categorization to be of use in effectiveness evaluation. There are at least five broad categories, each defined differently throughout the literature.[93,132,163] For this study, the following categories are defined as modified from Schrettenbrunner and Harpham:[134]

a) inputs: physical and human resources mobilized to produce planned outputs
b) process: the array of activities aimed at affecting outcome and impact (i.e. health education, primary and secondary care services)
c) outputs: the product of the system (i.e. service)
d) effects: the effects of the outputs (i.e. knowledge, attitudes and practices)
e) impacts: changes in biology (i.e. mortality, morbidity, nutritional status)

Inputs and outputs are best measured using service-based information.[4,132] Process, effects and impacts are best measured with community-based information.[92] This study was community-based, measuring the latter group of categories. To relate Program exposure (utilization/coverage) to Program outcomes, the conceptual framework shown in FIGURE 1 was developed.

Figure 1: Conceptual Framework for PHC Program Effectiveness Evaluation

"process" indicators -----> "effect" indicators -----> "impact" indicators

Program Coverage ----> Intermediate Outcomes ---> Health Impact

Program Exposure
---> Health Knowledge
---> Healthy Behaviours
---> Health Status Impact

3.3 General Evidence for PHC Program Effectiveness

Epidemiologic studies have a number of possible designs classified (by decreasing validity or strength of evidence) as follows: randomized controlled trials, longitudinal studies, case-control studies, quasi-experimental designs, cross-sectional surveys, ecologic studies, and descriptive studies.[129] These studies typically relate a number of exposures to a number of outcomes. Over the past decade, there have been criticisms of program evaluations which simply related what was put 'in' to a program to what came 'out' of a program.[132,134,163]

Program evaluation must also explore the 'process' or degree to which a program has been successfully implemented, to avoid deeming an intervention ineffective due to problems in implementation, or in the appropriateness of the population for the intervention.[61] Many factors are important in the process of Primary Health Care implementation including: socio-cultural, financial and geographic accessibility; planning and integration within the broader health sector; the development of health care teams; a focus on infrastructure, support and management; and multi sectoral approaches to health

development.[13,53,57,58] All of these factors should be considered in a Primary Health Care effectiveness evaluation.

The basic epidemiologic study framework has been modified for the program effectiveness assessment of preventive health interventions,[65,172] water and sanitation programs,[43,66] and health education curricula.[102] From these authors, a quality of evidence grid was developed for my examination of the literature. The study grid (in decreasing strength) was as follows: randomized controlled trials; longitudinal (cohort/case-control replicated); cross-sectional (quasi-experimental) time-series or ecological comparisons; descriptive studies; and the opinions of experts.

Manuals of program evaluation exist in the education[61] and health promotion[90] literature. From these sources, the consensus is that to attribute effectiveness to a program, descriptive studies or the opinions of experts are insufficient. Evidence should be drawn from only those studies with a comparison population (either external or internal over time) in an experimental, quasi-experimental, or observational design allowing one to quantify and control for effect-modifiers and confounders of effectiveness.[65] Accordingly, only studies fitting the first three categories in the study grid are reviewed here.

Efficacy is the degree to which an intervention works in an ideal setting, and effectiveness considers the degree to which an intervention works in a real setting.[34,131] The efficacy of the various PHC strategy's GOBI-F components were demonstrated in many studies during the late 1970's and early 1980's.[116,156] There has also been reasonable evidence for the effectiveness of most PHC components selectively implemented in rural areas.[20]

Taken one-by-one most of the above PHC components have been shown in observational or experimental studies to lower infant mortality rates to the World Summit for Children's goal of 70 per 1,000 live births.[159] The evidence for such selective effectiveness is particularly convincing for the following PHC components: water and sanitation interventions,[43,44] immunization,[9,76,99] and the treatment of common illnesses

(including Oral Rehydration Therapy[156] and antibiotics for pneumonia[63,85,120]). The evidence for other components of the PHC intervention (growth monitoring,[17,56] family planning[109] and prenatal care)[142] is less clear.

When implemented in comprehensive rural 'pilot-projects' the PHC strategy was shown to be effective in bringing about impressive health improvements.[17,56] Among the best examples are the Jamkhed[116] and the Narangwal Projects in India.[145]

A review of the evidence for effectiveness of larger scale rural projects was published by Berman in 1988.[20] The limited quantitative evidence reviewed came from internal documents of funding agencies, and hence was inaccessible for review here. Berman concluded that there was, however, ample evidence for the effectiveness of small-scale locally-initiated PHC projects, but little evidence for the effectiveness of large-scale programs. Though the large-scale programs did increase the coverage and equity of health service delivery, there was inconsistent evidence of substantial health impact. Specifically, there was quantitative evidence supporting the impact of some components (immunization, plus oral rehydration, pneumonia and malaria therapies), but little quantitative evidence for the impact of the remaining components (health and nutrition education, referral, and community activity). I have built on Berman's review to examine a Medline search of the subsequent ten years (1985-1994).

The Medline search was limited to evaluations of programs with community health workers which measured indicators of GOBI-F interventions similar to the studied Program, and included process, effect and impact indicators rather than inputs, outputs or more proximal measures of CHW functionality.[11,107] Only 18 publications met the inclusion criteria,[8,16,30,32,33,36,42,46,56,62,64,77,85,87,88,98,120,146] two pairs of which were publications from the same studies analyzed differently and two of which were insightful reviews of the evidence from other studies[32,46] One study was added from unpublished sources in Pakistan.[123] A total of 14 separate studies were reviewed and shown in APPENDIX II which lists the studies in three groups: longitudinal studies, cross-sectional studies with external controls, and cross-sectional studies with only internal comparison over time.

Details are included of the study location, date, type and duration of intervention, study design, sample size and data collection instruments, indicators used, along with a critique of the study strengths and weaknesses. The tables are ordered from strongest to weakest design, and the studies within each table are similarly ordered.

Using the study grid, the literature review included one randomized controlled trial, five longitudinal studies, five cross-sectional studies with external comparison (three with full pre- and post- quasi-experimental designs, two with post- only quasi-experimental designs), and three with repeated cross-sectional studies in one population only. As different studies examined different indicators, TABLE 3.1 summarizes the results by the number of studies which examined specific GOBI-F interventions, or the impact of general PHC programs.

Table 3.1 : Result Summary from the 14 Reviewed PHC Effectiveness Studies

Specific GOBI-F Intervention or General PHC Impact Indicator	Intermediate Outcomes (knowledge & behaviour)	Hard Outcomes (impact)
Growth Monitoring (nutr)	nil	3/3 neg
Oral Rehydration Therapy (ORT)	6/8 pos, 2/8 neg	nil
Breast Feeding (BF)	1/1 pos	nil
Immunization (Imm)	nil	6/6 pos
Family Planning (FP)	5/6 pos, 1/6 neg	nil
Prenatal Care (Prenatal)	2/3 pos, 1/3 neg	nil
Pneumonia Treatment	nil	2/2 pos
Perinatal Mortality Rate (PNMR)		2/2 neg
Infant Mortality Rate (IMR)		2/5 pos, 3/5 neg
Under Five Mortality Rate (U5MR)		3/5 pos, 2/5 neg
Child Morbidity Rate		1/1 pos

In terms of GOBI-F intervention effectiveness: the evidence for oral rehydration therapy, immunization, family planning, and pneumonia treatment are consistently positive; the evidence for prenatal care and the three mortality variables are contradictory; and evidence for growth monitoring is negative. The evidence for breast feeding is limited to one positive study. In terms of general PHC program impact, evidence for mortality impact is contradictory, and morbidity impact limited to one positive study.

This limited number of rigorously designed PHC studies is consistent with a recent review of health education interventions which found only four.[102] The number of PHC programs currently implemented is much greater than the number of published articles, which points to either a lack of program evaluation, or potential publication bias. Since the reviewed studies have predominantly positive results, positive publication bias cannot be ruled out.

Though all 14 studies adjusted for confounding exposures to some degree by design, few described their methods or the comparability of the exposed and non-exposed populations (except the study by Rashid which had a poor match). Many did not use the comparison group in the analysis (including the only randomized controlled trial). Either the duration of intervention (one year or less in half the studies), or the sample size limited the ability of the study to detect the hypothesized differences in all but 5 studies.[30,42,62,64,77,85,146]

Where pre- and post- cross-sectional data were collected for both exposed and control populations, adjustment was required for secular improvements observed in the comparison group. These studies, therefore, demonstrate the need to adjust for secular trends in health status. Unfortunately, the limited analyses of the reviewed studies make it difficult to assess the degree of confounding by non-secular factors such as socioeconomic status and education.

Only four of the reviewed studies listed the variables on which communities were matched, and none evaluated the quality of the match. The strength of the comparison between areas depends on their degree of socioeconomic and demographic similarity. A review of literature for definitions of socioeconomic status over the last 20 years revealed 45% of studies using education, 22% used occupation, 15% used income and 18% used composite measures.[100] It has been argued elsewhere that multiple measures must be used to properly assess socioeconomic status.[27,41] Demographic similarity can be assessed using the procedures from taxonomic or grouping analysis, adopted from the social sciences,[127] into epidemiologic studies.[114]

It has been argued that the effective program evaluation sample size should ideally be limited to the number of communities included,[39] however, other authors counter that such a purist approach would make the finding of significant Program effect essentially impossible.[89,103,169] Though exposure to PHC is at a community or household level, most of the reviewed studies were analyzed at an individual level. No adjustment was made for clustering of individuals within households. A number of authors have

recently discussed statistical techniques to correct for such clustering.[39,40,55,108] Clustering artificially inflates the study sample size in proportion to the intraclass (or intra-household) correlation coefficients. Coefficients above 0.3 are felt to require adjustment through multiplying the standard error of the study estimates by the intra-class correlation coefficient times a factor approximately the square root of two.[1,49]

In summary, the literature review included only 14 published PHC evaluations in the last ten years, all of which had significant shortcomings in either the design, community matching or analysis. There are many explanations for the lack of well controlled studies including: the numerous factors which influence health status without knowledge of their relative effects; the ethical considerations of using a control population; and the costs of program evaluation.[164] These factors contribute to the inherent difficulties in attributing specific effects to specific interventions, while adequately controlling for confounding influences of program effectiveness. With these problems in mind, I now move on to a methodologic critique the AKU surveillance data, followed by a substantive comparison to other available data.

3.4 Methodologic Review of AKU Time-trend Evidence for Program Effectiveness

3.4.1 Pre-Implementation Estimates: The Baseline Surveys

The pre-implementation surveys have been performed since 1983 by subsequent cohorts of AKU medical and nursing students. The first (in 1983) included only 507 households,[7] when accurate estimates of child mortality and morbidity require a sample size of several thousand mothers.[150] Subsequent surveys constantly modified the questionnaire, approaching almost half of the required mortality sample size by adding a 'quick count survey' (one page of basic socio-demographic variables) on approximately 1,300 households to the 'in-depth survey' asked of 392-581 mothers. Unfortunately, the

quick count survey did not include a pregnancy history, but rather questioned births and deaths in children under the age of five during the last 12 months (one year recall).

The reliability of one year recall for mortality has been repeatedly criticized throughout the literature due to recall bias with telescoping of both births and deaths into the recall period.[23,150] There also have been problems of under-reporting neonatal deaths.[28] Since the early 1980's the main international surveys (the World Fertility Survey and the Demographic and Health Surveys) have moved to a truncated five-year birth history as the only way to get reliable estimates of infant and child mortality.[28,50]

In the later pre-implementation surveys full pregnancy histories were asked of only 400 women in each site, and the mortality estimates are based on mortality reported in the quick-count. Given the fluctuations in mortality, many authors claim that rates should be averaged over 3-5 years to look at trends.[28,150] Furthermore, there is evidence to show that medical interviewers introduce biases into a survey through medicalization of the interview.[137,150] Given the medical students non-blinded status
there is a further potential bias towards defining the initial health status to be as poor as possible.

In summary, the reliability of the baseline mortality estimates is potentially limited as they were obtained using imprecise and possibly biased methods by inexperienced and possibly biased interviewers on a sample size too small for stable estimates. Other indicators would be subject to the same problems, though to a lesser degree. The AKU baseline estimates could be biased in either direction, but are most likely to be negative (towards a worsened health status) given the biases of the medical students.

3.4.2 Subsequent Monitoring: The Management Information System (MIS)

The Management Information System (MIS) is a surveillance system based on reports of the AKU CHWs from their monthly home visits.[75] The yearly mortality

estimates in each Program site are based on 200-300 live births, 15-40 infant deaths, and only 2-15 child deaths. Therefore, the estimates have large confidence intervals, and the rates could fluctuate markedly due to the omission of a few vital events. Some events are missed when women return to their place of origin to give birth, and for the subsequent Muslim 40 day period of strict seclusion.[75] When they return, reporting would potentially bias mortality estimates in a positive direction by missing stillbirths and neonatal deaths (who would not need registration for immunizations). Given that the health workers see the mortality rates as a main indicator of their effectiveness, they would be potentially biased towards under-reporting mortality, if an event (such as residency) was difficult to classify. However, there are a number of quality control and reliability checks of CHW reports, so it is unlikely that there are major errors in reporting of the vital events. With regard to the other maternal-child indicator estimates, the same biases could apply, but there are less issues with less potential for fluctuating rates.

Therefore, the MIS is a compilation of good quality data, collected monthly with quality control. Unfortunately, the MIS data are limited to the registered population, which is a subset (the Program users) of the whole community. During the first year of the MIS only 30-60% of the community was registered, and currently 75-90% are registered. The registered population is likely to include innovators whose health knowledge and practices are better than that of the general population.[61] Given the selection-bias of a motivated registered population, the MIS is likely to have over-estimated the health status (positive bias) of the community, especially in the earlier years of the Program.

The data problems are further complicated by the fluidity of the community. Annually a 10% in-migration is mostly from rural areas, and a 5% out-migration is either to a better neighbourhood or back to the rural area.[6] Assessment of changes in community indicators over time must, therefore, take the population's mobility into account. Newer migrants are less likely than more long term residents to be registered with the program,

and more likely to have a poorer health status.[170,184] Therefore, the mobility may bias the MIS estimates in a positive direction, towards overestimation of health status.

The MIS has further limitations. Spill-over to the non-registered population cannot be measured nor can other intermediate variables on the causal pathway from health system exposure to improved health status (knowledge, attitudes, practices, and health-seeking-behaviours to health providers other than within the AKU system). Depending on the importance of these variables, the MIS could have limitations in assessing effectiveness. If present, any bias in the MIS is likely positive (i.e. over estimating health status).

Putting the possible biases of the two data sources together, would result in a combination where the baseline studies have possible negative bias, and the MIS possible positive bias. Given the lack of information on confounding influences, and the reportedly improving health status in Pakistan, it is likely that AKU's evidence over-estimates the Program's effectiveness. However, given the limitations of Pakistan's statistics background information on potential secular trends in the health status of similar Pakistani urban squatter settlements is required.

3.5 Substantive Review: Comparison to Outside Data

The Aga Khan University has twice collected supplementary data with potential information about Program effectiveness. In 1989, a well designed maternal and infant mortality survey (MIMS) was carried out in all Program sites, and in one comparison area.[51] For each of the sites, improvements were consistently seen in health outcome indicators when comparison was made to pre-implementation surveys, which suggested a positive Program effect. However, when the results of the comparison area were contrasted to the Program area contiguous with it (in which the Program had then been implemented for over 5 years) the maternal and infant mortality rates, and contraceptive prevalence rates were equivalent.[6] Though this equivalency might suggest the Program had been ineffective, there was also the possibility in the comparison area of spill-over

exposure from the Program, and of exposure to health workers from a nearby development project (the Orangi Pilot Project).[84] The implications of the MIMS survey for Program effectiveness were, therefore, inconclusive.

In early 1993, a survey was undertaken in an area proposed for Program expansion.[6] Infant and child mortality rates on one year recall were similar to those reported in contiguous Program areas.[112] A repeat survey in the same area, using an even less reliable estimator (3 year mortality recall) estimated higher mortality rates, more comparable to the pre-implementation Program area's estimates. The specific data and methods are unavailable, however both studies have limitations: small sample size of 600 households, and the potential incomparability of the survey and Program populations.

Despite these limitations, both the 1989 and 1993 studies provide enough evidence to generate a hypothesis that health outcomes in Program neighbouring communities are potentially equivalent to those of Program areas. In other words, there is evidence of parallel improvements in health status in neighbouring communities, which would be due to either Program spill-over or secular trends in health determinants external to the Program.

The five pre-implementation surveys were performed sequentially, one year apart. There were no obvious secular trends in health indicators across surveys. However, the surveys were differently worded and the communities were not ethnically or economically comparable. Therefore, an estimate of background secular trends in squatter settlements cannot be made from within AKU's baseline data, and the best comparison is to other urban data.

There are two recent outside sources of good population-based data on Pakistan. The first is cross-sectional: the 1990-91 Demographic and Health Survey (PDHS).[2] A full description of the methods, reliability and validity of the measures is available.[50] As part of the WHO's worldwide Demographic and Health Survey, the PDHS was a stratified clustered systemic random sample of 8,019 households in Pakistan. The results have

narrow confidence intervals, even when dis-aggregated to major city, other-urban, and rural categories.

The other data source is longitudinal: the 'Early Child Health in Lahore' cohort.[78] The study systemically chose three communities to be representative of Pakistan's urban poor, peri-urban slum, and village population. The comparison population were women of middle socioeconomic class, who registered with obstetricians. In 1984, baseline surveys were carried out on approximately 1000 households in each of the three communities. Pregnancies and the resulting children born were followed longitudinally until 1989. A whole supplement of *Acta Pediatrica* [10,67,78,81,86,106,186,187] is devoted to the results of the study. Other than possible selection bias in community selection, the data appear to be of good quality.

Other surveys have been carried out including the National Nutrition Survey in 1981, and the Population Contraception Prevalence Survey in 1984.[50] Reports of these surveys were not available for methodologic review, however their results were consistent with the PDHS and Lahore data. The last government census was in 1981, and a repeat is unlikely in the near future due to the political ramifications of the results.[158] This information is too dated for comparison to AKU data.

In TABLE 3.2, pre-Program (baseline) data aggregated for all five Program sites are contrasted with the most comparable estimates from the above studies: the Lahore Cohort urban slum, and the PDHS Major City estimate. In terms of socioeconomic status, the AKU population was comparable to slightly less well off. Demographic status was similar. Health status was 10% poorer. All estimates were significantly better than the Lahore Cohort's peri-urban and village estimates and the PDHS rural estimates.

A similar pattern was noted where recent Management Information System health status indicator rates were contrasted with rural and major city PDHS estimates. Compared to the PDHS major city estimates, immunization rates (both childhood and maternal) rates were 10-15% better in AKU sites, though nutrition, family planning and prenatal care indicators were similar.

Putting the external comparisons together, the baseline data were substantively comparable to other urban estimates for Pakistan: describing a 10% less well off community in terms of socioeconomic and health status, which could be in part explained by the negative study bias suggested above. Comparison of ongoing surveillance data also demonstrates a substantive similarity in all outcome indicators save immunization.

In summary, a comparison to outside data sources suggested that the AKU pre-Program and surveillance data were reasonable in terms of their magnitude, hence the data were adequately reliable. Outside data also suggest secular improvements in health status concurrent with the Program.

Table 3.2: Comparison of AKU pre-implementation survey to data for urban Pakistan

SOCIO-ECONOMIC INDICATORS	1984-87[67] LAHORE* Urban Slum	1990-91[50] PDHS** Major City	1984-87[75] AKU *** Mean	1984-87[75] AKU *** Range
Mean Persons per House	5.6	7.2	7.1	6.7-7.6
Mean Rooms per House	2	1.6	2	1.7-2.1
Mean Persons per Room (Crowding Index)	4.1	4.5	3.7	3.2-4.2
Median Monthly Family Income (Pakistan Rupees)	1290	-	1472	1250-2000
Median Per Capita Income (Pakistan Rupees)	230	-	209	190-300
% Households with Private Water Hookup	-	79	28	5-49
% Households With a Modern Toilet	99	89	75	35-88
% Households with Electricity	-	98	77	60-90
DEMOGRAPHIC and HEALTH STATUS INDICATORS				
% Population Male	-	51	52	51-53
% Population below 5	-	13	20	18-21
% Population below 15	45	42	49	47-50
% Population above 60	-	5	4.5	3.5-5.2
Crude Birth Rate (per 1000 population)	-	34	41	41-44
Infant Mortality Rate (per 1000 Live births)	107	74	117	93-145
Under 5 Mortality Rate (per 1000 Live births)	184	94	168	110-240
% married women ever using Contraceptives	-	21	17	14-21
Current Contraceptive Prevalence women age 15-49	-	19	10	6-14

* Lahore Cohort Study: Data from the baseline survey of 1,000 households in a systemically chosen urban slum

** PDHS: Pakistan Demographic and Health Survey: above data from the 'major city portion', or 2,200 of 18,019 randomly surveyed Pakistani households

*** The Aga Khan University Program Pre-implementation Surveys averaged for all 5 Program sites

4. STUDY PROBLEM

4.1 Problem Statement

In 1993, the Aga Khan University's Urban Primary Health Care Program surveillance data indicated parallel two-fold improvements in health indicators in five Program sites over five years of Program implementation. There were five reasons to supplement this surveillance data.

First, the data reliability and validity were open to methodologic critique. Pre-implementation (community-based) survey data were compared to post-implementation (service-based) surveillance data despite potential incomparability.

Second, data were not collected on a comparison population which was unexposed to the Program, and estimates of the same from outside sources may not have included the squatter population served.

Third, since Program implementation, there had been concurrent general development and specific health-related services and interventions from the governmental, non-governmental, and private sectors, an unknown proportion of which reached the Program areas.

Fourth, concurrent improvements in the health status have been recorded for two populations which were unexposed to the Program: urban Pakistanis in general, and possibly two specific communities neighbouring the Program.

Fifth, infant mortality rates of 50-60 per 1,000 live births were achieved with AKU's full GOBI-F intervention, yet similar effects have been reported with individual GOBI-F components alone.

The descriptive surveillance data, therefore, were insufficient to infer Program effectiveness (the analytic association between improvements in health status and exposure to the Program). To assess Program effectiveness, adjustment needed to be made for concurrent secular trends in determinants of health external to the Program.

Community-based estimates of four types were required: indicators of Program exposure, indicators of health knowledge and behaviours on the causal path from

Program exposure to health impact, indicators of health impact, and estimates of the concurrent health-related development external to the Program. To obtain these estimates, this study was designed and carried out in collaboration with the AKU.

4.2 Study Questions

To test Program effectiveness, the central study question was:

> **What has been the benefit of the Aga Khan University Urban Primary Health Care Program over and above the background secular trends in the health status within Karachi squatter settlements?**

To answer the central study question, four subsidiary questions were addressed:

a) What was the degree of Program exposure (i.e. was the Program successfully implemented)?

b) What were the improvements in health outcomes at the community-level?

c) Have there been changes in confounding factors of Program effectiveness (i.e. interventions and secular changes in other determinants of health)?

d) Was the Program effective (ie. for each GOBI-F Program component, how much of the observed health improvements should be attributed to confounding factors and how much to Program effectiveness)?

5. METHODS

5.1 Study Design

A **post-post quasi-experimental design**[35] was used to supplement the AKU surveillance data. The data were obtained through **parallel cross-sectional surveys in two matched populations:**

a) Program Area — residents of one squatter settlement with the Program from 1987 through 1994, hence 'exposed' to the Program for up to 6 years.

b) Comparison Area — residents of a neighbouring squatter settlement, chosen to be 'unexposed' to the Program or other outreach PHC, and matched to the Program area on socioeconomic status, ethnicity and other determinants of health status over the previous 5-10 years.

5.1.1 Design Assumptions

a) Current matching was a reasonable proxy for pre-Program status, as trends in socioeconomic status and ethnicity were likely to have been consistent between neighbouring squatter settlements over the previous 5-10 years.

b) Secular trends in potentially confounding determinants of health status (economic development, education, health services, water and sanitation) could be identified by a qualitative investigation utilizing local key informants.

c) Exposure was expected for all residents of the Program area, regardless of individual family exposure, due to spill-over between households.[184]

d) Differences in community rates or proportions with adjustment for secular trends, therefore, were the appropriate statistics to test.

5.1.2 Design Justification

The study was limited to six months of fieldwork beginning in November 1993, which ruled out prospective experimental or cohort designs. The Program had many potential outcomes, which limited the usefulness of a case-control design. A full pre- and post- quasi-experimental design was not feasible due to the unavailability (from AKU or other sources) of pre-implementation data on a control population. The post-post quasi-experimental design, therefore, was the best possible given the *post hoc* situation, the urgency of the question, and practical constraints.

A number of authors mention the problems of including a comparison or control group in Primary Health Care evaluation.[134,150,164] The problems are methodologic (the difficulty of making and maintaining a valid comparison), conceptual (can two communities be truly similar), practical (the additional costs of studying comparison areas and difficulties in maintaining community involvement once the variables and methods are defined), and ethical (the issue of having an unexposed population when the intervention is deemed effective). A comparison population was vital for this study because there was no other way to obtain an estimate of the background exposures and outcomes in neighbouring squatter settlements. Methods were developed to address each of the above listed problems, descriptions of which are included in the relevant sections below.

As community-based estimates were needed to complement the service-based Management Information System, a community survey was the appropriate data collection method. The main advantages of the survey were efficiency of data collection, collection of exposures, outcomes, and confounders at the household level, and the inclusion of exposures outside the Program.[29,92,128]

The study was a one-to-one comparison of communities, which could have dissimilarities unmeasured in the study (i.e. community organization, cohesiveness and character). These differences were qualitatively looked for, and known quantitative variables were measured. Unlike the community comparisons reviewed previously, this study adjusted for differences in matching variables at the household level, and for the design effect of clustering within households.

5.1.3 Study Indicators and Variables

A large body of literature exists on the basic methods for community surveys,[4,29,91,139] and on their application in Primary Health Care Research.[3,53,90,91,122] A further body of literature examines the modification of community surveys for developing countries,[28,92,137,144,150,177,184] and the associated methodologic problems.[18,23,65,93,94,128,142,167]

Potential indicators of Program effectiveness were first identified in the international literature. Collaboration was then undertaken in Pakistan to identify other potential indicators for the Program's original objectives and new or planned initiatives and indicators for comparison to the pre-implementation survey and the ongoing surveillance data. From this long list of potential indicators the study indicators were chosen, through collaboration with the AKU Department of Community Health Sciences, the Program staff and the communities, to reflect the major focuses of the Program. Indicators which had been shown elsewhere to be reliably obtained on community surveys in developing countries[28,176] and in Pakistan[50,78,158] were included in the study.

The survey included three indicators of general household PHC exposure (duration of residence in the Program area, number of home visits by a health worker in the last three months, and the number of health meetings attended in the last three months) and three indicators of general PHC impact (infant mortality, perinatal mortality, and childhood diarrhea and pneumonia morbidity). The survey also included specific indicators of exposures, outcomes and impacts for each GOBI-F Program component, which are listed in TABLE 5.1.

Table 5.1 Specific Study Variables Fit into the GOBI-F Conceptual Framework

	Program / PHC Exposures		Intermediate Outcomes	Impacts
PROGRAM ELEMENTS	COVERAGE	KNOWLEDGE	BEHAVIOURS	IMPACTS
GROWTH MONITORING (Children under age 5)	% ever / recently weighed % with growth card			% Underweight % Stunted % Malnourished
ORAL REHYDRATION THERAPY (Usual care from all mothers or caregivers of children under age 5)	Sources of diarrhea Rx info Sources of ORT supplies	Knowledge of: diarrhea warning signs	Amount Fluids given during diarrhea Amount Food given with/after diarrhea % ORT use	
(Children under age 5 with diarrhea on 2 week recall)	Sources of ORT supplies		Mean Diarrhea Treatment Score % ORT Use	
BREAST FEEDING (during most recent term pregnancy)			% Fed Colostrum Duration (Exclusive/Total) BF % Complementary food 6-9 m	
IMMUNIZATION (children 12-23 mo or under age 5)	% with Immunization card	Knowledge of timing: BCG and Measles	% Never / Measles / Complete Immunisation	
(Most recent term pregnancy)			% Maternal Tetanus Immunization	
FAMILY PLANNING (women who have been pregnant in the last 5 years)	Sources of FP info Sources of FP supplies	Knowledge of methods	Ever contraceptive Prevalence Current Contraceptive Prevalence Mean Duration of contraceptive use	Crude Birth rate Birth Interval Total Fertility Rate
MATERNITY CARE (during most recent pregnancy)	Sources of Prenatal Care	Reason for seeking prenatal care	% Any Prenatal Care % Adequate Prenatal Care % Trained Birth Attendants % delivering at home	Perinatal Mortality Rate
PNEUMONIA (Children under age 5 with pneumonia on 2 week recall)			% Home Rx with/without consultation % Receiving antibiotics	

Definitions for indicators included in the study were chosen to be comparable to the international literature,[157,159-161,173,176] the Aga Khan Foundation program evaluation modules,[54,124] and the AKU Management Information System (see APPENDIX I).[6,75] Study variables with potentially ambiguous definitions are defined and referenced in TABLE 5.2.

Table 5.2 Definitions of Variables Measured in the Study

Variable	Operational Definition
Age-specific fertility rate	Number of births during a specified period to women of a specified age group, divided by the number of person-years lived during that period by women of that age group[96]
Birth interval	Interval between termination of one completed pregnancy and the termination of the next[96]
Births	live births plus stillbirths[96]
Births attended	Percentage of births attended by physicians, nurses, midwives, trained primary health care workers or trained traditional birth attendants[162]
Contraceptive prevalence rate	Percentage of married women aged 15-49 currently using modern contraception[162]
Crude birth rate	All births to total population regardless of gender or age, expressed as annual births per 1000 population.[97]
Early neonatal death	Death of a liveborn infant before 7 days of life[96]
Infant mortality rate	The proportion of live born children who died before their first birthday.[96]
Live birth	Any child which breathed or moved at least once after birth[182]

Perinatal mortality rate	Stillbirths plus early neonatal deaths divided by the total births (Live births plus stillbirths), times 1000.
Prenatal care coverage	The proportion of women who, in their last pregnancy, had at least one contact with the formal maternal health care system.[48]
Stillbirth	A death prior to birth of fetus born at term (after 6 months gestation)[182]
Total fertility rate	Sum of all of the age-specific fertility rates by maternal age category, multiplied by the width of the age category in years[97]
Under five mortality rate	The proportion of liveborn children dying before reaching their fifth birthday[96]

The variables on which to match communities in this study were modified from W. O. Spitzer's Snodgrass study[138] which used twelve variables from the Canadian census to measure age structure, family size, mobility, income, educational achievement, occupational status, and religion. These variables were modified for the Pakistani setting in consultation with governmental and non-governmental experts, Professor R. T. Murdie of York University,[114] and by referring to the social geography literature for Asia.[21,22] In the study survey, 25 matching variables were included to examine demographic, wealth, education, crowding and housing situation aspects in a *post hoc* assessment of the community match. The specific matching variables are listed and defined in APPENDIX VII.

5.2 Study Objectives and Hypotheses

a) Objective: To assess Program coverage: the degree to which the Program had been implemented, for each GOBI-F program element.

Hypothesis: The Program was successfully implemented: at least 50% of people resident in the Program area have had contact with the Program.

b) Objective: To assess the quality of the community comparison.

Hypothesis: The matching method would define an ethnically and socioeconomically similar Comparison area, with insufficient exposure (from either Program spillover or other programs) to invalidate the comparison: i.e. less than 10% of the Comparison Population have been exposed to outreach home visits.

c) Objective: To assess secular trends in health determinants external to the Program.

Hypothesis: Important health determinants include other sources of Primary Health Care (including water, sanitation, and education services), other health services (from both the public and private sectors), and economic development.

d) Objective: To assess health outcomes: to obtain and contrast community-based estimates of health knowledge, healthy behaviours, and health impact indicators between the Program and Comparison areas, for each of the GOBI-F program elements.

Hypothesis: Program outcomes are substantially better within the Program area, even after control is made for secular trends.

5.3 Study Sites

5.3 1 Selection of Program (Exposed) Area

Only one of the five Program sites could be included in the study due to time and financial restraints. Of the five Program field sites, two were in unique communities without potential comparison communities. Site visits were performed to the other three field sites, and interviews with the PHC teams and local leaders, as well as observations of the Program and surrounding areas were carried out.

Azam Basti was chosen as the study site because it had a number of potential comparison populations in the surrounding areas, and had no differential development compared with the surrounding areas over the preceding 10 years. Furthermore, Azam Basti included a small laboratory and performed some medical procedures which were part of the model for potential Program expansion, had the best growth monitoring effort, had a recent pneumonia treatment intervention, was the safest during city riots, and had not undergone an AKU survey in recent years. Local leaders were interested in the results, and willing to facilitate access to the households.

5.3.2 Selection of the Comparison (Unexposed) Area: The Matching Method

Initial efforts to define potential comparison areas consisted of networking for one month within Karachi in an effort to find pre-implementation data on communities similar to a Program community. The last Pakistan census had been in 1981, and the results had been discredited due to their political implications.[7,158] No quantitative information or small areas estimators for any Karachi community even remotely similar to a Program community were available in the government sector (Federal Bureau of Statistics, Karachi Metropolitan Corporation, Karachi Development Authority), AKU and other universities, UNICEF and other non-governmental organizations, or the various

squatter settlement associations. Therefore, the comparison area could not be chosen *a priori* using quantitative data, but rather was chosen using qualitative data gathering techniques, with quantitative assessment of the comparison only possible *a posteriori*, once the survey results were compiled.

Key informant interviews were used to identify areas which were socioeconomically and ethnically comparable to the Program area. The main sources of information were the AKU academic and service staff, discussions with local residents, and inspections of the areas surrounding the Program area. Other sources included religious leaders, community organizations, and political leaders. The main question asked was "Where else do people like you live?", followed by the same procedure in identified areas. The iterative process was continued until a short list of potential comparison areas was compiled. Qualitative assessment of socioeconomic-status was made by travelling to the identified areas, and further key informant interviews were undertaken to rule out other sources of outreach home visits or differential health development.

Three sectors (C, D and E) of a nearby community (Akhtar Colony) were finally chosen as the Comparison area. The comparison area was part of the same larger squatter settlement as the Program area. It was settled by the same ethnic groups, at the same time (25-30 years ago). It is similar in size (3,500 households) separated by another part of the squatter settlement (Azam Town) which was 0.5-0.7 km (15 minutes walk) in width. The Comparison and Program areas were by appearance and all accounts socioeconomically similar. The two areas were equidistant from and have equivalent road access to the maternity home and teaching hospitals. The comparison area had no outreach health care that anyone was aware of, and no confounding development activities (i.e. differential economic, water, sanitation, education or health interventions) were identified in the key informant discussions.

Therefore, the Comparison and Program areas were qualitatively similar in size, duration of existence, socioeconomic-status, ethnicity, occupations, and proximity to

other secondary and tertiary care medical services. Both areas had had no PHC outreach or new development over the last 10 years. Information on Primary Health Care exposures in both areas was collected through interviews with service providers as they were identified during the survey. The results of the interviews are reported in section 6.2.1.

Involvement in the study of residents from the Comparison area was the last criteria in the choice. A local socially active youth group (the National Youth League) volunteered their time to facilitate access and mapping, in exchange for access to the results in terms of identification of their community's health needs and priorities. Local leaders were involved from the outset in the Program areas. The research thus was participatory in both study areas.[141,180]

5.3.3 Study Population

The Program actively targeted households with married women of childbearing age and children under age 5. The survey was designed, therefore, to collect information on the five subpopulation which should have benefited most from the Program: households, women who were actively childbearing, children under the age 5, and children who had been ill with diarrhea or pneumonia within the previous two weeks.

To ensure a minimum exposure to the community environment, a minimum one year duration of residence was required. The study population was therefore defined in both Program and Comparison areas as:

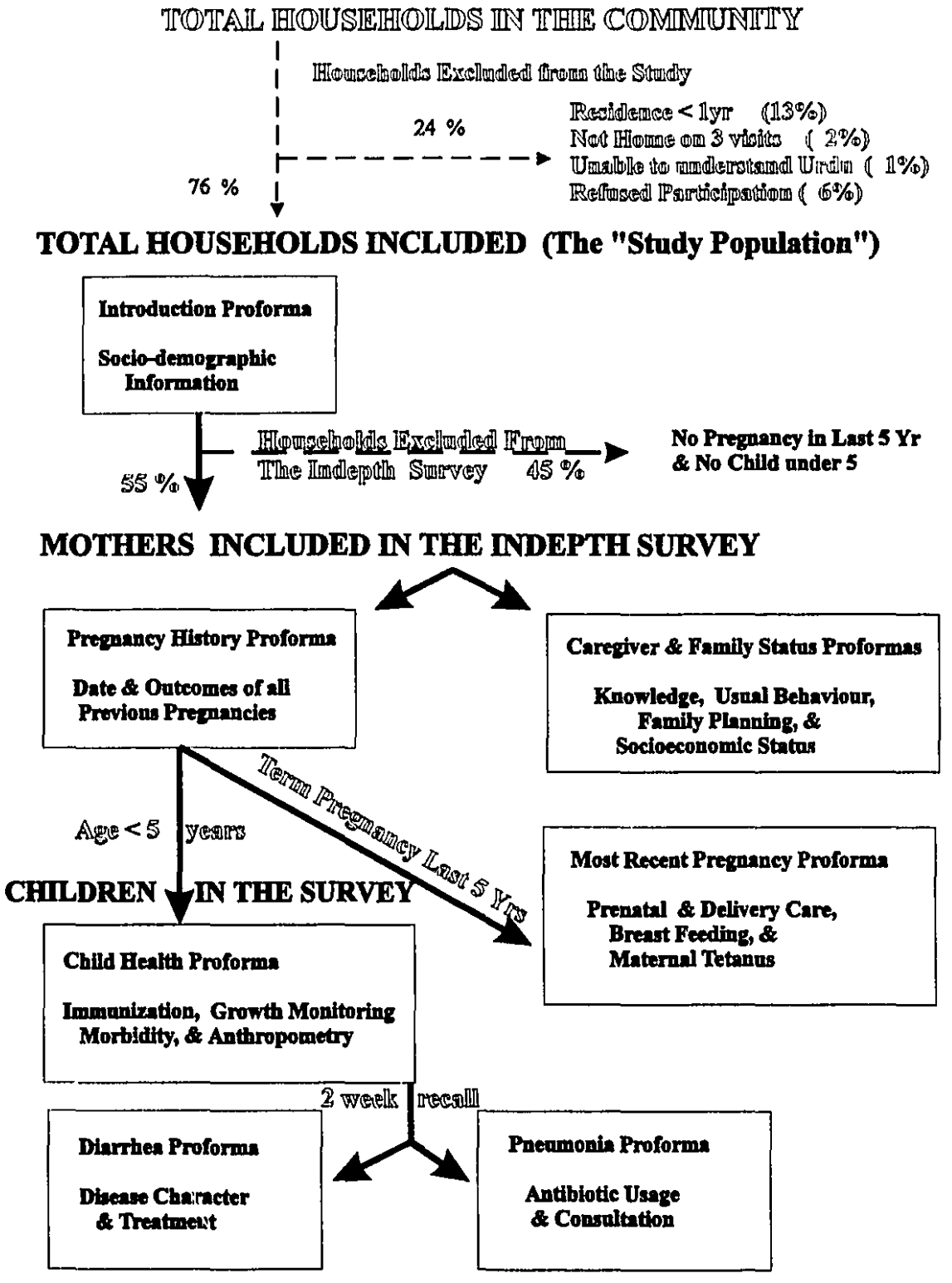
a) women who had been pregnant in the last five years

b) and other caregivers of children under age five who

c) had been resident in the community for one year or more.

The organization of the survey, with the successive inclusion and exclusion criteria is shown in FIGURE 2.

FIGURE 2: SURVEY DESIGN, INCLUSION AND EXCLUSION CRITERIA FOR HOUSEHOLDS AND INDIVIDUALS



5.3.4 Sample Size and Power

Given the many outcomes of interest in the study, the sample size was driven by the outcomes with least potential difference between the areas:[103] mortality, morbidity, and child nutritional status. The infant mortality rate was expected to be 45 per 1,000 live births in the Program area,[75] and 80 or more in the Comparison area.[86,158] To detect a difference of this magnitude (with a 2 sided test, alpha of 0.05, and power of 0.8) would have required 800 live births in each study area from 1989 to 1992 (calculated using EPI-INFO, version 6). Children born since 1993 had lived one month but not a full year would be excluded from the infant mortality statistics, but not the perinatal mortality statistics. A similar sample size (980 live births in each area from 1989 to 1993) would have been required to detect a difference between the Program area's expected perinatal mortality rate of 25 per 1,000 births and the Comparison area's expected perinatal mortality of 50. Indirect estimates of mortality were not included in the study because pregnancy histories would have been required from the 45% of women who had not been pregnant in the last five years,[23,153] and because ten year retrospective estimates would have been of limited usefulness in assessing the Program's more recent impact.

The percentage of children more than two standard deviations underweight for age was expected to be 40% in the Program area,[123] and 45% or more in the Comparison area.[50,81] To detect a difference of this magnitude (with a 2 sided test, alpha of 0.05, and power of 0.8) would have required a sample size of 1,500 children in both areas. However, the hypothesis was a 1 sided one, and weight-for-age z-scores were also analyzed as a continuous variable. To detect a practically significant difference in the z-score of 0.25 or larger,[81] given a standard deviation of 1.5[6] (with a 2 sided test, alpha of 0.05 and power of 0.8) would have required a sample size of only 525 children in each population. Height measurement were not included in most other data sources (including the AKU data) as it is generally less reliably measured.[6,50] Sample size calculations could, thus, not be performed for the less reliable height-for-age or weight-for-height indices. The mortality sample size was, therefore, deemed adequate for the nutritional indices.

Morbidity information was proposed for the two tracer diseases with specific Program interventions: diarrhea and pneumonia. The predicted oral rehydration therapy (ORT) usage was 70% in the Program area,[6] and 60% or worse in the Comparison area,[49,50,106] which would have required a sample size of 750 cases of diarrhea. With the maximum two week diarrhea prevalence of 13.5% found in a previous AKU survey,[101] the study would have required 5500 children. To compensate for this unrealistic sample size, a diarrhea treatment score (shown in APPENDIX III) was developed in collaboration with AKU and the CHWs themselves.[106,183] Given the above diarrhea prevalence, it was predicted that the study would have power to detect a difference of 10% or one out of a maximum total of 10 in diarrhea treatment with 1800 children who had been born in the last five years.[103]

The pneumonia prevalence was predicted to be even lower than diarrhea, so the objective of determining differences in antibiotic usage was changed to a description of pneumonia treatment and consultation alone. The study had the power to find 5-10 percentage point differences in all other outcome variables of interest.

In short, just under 1,000 live births in the last five years were required in each area. The total number of births expected in the Program area was just over 200 per year.[75] Therefore, the required sample size could be attained only with a census of the study population in the Program area, and in a similar sized Comparison area (assuming a similar or higher birth rate), and sampling was not undertaken.

5.4 Instruments and Measures

5.4.1 The Questionnaire

Health interviews, rather than self-reported questionnaires, were undertaken due to the high illiteracy rate.[4] Questions were taken from the AKU pre-implementation surveys and modified where necessary. Additional questions for indicators not collected at baseline were modified from the AKU Maternal and Infant Mortality Survey,[51] the Pakistan Demographic and Health Survey,[7] or the Aga Khan Foundation Management

Advancement Modules.[54] Only 12 new questions, which had not previously been field tested in Pakistan, we included.

After the draft list of English questions was compiled, the questionnaire was circulated using the Delphi method to my thesis committee, interested members of AKU, community health station members, community health workers, and members of the community. The English draft was modified to reflect their concerns and suggestions, then translated into the language of Pakistan (Urdu), and back-translated, by two separate people, into English. Discrepancies between the original and back-translated English versions were corrected to produce the draft English-Urdu questionnaire. The draft English-Urdu questionnaire was pilot tested twice in training the interviewers. Post-interview interviews were undertaken of both subjects and interviewers to assess misunderstood, difficult, or embarrassing questions, and to ensure that there were no questions asked which would have had ill or mistaken effects. After appropriate modification, the questionnaire underwent two further rounds of field testing (including editing and data entry) in 24 households. The final questionnaire (shown in APPENDIX IV) was modified to be as user-friendly, succinct and culturally-sensitive as possible. Though 19 pages in total, the questionnaire required no more than 30 minutes to administer.

5.4.2 Anthropometry

Health examinations were not performed, due to the potential bias and cost of using medical interviewers.[18] Anthropometry was performed by the interviewers after extensive training and quality control. Measurement instruments were Salter scales for weight, measurement stick for height (made by nailing cloth tape measures onto hinged wooden sticks), and age from a full pregnancy history and local events calendar (to translate from the Islamic to Arabic calendars, and estimate age if the date was unknown).[50,59,121] The z-scores for weight-for-age, weight-for-height, and height-for-age were calculated using the EPI-INFO (version 6) EPINUT Program , which uses the

National Center for Health Statistics-Center for Disease Control (NCHS-CDC) Standards recommended for international use by the World Health Organization.[38,178]

5.4.3 Interviewers

Sixteen potential interviewers were recruited from local women, who were not part of the Program staff and who had a minimum of seven years of formal education (as there were insufficient women with matriculation or 10 years of education). All were trained over 8 days on the broad study purpose without biasing them towards the hypothesis, on obtaining informed consent, reliably asking the questions, reliably coding the answers, reliably doing anthropometry, answering requests for care/assistance from subjects, and paper verification of questionnaires (their own and those of others). The 12 interviewers used in the final survey were selected only after the final round of pilot testing. An interviewer's manual was developed in collaboration with the field supervisors and AKU, as a modification of manuals used in recent surveys.[7,121]

5.5 Study Procedures

5.5.1 Area Mapping

Only households living in the geographically defined study areas were included in the study. Household maps for these sectors had been drawn by AKU for the Program area, and they were developed for the Comparison area. The map represented the sampling frame. As households had been renumbered five times over the last three years, the number first reported by the resident was put on the map at the end of the day for cross-referencing and revisiting if necessary.

5.5.2 Survey Organization

The survey was undertaken by two teams, each composed of six interviewers, a male supervisor, a female supervisor, and a driver. All supervisors had Masters level education. The male supervisor was responsible for managing survey operations (ie coordinating logistics and personnel). Their duties were supervising the allocation of households from the master map (including revisits for completion or test-retest reliability), facilitating household access, reviewing questionnaires in the field for missing data, coding a triage face sheet for each questionnaire (as to the result, time and date of visit, and to track the completed proformas including multiple households per address, and multiple caregiver and child proformas per household), ensuring that all households were visited and had completed questionnaires, running the daily post-survey meeting of interviewers, and collecting and delivering completed questionnaires to the data editing clerks daily. The female supervisors were involved in quality control of the data. Their duties were advising the interviewers when problem questions were encountered, sitting in on 5% of the interviews, and undertaking complete re-interviews within 48 hours on a 5% random sample of households to assess the reliability of the survey questions. Both the driver and male supervisors escorted the interviewers for safety reasons.

The full survey took five weeks to complete. The teams were crossed over from Program to Comparison area or vice-versa after 2 ½ weeks to minimize interviewer bias. Though the interviewers knew the study was an evaluation of the Program, they believed the Comparison area was used a baseline for possible future expansion, and thus were as blind as possible to the study hypotheses. The members of the teams were paid appropriate local daily wages by job description, with a final bonus based on performance.

5.5.3 Data management

A data editor went through each questionnaire within 72 hours of interview, checking for missing data and gross logical inconsistencies, plus manually re-coding the open ended questions such as occupation and illness. Once edited, the data were entered twice into eleven separate data bases (one for tracking the proformas per household, and one for each table or proforma) by two professional data entry clerks, using D-BASE screens programed by AKU staff. The two data sets were compared to each other, (or mirrored) to check for inconsistencies in double entry, which were then corrected by referring to the original questionnaire. Further data management included a logical internal consistency program was developed by AKU staff using FOXPRO for WINDOWS. Inconsistencies were corrected where possible, and re-coded as missing data where not possible. Data entry took six weeks, mostly concurrent with the survey. Data cleaning required a further five weeks.

5.5.4 Ethical Issues

Informed consent was obtained verbally. Consistency of the informed consent was maintained by reference to a standardized consent form (the first page of the questionnaire shown in APPENDIX III). The consent form was read aloud by the interviewer prior to entering the house, and information was collected from only those houses where informed consent was granted. The consent form was designed in a similar manner to the questionnaire. The consent form along with draft and final versions of the protocol and questionnaire obtained ethical approval from both the McGill University Department of Epidemiology and Biostatistics Ethics Committee, and the Aga Khan University Human Subjects Protection Committee. The issue of involving a Comparison area without a planned intervention was minimized by involving and educating members of the Comparison area as to the study's implications in terms of their health status and health needs. Furthermore, a health survey is an educational intervention in and of itself.[90]

5.6 Analysis

Analysis was undertaken using SAS version 6.04, EPI-INFO version 6, and FOXPRO for WINDOWS version 2.5. In primary analysis indicators of Program effectiveness were calculated: the difference in the outcome rates and proportions between the Program and Comparison areas (i.e. area of residence was the proxy for Program exposure). The following steps were taken:

a) CRUDE DIFFERENCES in outcome rates (for continuous variables) and proportions (for binary variables) were calculated.

b) Residual CONFOUNDING VARIABLES were identified through contrasting the rates or proportions of matching variables for populations 'exposed' and 'unexposed'. Meaningful differences between the two populations were defined as being practically significant (not simply statistically significant).

c) ADJUSTED DIFFERENCES in outcome rates or proportions were then calculated by including matching variables found to be meaningfully different in regression models using multiple linear regression for continuous variables and multiple logistic regression for binary variables. The models were constructed as follows:

Outcome = $B0 + B1$ (Exposure) + $B2..Bn$ (Confounding Variables)

The ADJUSTED DIFFERENCE in linear regression equalled $B1$: the beta coefficient for the binary exposure variable (coded 1 for exposed and 0 for unexposed), and in logistic regression equalled *e to the exponent* $B1$.

Analysis was undertaken at the individual levels, though sampling was at the community and household level. To adjust for the design effect of potential clustering within households (ie multiple children or mothers), the intraclass correlation coefficient for households was calculated.[143] Where the intraclass correlation coefficient was greater

than 0.3 (indicating significant clustering and an inflated sample size), the standard error for the estimates were increased by the intraclass correlation coefficient times the square root of two.[169]

The Program area data were then compared to the AKU surveillance data: outcome and confounding indicators were compared to AKU's baseline survey (to validate reported time-trends); and outcome indicators were compared to the ongoing MIS surveillance data (to validate service-based and community-based data sources). The AKU surveillance differences (1992 MIS reports minus the baseline survey) were contrasted with the study's 'adjusted' differences (Program minus Comparison area) for outcome measures included in all three data sets. The disparities between the surveillance and adjusted differences estimated the degree of confounding effects which could not be controlled for by Program surveillance alone.

Secondary analyses were also undertaken within the study's Program area data set alone. Key outcome indicators were analyzed using two supplementary indices of exposure: a multiple measure for exposure to the AKU community health workers (as a proxy for Program registration versus non-registration), and utilization in the previous three months of supplies or services from the Program (as a proxy for active versus non-active users of the Program).

6. RESULTS

6.1 Study Participants

The survey inclusion and exclusion criteria were shown in FIGURE 2. As the proportions of households and individuals excluded or included were equivalent in the Program and Comparison areas, they are not described separately. Of the total 2716 households initially visited, 458 (16%) were immediately excluded: 363 (13%) due to residence of less than one year, 30 (1%) due to inability to converse in Urdu, and 65 (2%) who were not home on three repeat visits at different times of the day.

The remaining 2258 households were deemed eligible for the survey, and represented the total 'study population'. Basic demographic information was collected from 2110 of these households, as 148 (6%) did not consent to participate.

The in-depth caregiver survey was completed in the 55% subfraction of the study population (1145) which met the in-depth eligibility criteria. Participants in the caregiver survey totalled 1161, 1152 of whom were mothers who had been pregnant in the last five years, and nine of whom were other caregivers of children under age five.

The survey completion rate was over 99%: only five eligible mothers (0.3%) did not complete the full questionnaire once begun, and 14 eligible children (0.2%) either refused or were not available for anthropometry. The number of persons or events actually included in the study, which represented the various denominators for rates and proportions in the study, are shown in TABLE 6.1.

Table 6.1: Study Denominators (Persons and Events Included in the Survey)

DENOMINATOR	Number in the Program Area	Number in the Comparison Area	Total Number
Total Study Population	6,359	6,260	12,619
Households with In-depth Surveys	596	549	1,145
Caregivers	607	554	1.161
Most Recent Term Pregnancies	586	544	1,130
Children Under Age Five	906	825	1,731
Cases of Diarrhea (past 2 weeks)	70	58	128
Cases of Pneumonia (past 2 wk)	19	21	40

Of the 205 questions potentially asked of each mother, only seven had more than 1% missing data: employment status for 4% of people over age 15, occupation for 2% of those reportedly employed, income for 24% of workers, literacy for 4% of people over 15, living space for 15% of households, and two immunization knowledge questions for 3% of mothers. Given the importance of income as a socioeconomic indicator, missing income per worker was replaced with the median income by occupation from workers with reported income. Analysis was undertaken on data sets which either included or excluded replaced income values, with similar results.

6.1.1 Reliability

Re-interviews were performed by female supervisors on 56 randomly selected mothers (4.8%) and 81 children (4.7%) within 72 hours of the original survey (with only 3 refusals). The results for the 32 questions (16%) with more than one difference on re-interview are shown in Appendix V. Many of the differences were information that was

missing only on the first interview (income, plot size, number of visits, etc), showing that women had likely obtained information between interviews.

For categorical variables, the gross error rate was thus small, and only three had important net bias.[47] Literacy had coding problems as semi-literacy was the one question in the survey where code 2 was not a negative answer. The proportion coded literate was higher than the proportion reporting some education, so women initially coded semi-literate (20% of mothers in both communities) were re-coded as illiterate. As source of water and toilet facilities were from multiple sources, they were re-coded into inside versus outside water tap, and flush versus other toilet.

For continuous variables, the percent and mean differences were minimal for all but four variables.[24,47] The number of prenatal visits, tetanus immunizations, and duration of breast feeding were the same or more on re-interview. Anthropometric differences were meaningful (0.5 kg or 1 cm) for 10-11% of children, however there was no net bias, so the measurement error was likely to have been random, which should not have biased the community results.

6.1.2 Clustering

There were six households in the Program area and five households in the Comparison area with more than one caregiver. As this represented less than 1% of households in the survey, clustering was not considered a problem for caregivers. However, as exposure was measured at the caregiver level, there was potential clustering with multiple children within a household. This was adjusted for through calculation of the intra-household (intra-class) correlation coefficients,[169] using the smaller database which contained the 50% of households with more than one child. The calculations are shown in APPENDIX VI. In short, the intra-class correlation coefficients for household were meaningful (approximately 0.3 for the anthropometric indices), and insignificant 0.1

for the immunization indices. Accordingly, the anthropometric indices standard errors needed to be increased by 7-12%.[39,40,55,89,108]

6.2 Results of Community Matching

6.2.1 Qualitative Information: Development and Health Services

Key informant interviews were conducted with local women, political representatives, allopathic health service providers, non-governmental organizations and government representatives. The goal was to identify changes in known determinants of health which could confound either the observed Program effectiveness, or community comparison.

In terms of history, both the Program (Azam Basti) and Comparison (Akhtar Colony) areas were first settled in the late 1940's, due to migration from the construction site of the Mosque commemorating Mohammed Ali Jinna (the founder of Pakistan). Both study areas were on low-lying land not far from the outflow of Karachi's main open sewer.

Both communities were officially founded by the political leaders for which they are named (General Azam and Mia Mohammed Akhtar) in the late 1960's. Both were in essence planned metropolitan areas, with provision for streets and eventual water and sanitation. In the 1960's, most migrants were people displaced from the Tarbella Dam construction. More recent migrants have been from all over Pakistan, predominantly Muslim migrants from local Sindh, Christian Punjabis from Syal Coat & Lahore, Muslims from Hazaraa, and from the North West Frontier Province (who work mostly in transportation). Azam Basti was officially regularized (provided legal land tenure and official services to residents) in 1993 and Akhtar Colony is on the short list of squatter

settlements scheduled for regularization in 1994. The histories of both communities have thus been quite similar.

In terms of development, in the Program community (Azam Basti), the first piped water was brought to a few gullies in the late 1960's, and in 1975 concrete walls were built around the sewer. In the late 1970's, electricity was first hooked up, in the mid 1980's phone, gas, and sewage hookups began, and since 1988 there has been regularly piped water. At the time of the survey, there was piped water in virtually all lanes, 30% of which had been built during a government sponsored development project in 1972-3, and the rest by the people themselves. The major impetus for these improvements was the World Bank supported clean up of the sewage which flows through Azam Basti (and beside Akhtar Colony). The majority of improvements have therefore been the result of people in smaller groups (usually residents of one lane) organizing their own services. In the Comparison community (Akhtar Colony) similar development has occurred, though without a government water development project.

Both communities have similar government and many private educational facilities for both sexes, both with a new school in the last 10 years. According to the member of provincial parliament during the previous decade, there were 60% improvements in living standards in both communities since 1985. However, there had been "no new development, water, sanitation, or education programs" (personal communication, Usman Gunia, February 1994).

In terms of health services, there was a large private sector in both communities, composed mostly of physicians from the government sector who do extra clinics at night. There were two non-governmental clinics providing subsidized care. The Salvation Army Center had been open for five years in the Program community, and was staffed by a nurse providing basic care and immunization to 200 patients per month. The Al Halmra clinic had been open for two years, at the edge of the Program area, between the Comparison and Program communities, and was staffed by a physician, who saw 500-1000 patients per month.

The main maternity home (Bakbhari) was built between the Program and Comparison communities in 1992. It provided caesarian section backup for approximately 70 deliveries per month. The main tertiary care institution was the Jinna Post Graduate Medical Center, a teaching hospital two kilometers from both areas. In both communities, there were traditional birth attendants, some of whom have been trained by the government or NGOs.

There were two local providers of subsidized family planning education and supplies. The Sindh Government Dispensary and Family Welfare Center had been running for over 10 years (in the Program area). It was staffed by health workers who see 200 patients per month. The All Pakistan Women's Association (APWA) opened in 1987 (in the Comparison area), and was staffed by a physician who saw 500 patients per month. Both providers have "family-planning motivators" for home education and services to 200-300 known users per month. There were also two more distant family planning centers which serviced the whole study population (Chota Garana and the Behboud Center). There were no sources of outreach home visits save the family-planning motivators, and the AKU Program CHWs.

In terms of health education, there are a few NGO's which provided monthly seminars on health education. This activity was greater in Azam Basti due to the Layman's Association, therefore, there was minimal outreach health education in either community other than the Program's CHWs.

In summary, changes were identified in many health determinants since Program implementation. There were socioeconomic, educational, and municipal service (including water, sanitation and electricity) developments in both communities over the previous 10 years. However, there was little evidence that the development has been differential. At the time of the survey, the communities were similar in terms of location, history, environment, political status and municipal services. Both communities were exposed to many primary health care providers, mostly from the private sector. Both communities have similar access to the same sources of secondary and tertiary care

including a number of family planning and maternity services. There is essentially no other health outreach or differential health education. The only differential service may be in family planning where an NGO is more active in the Comparison community. Therefore, the communities were found to have been qualitatively similar, differing only in the Progam's CHW outreach services. Many of these variables were also quantitatively collected in the survey.

6.2.2 Quantitative Information: Socioeconomic and Ethnic Status

Appendix VII contrasts the full list of community matching variables included in the survey divided into five categories: variables modified from Spitzer's Snodgrass study[138], and additional demographic, wealth, education, and crowding or home situation variables. The variables modified from the Canadian studies capture the main socioeconomic differences, and the other tables are more specific for the Pakistani context. The magnitude of differences in matching variables which would be considered meaningful were identified from the literature,[21,22,50,114] and in consultation with local experts. Of 25 matching variables (which were categorized into a total of 49 variables) there were only three meaningful differences between the Program and Comparison areas: ethnicity, ownership of household items without differences in other measures of wealth; and maternal education. These differences represent residual confounding which was not successfully matched. They are shown in TABLE 6.2

Table 6.2: Residual Confounding: Meaningful Socioeconomic and Ethnic Differences Between the Program and Comparison Areas

Variable	Program Area	Comparison Area	Difference (Program minus Comparison)
% Urdu-Speaking Muslims	41 %	18 %	+ 23 %
% Punjabi/Saraiki-Speaking Muslims	22 %	29 %	- 7 %
% Pushto/Hindko-Speaking Muslims	22 %	18 %	+ 4 %
% Urdu/Punjabi-Speaking Christians	13 %	33 %	- 20 %
Mean Ownership of up to 9 items	4.6 items	4.2 items	+ 0.4 items
Mean Mother's Years of School	4.2 yrs	3.2 yrs	+ 1 year

Of the demographic indicators, only proportionate religion and language were meaningfully different. Due to the high correlation of religion with language, a combined variable was needed for multi-variate analysis. An ethnic classification was developed in consultation with collaborators in Pakistan, before looking at study outcomes. There were only two Pushto speaking Christian households, three Katchi-speaking households, 13 Sindhi-speaking households, and 18 other-speaking households. Removing these 36 outlying households (3%) and combining the other languages by area of origin left five distinct ethnic groups. Due to the small number of Urdu-speaking Christian households (30), they were combined with Punjabi-speaking Christian families (227) into one group of Christians. In the Program area there were significantly more of the most affluent ethnic group (Urdu-speaking Muslims), and significantly less of the least affluent group (Christians) compared to the Comparison area. Statistically significant demographic

differences also existed in mean mother's age (0.8 years) and mean mother's age at marriage (0.3 years), but these were not to be practically meaningful.

There was no difference in maternal duration of residency during the time of Program activity (1989 to present), whether analyzed continuously or as a categorical variable. Some 57% of mothers in both areas were resident for six or more years, and the distributions of residence duration were identical. This indicated that differential maternal urbanization was unlikely to have biased the study.

Of the wealth indicators, income, occupation, and employment were similar. However, mean ownership of nine household items (bicycle, motorbike, car, radio/cassette recorder, television, video cassette recorder, washing machine, refrigerator, and sewing machine) was somewhat higher in the Program area, whether measured continuously, or as proportion of households owning more than three or four items.

Of the educational indicators, there was a practically significant higher maternal years of school and literacy in the Program area, a practically insignificant higher paternal years of school (0.6 years) without a difference in literacy. Given that literacy was not reliably answered, the best indicator of educational status is likely years of school.

Of the crowding or household situation indicators, only water supply was somewhat different. In the Program area, there was more water piped directly into the households, however both communities had over 98% access to tap water in or near the house. Given that virtually no households used the less clean tankered water, the water difference was felt to be practically insignificant, especially when sanitation services were identical.

To summarize the qualitative and qualitative community matching results, the Program area was matched a similar Comparison area which was slightly less socioeconomically well off, and slightly different in terms of proportionate ethnicity. The socioeconomic advantage of the Program area would bias the study to finding a Program effect.

Because of this potential positive study bias, all CRUDE exposure and outcome indicators (i.e. the differences between Program and Comparison areas) were ADJUSTED by including these three matching variables in multiple linear and logistic models as described in Section 5.6 above. As there were minimal correlations between these three variables (Pearson correlation coefficients ranged from -0.3 to 0.4), collinearity was not problematic.

6.3 Program Implementation and Coverage

TABLE 6.3 shows results of the Program coverage (health education and health service utilization) indicators by area, adjusted by the matching differences. In the Program area, there was substantial exposure to the Program's services (health education, health center clinical services, and diarrhea or family planning supplies). In the Comparison area there was essentially no Program exposure, though other facility-based services were utilized. This indicates good Program coverage in the Program area with minimal Program spill-over to the somewhat distant Comparison area.

Table 6.3 Specific AKU Program Exposures: Coverage of Outreach Services, and the Utilization of Health Center Services

Indicator	Program Area	Comparison Area	DIFFERENCE (Program MINUS Comparison) CRUDE Difference	ADJUSTED Difference	Lower 95 % C I	Upper 95 % C I	P Value Difference	
% Mothers Attended AKU Health Education in the Last 3 mo	17%	0.5%	+ 17 %	+ 16 %	(12 ,	19)	<0.001**	
% Children Taken to AKU-Center in the Last 3 mo	36%	2%	+ 34 %	+ 32 %	(30 ,	35)	<0.001**	
% Mothers, AKU-CHW main source diarrhea information	42%	0.5%	+ 41 %	+ 40 %	(35 ,	44)	<0.001**	*1*
% Mothers, AKU-CHW secondary source diarrhea information	40%	6%	+ 34 %	+ 32 %	(27 ,	37)	<0.001**	*2*
% Mothers, AKU Program as a source diarrhea information	84%	9%	+ 74 %	+ 71 %	(66 ,	75)	<0.001**	
% Mothers, AKU-CHW main source Family Planning information	50%	1.6%	+ 49 %	+ 46 %	(41 ,	50)	<0.001**	*3*
% Mothers, AKU-CHW secondary source FP information	26%	7%	+ 19 %	+ 17 %	(13 ,	21)	<0.001**	*4*
% Mothers, AKU Program as a source Family Planning info	76%	10%	+ 66 %	+ 61 %	(57 ,	66)	<0.001**	
% Mothers Currently FP supplies from AKU Program	12%	0.7%	+ 13 %	+ 12 %	(10 ,	14)	<0.001**	*5*
% Women, Prenatal Care from AKU Program	28%	4%	+ 24 %	+ 23 %	(19 ,	26)	<0.001**	*6*

** statistically significant at p=0.05 and a practically meaningful magnitude of the difference

1 Main sources diarrhea info: family (24%-25% = -1%, radio (6%-18% = -12%), TV (2%-1% = +1%), other doctors (19%-44% = -25%), other health workers (2%-0.5% = +1.5%)

2 Secondary sources diarrhea info: family (37%-35% = +2%), radio (76%-67% = +9%), TV (32%-27% = +5%), chemist (19%-14% = +5%), other doctors (38%-34% = +4%), other health workers (17%-15% = +2%)

3 Main sources FP info: family (24%-35% = -11%), other FP worker (6%-15% = -10%), other doctors (6%-21% = -15%), radio & TV (4%-11%= -7%), newspaper (2%-3% = +1%)

4 Secondary sources FP info: family(34%-22% = +12%), other FP worker(24%-14% = +10%), other doctors(31%-32%= -1%), radio/TV (70%-61%= +9%), newspaper (25%-20% = +5%)

5 Suppliers of Family Planning: NIL (67%-70% = -3%), Govt (5% - 10% = -5%), Private/NGO (6%-12% = -6%), Chemist (10%-7% = +3%)

6 Sources of Antenatal Care: NIL (18%-26% = -8%), TTBA (2%-1% = -1%), nurse/midwife (4%-6% = -2%), doctor (52%-63%= -9%)

Table 6.4 Composite Indices of AKU Program Exposure

Indicator	Program Area	Comparison Area	DIFFERENCE (Program MINUS Comparison) CRUDE Difference	Adjusted Difference	Lower 95 % C I	Upper 95 % C I	P Value Difference
% Mothers AKU-CHW main source info or health meeting	66%	5%	+ 61 %	+ 59 % (	54 ,	63)	<0.001**
% Mothers AKU-CHW a source info or health meeting	86%	9%	+ 78 %	+ 74 % (	13 ,	21)	<0.001**
% Mothers AKU-Clinic as main source of information	13%	2%	+ 11 %	+ 10 % (	7 ,	13)	<0.001**
% Mothers AKU-Clinic as a source of information or services	66%	12%	+ 54 %	+ 52 % (	47 ,	57)	<0.001**
% Mothers any Program Exposure, Clinic or CHW for info / service	88%	14%	+ 74 %	+ 69 %(	65 ,	73)	<0.001**

Table 6.5 Indicators of General PHC Exposure

Indicator	Program Area	Comparison Area	DIFFERENCE (Program MINUS Comparison) CRUDE Difference	Adjusted Difference	Lower 95 % C I	Upper 95 % C I	P Value Difference
% Mothers Visited by a Health Educator Last 3 mo	59%	2%	+ 57 %	+ 52 %(	47,	57)	<0.001**
% Mothers EVER Attending a Health Education Meeting	21%	2%	+ 18 %	+ 17 %(	13,	21)	<0.001**
% Mothers Attending Health Education Meeting Last 3 mo	11%	1%	+ 10 %	+ 10 %(	7,	13)	<0.001**
% of Children EVER Weighed	81%	26%	+ 55 %	+ 51 %(	47,	55)	<0.001**
% of Children Weighed in last 3 mo	55%	7%	+ 47 %	+ 44 %(	40,	48)	<0.001**
% of Children Having Growth Card	74%	26%	+ 47 %	+ 43 %(	38,	47)	<0.001**
% Children with an Immunization Card	81%	58%	+ 23 %	+ 19 %(	15,	24)	<0.001**

** statistically significant at p=0.05 and a practically meaningful magnitude of the difference

The use of other sources of health information and health service providers are shown in the footnotes of TABLE 6.3. There were no significant differences in the utilization of alternative health resources between the communities. Both areas frequently utilized family and other doctors as main sources of information, with the addition of the media (radio, television and newspapers) as secondary sources. Other health workers were utilized infrequently for health information or services. Other doctors were used frequently as providers of health services, especially prenatal care, therefore, there was substantial Primary Health Care Exposure from other sources in both communities, especially from other doctors. This exposure was not different between the two areas, thus the comparison was reasonable.

TABLE 6.4 displays the many possible composite indices of Program coverage. In the Comparison area there was minimal exposure by all indices. In the Program area, if getting information from the AKU Community Health Worker (CHW) was taken as the measure of exposure, two-thirds of the population utilized the CHW as a main source of information, and virtually all utilized the CHW as one source of information. The AKU clinic exposure was minimal as a primary source of information, and two-thirds reported it as a secondary source. Furthermore, if exposure to the CHW and clinic were combined into an indicator of any Program exposure, few mothers beyond those exposed to the CHW would be deemed exposed. Therefore, the main exposure to the Program was through exposure to the CHWs. Given that the CHWs provided primary-care, this exposure index shows that the health center was most likely used as a source of secondary-care, as it was designed to be.

The study did not include specific questions on coverage of the Program's CHW's as such a question might have biased the interviewers through knowledge of the respondent's exposure status. The proxy measures of exposure to primary health care (outreach and other activities) are shown in TABLE 6.5. Home visits were utilized by over half of caregivers in the Program area, and essentially none in the Comparison area. Similar results to a lesser degree are found in health education meetings. Therefore, there

were extensive outreach home visits and health education exposure in the Program area, but not in the Comparison area.

Extensive growth monitoring also occurred in the Program area but not in the Comparison area, with almost an additional half of children being ever weighed, weighed in the last three months, or having a growth card. The mean number of weighings in the last three months was also significantly different: 1.4 weighings in the Program area and 0.2 weighings in the Comparison area, which after adjustment for matching variables, meant Program children had at least one more weighing per month than children in the Comparison area. The differential in Primary Health Care immunization exposure (measured by the presence of an immunization card in the home) was smaller, but still substantially different. Therefore, the activities associated with Program outreach were carried out to a substantially greater degree in the study areas.

More than 97% of the mothers in the Program area who reported home visits in the last three months also reported receiving health information from the Program CHWs. Respondents did not report other outreach health workers to have been active in either study area. Therefore, virtually all home visits should have been from the Program's health workers, indicating substantial coverage of the Program area by Program CHWs.

The Program, therefore had good coverage (or was well utilized) in the Program area with little spill-over coverage in the Comparison area. Essentially the only source of outreach health services was the Program, which operated only in the Program area. Both communities utilized and had similar access to other health services and sources of health information.

6.4 Specific Program Outcomes (GOBI-F)

The following sections describe the outcome results by GOBI-F category, followed with a summary table which fits all of the outcome indicators into the conceptual framework. The statistic of interest (or study assessment of Program effectiveness) was the difference in rates or proportions between the Program and Comparison areas. The CRUDE difference is simply the Program minus the Comparison statistic which represents control of confounding factors by design (i.e. community matching). The ADJUSTED difference reflects correction of residual confounding which had not been successfully removed through matching (i.e. ethnicity, ownership, and maternal years of school were included in multiple linear or logistic models as described in Section 5.6).

6.4.1 Growth Monitoring Outcomes: Children's Nutrition

The results of growth monitoring impact indicators (anthropometric indices) are shown in TABLE 6.6. There were no practically significant differences in acute malnutrition or 'wasting' (measured by Weight-for-Height). However, there were practically significant differences in chronic malnutrition or 'stunting' (measured by Height-for-Age), and acute or chronic 'under nutrition' (measured by Weight-for-Age).

These differences in chronic nutritional status were opposite of what was hypothesized: children in the Program area were found to be more malnourished than children in the Comparison area. The differences were significant both for the whole population (measured by the mean difference in z-scores) and the malnourished tail of the population (measured by the difference in proportion less than 2 standard deviations from the mean). These differences were similar when dis-aggregated by age or sex, including the appropriate age groups for each WHO indicator.[160,161,178]

Table 6.6 Growth Monitoring Indicators: Nutritional Anthropometry

IMPACT INDICATORS	Program Area	Comparison Area	DIFFERENCE (Program MINUS Comparison) CRUDE Difference	Adjusted Difference	Lower 95 % C I	Upper 95 % C I	P Value Difference
Mean Weight-for-Age Z-score, Children 0-59 mo	-1.3 Z	-1.3 Z	-0.03 Z	-0.1 Z	(-0 ,	0.2)	0.55
% children 0-59 mo underweight (< 2 SD Wt-for-age)	35 %	30 %	+ 4 %	+ 6 %	(2 ,	11)	0.008 **
Mean Weight-for-Height Z-score, Children 0-59 mo	-0.3 Z	-0.5 Z	+ 0.2 Z	+ 0.2 Z	(0 ,	0.4)	<0.02 *
% Children 0-59 mo wasted (< 2 SD Wt-for-Ht)	12 %	15 %	- 2 %	- 3 %	(-6 ,	1)	0.14
Mean Weight-for-Height Z-score, Children 12-23 mo	-0.3 Z	-0.5 Z	+ 0.2 Z	+ 0.2 Z	(-0 ,	0.6)	0.65
% Children 12-23 mo wasted (< 2 SD Wt-for-Ht)	16 %	13 %	+ 3 %	+ 2 %	(-6 ,	11)	0.5
Mean Height-for-Age Z-score, Children 0-59 mo	-1.8 Z	-1.5 Z	- 0.3 Z	- 0.4 Z	(-1 ,	-0.21)	0.003 **
% Children 0-59 mo stunted (< 2 SD Ht-for-age)	43 %	37 %	+ 6 %	+ 10 %	(5 ,	15)	< 0.001 **
Mean Height-for-Age Z-score, Children 24-59 mo	-1.9 Z	-1.5 Z	- 0.3 Z	- 0.4 Z	(-1 ,	-0.1)	0.003 **
% Children 24-59 mo stunted (< 2 SD Ht-for-age)	42 %	35 %	+ 7 %	+ 9 %	(4 ,	16)	0.008 **

* statistically significant at p=0.05 yet not a practically meaningful magnitude of difference

** statistically significant at p=0.05 and a practically meaningful magnitude of difference

6.4.2 Oral Rehydration Therapy Outcomes: Diarrhea Treatment

Results of oral rehydration therapy knowledge and behaviour indicators are shown in TABLE 6.7. Maternal knowledge of appropriate diarrhea treatment was extremely high in both areas. Behaviour during a hypothetical (usual) case of diarrhea favoured the Program area, but after adjustment for residual confounding, behaviour was substantially different only in the continuation of food in the Program area.

There were only 128 cases of diarrhea reported on maternal two week recall which was just over half the expected number due to the low diarrhea prevalence (7%) in the winter months. Maternal behaviours in these cases were parallel to the responses for usual diarrhea with respect to fluids and food. Despite the small numbers, there were no differences in diarrhea character (measured by frequency, duration, severity, chronicity, recurrence, and point prevalence). Use of oral rehydration therapy (ORT) was 10 percentage points lower in the Program area, and the diarrhea treatment score was 15% less in the Program area. Both differences were meaningful but not statistically significant due to the limited number of cases. These differences were in the opposite direction of the hypothesis, with the Program area's treatment being poorer.

6.4.3 Breast Feeding Outcomes

The results of breast feeding behaviour indicators are shown in TABLE 6.8. There was a substantially higher proportion of women feeding colostrum (10%) in the Program area, which was a major focus of the CHW's efforts in breast feeding. Both exclusive and prolonged breast feeding were more common in the Program area, but the difference was not statistically or meaningfully different. In both communities, low exclusive breast feeding rates reflect the cultural norm of early supplementary fluids, and the high 6-9, 18 and 24 month breast feeding rates reflect the cultural norm of universal, and prolonged (mean duration 15 months, and median luration 19 months) breast feeding (only three women did not breast feed a livebor. child).[10,50,158]

Table 6.7 Oral Rehydration Therapy (ORT) and Diarrhea Treatment

KNOWLEDGE INDICATORS	Program Area	Comparison Area	DIFFERENCE (Program MINUS Comparison) CRUDE Difference	Adjusted Difference	Lower 95%C I	Upper 95% C I	P Value Difference	
Mean Mother's Knowledge 7 Diarrhea Warning Signs	6.3	6.3	+ 0.01	+ 0.005	(-0 ,	0.1)	0.95	
BEHAVIOUR INDICATORS								
% Mothers Increasing Fluids During Usual Diarrhea	78 %	73 %	+ 5 %	+ 2 %	(-3 ,	7)	0.4	
% Mothers Maintaining Food During Usual Diarrhea	66 %	56 %	+ 10 %	+ 4 %	(0 ,	12)	0.05	**
% Mothers Increasing Food After Usual Diarrhea	52 %	48 %	+ 4 %	0 %	(-7 ,	6)	0.95	
% Mothers Using ORT during Recent Case of Diarrhea	59%	67%	-8%	-10%	(-28 ,	8)	0.25	
Mean Diarrhea Treatment Score for Recent Case (of total 10)	3.9	4.7	-0.8	-0.8	(-2 ,	0.1)	0.06	*1*

1 The diarrhea treatment score (a composite of the CHW's messages) is shown in APPENDIX III

Table 6.8 Breast Feeding Indicators

BEHAVIOUR INDICATORS *2*	Program Area	Comparison Area	DIFFERENCE (Program MINUS Comparison) CRUDE Difference	Adjusted Difference	Lower 95% C I	Upper 95% C I	P Value Difference	
% Mothers Feeding Colostrum	49%	33%	+ 16 %	+ 10 %	(4 ,	16)	<0.001	**
% Mothers Exclusively Breast Feeding (0-3 mo)	36%	29%	+ 7 %	+ 3 %	(-3 ,	8)	0.4	
% Mothers BF with complementary food (6-9 mo.)	70%	73%	- 3 %	- 4 %	(-11 ,	2)	0.2	
% Mothers Still Breast Feeding at 18 mo	69%	63%	+ 5 %	+ 4 %	(-3 ,	12)	0.3	
% Mothers Still Breastfeeding at 24 months	22%	24%	- 2 %	- 2 %	(-7 ,	4)	0.5	

* statistically significant at p=0.05 yet not a practically meaningful magnitude of difference

** statistically significant at p=0.05 and a practically meaningful magnitude of difference

2 Rates are for the one most recent term pregnancy per mother having been pregnant in the last 5 years

Table 6.9 Immunization Indicators

			DIFFERENCE (Program MINUS Comparison)				
KNOWLEDGE INDICATORS	Program Area	Comparison Area	CRUDE Difference	Adjusted Difference	Lower 95 % C I	Upper 95 % C I	P Value Difference
% Mothers knowing immunization given age 1 wk	37 %	25 %	+ 12 %	+ 7 %	(6 ,	11)	0.01 **
% Mothers knowing measles given age 8-12 mo	73 %	64 %	+ 8 %	+ 6 %	(-2 ,	11)	0.1
BEHAVIOUR INDICATORS							
% children age 12-59 mo NEVER immunized	6 %	13 %	- 7 %	- 4 %	(-7 ,	-2)	<0.001 **
% children age 12-23 mo NEVER immunized	7 %	13 %	- 6 %	- 4 %	(-10 ,	2)	0.15
% children age 12-59 mo MEASLES immunized	86 %	74 %	+ 12 %	+ 8 %	(4 ,	13)	<0.001 **
% children age 12-23 mo MEASLES immunized	80 %	67 %	+ 13 %	+ 10 %	(3 ,	19)	0.03 **
% children age 12-59 mo COMPLETELY immunized	84 %	67 %	+ 17 %	+ 13 %	(8 ,	18)	<0.001 **
% children age 12-23 mo COMPLETELY immunized	76 %	61 %	+ 15 %	+ 11 %	(1 ,	21)	0.02 **
% mothers TETANUS immunized last term pregnancy	80%	66%	+ 14 %	+ 11 %	(6 ,	16)	<0.001 **
% mothers TETANUS immunized twice in last 5 years	89%	75%	+ 14 %	+ 11 %	(5 ,	17)	<0.001 **

** statistically significant at p=0.05 and a practically meaningful magnitude of difference

6.4.4 Immunization Outcomes

The results of immunization knowledge and behaviour indicators are shown in TABLE 6.9. All maternal knowledge and behaviour indicators , including both maternal and child immunizations were approximately ten percentage points better in the Program area.

6.4.5 Fertility Outcomes

6.4.5.1 Family Planning

The results of family planning knowledge, behaviour and impact indicators are shown in TABLE 6.10. There were consistently better knowledge and behaviour indicators in the Program area, however, only knowledge differences were substantial.

There were minimal differences in family planning methods currently used by women who had been pregnant in the last 5 years. In both communities 7% of these women were now sterilized, and only one husband was reportedly sterilized. Two percent of women were using traditional means of contraception (mostly withdrawal), and 22-24% of women were using modern birth spacing methods. In the Program area, women reported use of more short term birth spacing methods (condoms 13% versus 8% and the pill 4% versus 2%), and less longer term birth spacing methods (injectable 2% versus 4% and intra-uterine devices 5% versus 7%). Adjustment for matching differences did not change these estimates.

In terms of fertility impact indicators, the crude birth rate was calculated as all term births during 1993 divided by the current study population. The total fertility rate (TFR) was calculated as the sum of age specific fertility rates.[50] The TFR using births from 1993 was 3.8 in both study areas. The TFR from combining 1992 with 1993 births

was 4.1 in both study areas, combining 1991, 1992, and 1993 births was 4.3. No differences were observed between the Program and Comparison areas.

Birth spacing was calculated as the number of months between the two most recent live births for women who had been pregnant in the last five years. Median birth spacing was 18 months in the Program area, and 15 months in the Comparison area, not significantly different on non-parametric testing. In summary, there were minimal differences in fertility impact indicators between the Program and Comparison areas.

6.4.5.2 Maternity Care Indicators: Prenatal and Delivery

The results of maternal prenatal and delivery behaviour indicators are shown in TABLE 6.11. There was a marginally higher prenatal coverage in the Program area, but no other indicators were different. In both communities, women utilized other doctors for most of their maternity care: over 60% for prenatal care and 41% for delivery care (all in hospitals). Only one quarter of women in the Program area reported receiving prenatal care from the Program.

Table 6.10 Family Planning Indicators

KNOWLEDGE INDICATORS	Program Area	Comparison Area	DIFFERENCE (Program MINUS Comparison) CRUDE Difference	Adjusted Difference	Lower 95% C I	Upper 95% C I	P Value Difference
% Mothers knowing at least one FP method	94 %	88 %	+ 6 %	+ 5 %	(1 ,	8)	<0.001**
Mean # of Family Planning Methods Known (methods)	4.9 meth	4.2 meth	+0.6 meth	+0.5 meth	(0.2 ,	0.7)	0.008**
BEHAVIOUR INDICATORS							
% Mothers EVER using modern FP Methods	49 %	43 %	+ 6 %	+ 5 %	(-1 ,	11)	0.07
% Mothers CURRENTLY using modern FP	31 %	29 %	+ 3 %	+ 2 %	(-4 ,	8)	0.4
Mean Duration of CURRENT FP Use (among users)	20 mo	20 mo	+ 0.3 mo	+ 0.1 mo	(-2 ,	3)	0.9
IMPACT INDICATORS							
% Mothers with last birth interval 18-23 mo	20%	17%	+ 3 %	+ 2 %	(-3 ,	5)	0.6
% Mothers with last birth interval > 23 mo	58%	62%	- 3 %	- 4 %	(-11 ,	3)	0.2
Crude Birth Rate (per 1000 population)	31	29	+ 2	+ 2	(-3 ,	5)	0.4
Total Fertility Rate	4.1	4.2	-0.1	0	(-1 ,	1)	0.9

** statistically significant at p=0.05 and a practically meaningful magnitude of difference

Table 6.11 Maternity Care Indicators

BEHAVIOUR INDICATORS *1*	Program Area	Comparison Area	DIFFERENCE (Program MINUS Comparison) CRUDE Difference	Adjusted Difference	Lower 95% C I	Upper 95% C I	P Value Difference
% Women who received any Prenatal Care (Prenatal Coverage)	82%	74%	+ 8 %	+ 4 %	(-1 ,	9)	0.1
% Women who received adequate Prenatal care *2*	34%	30%	+ 4 %	0	(-6 ,	6)	0.9
% Women who delivered at home	51%	55%	- 4 %	+ 2 %	(-4 ,	9)	0.2
% Women attended by traditional birth attendant	34%	42%	- 8 %	- 4 %	(-10 ,	2)	0.3

1 Rates are for the one most recent term pregnancy per mother who was pregnant in the last 5 years

2 At least 4 Prenatal visits, beginning in the first trimester (before the fourth month) of pregnancy

6.4.6 Summary of the GOBI-F Outcome Results

The estimates of Program effectiveness consisted of the rate differences between Program and Comparison areas which were adjusted for confounding secular trends in the design (through matching), and in the analysis (through regression with residual confounders which had been unsuccessfully matched). The results are fit into the conceptual framework in TABLE 6.12.

Table 6.12: Estimates of Program Effectiveness Fitted Into the GOBI-F Conceptual Framework

Program Element	Knowledge	Healthy Behaviours	Health Impact
Growth Monitoring	-	-	NIL
ORT	NIL	NIL except solids-feeding pos trend	NIL
Breast Feeding	-	NIL except **Colostrum-Feeding POS**	-
Immunization	**POS**	**maternal & child POS**	-
Family Planning	**POS**	pos trend	NIL
Maternity Care	-	NIL	-

POS: meaningful positive effect, NIL: no effect

pos trend: insignificant positive trend - : variables not measured

6.5 Comparison to AKU Surveillance Data

6.5.1 Validation of Surveillance Estimates

Time-trends within the Program area can be assessed by comparing this study's (current) results to the baseline (pre-implementation) survey of 1987. These comparisons for key indicators included both surveys are shown in TABLE 6.13.

Socioeconomically, there have been improvements in income (above the 20% devaluation of the Pakistan Rupee during the same period),[50] marked improvements in living situation and municipal services, and a change in proportional ethnicity including more Urdu speakers (most of whom are Muslim), and less Punjabi speakers (most of whom are Christian). There has also been an increasing net in-migration as on the current survey 18% more households had migrated in the previous ten years.

The study's health outcome estimates were essentially identical to the MIS estimates shown in TABLE 6.14. Therefore, the study's community-based results were in concert with AKU's service-based data, despite the differences in populations. Agreement in the results supports their concurrent validity: both methods of data collection were reasonable means of assessing the community's health status.

Comparison to AKU surveillance data, therefore, substantiated the reported time-trend health improvements in the Program area at a community-level. However, concurrent secular trends in other determinants of health are also shown, which should be adjusted for in an assessment of Program effectiveness.

Table 6.13 Secular Trends in Socioeconomic Status, Comparison of Pre-Implementation to Current Survey Results

	Pre-Implementation		Current Study		CHANGE
SOCIO-ECONOMIC INDICATORS	1987	95 % CI	1993	95 % CI	1987-93
Median Family Income (Pak Rupees/mo)	2036	(1500,2500)	3000	(2500,3500)	964
Median per Capita Income (Pak Rs/mo)	295	(200,390)	500	(450,550)	205
Mean Persons per household	6.9	(6.5,7.3)	6.3	(6.1,6.5)	-0.6
Mean Persons / room (crowding index)	3.3	(2.9,3.8)	3.8	(3.6,4.0)	0.5
% Population > 15 literate	67	(66,68)	66	(65,67)	-1
% Households with private water tap	49	(45,53)	84	(81,87)	35
% Households with modern toilet	85	(82,88)	99	(98,99)	14
% Households temporary construction	23	(20,26)	1	(0,1)	-22
% Households Urdu-Speaking	38	(34,42)	44	(40,47)	6
% Households Punjabi-Speaking	42	(38,46)	29	(26,32)	-13
% Households Pushto-Speaking	8	(6,10)	8	(6,10)	0
% Households migrated last 10 years	23	(20,27)	41	(38,44)	18

6.5.2 Adjustment of Surveillance Estimates for Confounding Secular Trends

TABLE 6.14 contrasts the crude or 'unadjusted' AKU surveillance estimates of Program effectiveness to the 'adjusted' estimates from this study, for the nine variables that were common to all three data sets. The AKU estimates were calculated as the differences in health status indicators between the pre-implementation survey and current estimates from MIS surveillance. The study estimates were calculated as differences between the Program and Comparison areas. The study estimate represents adjustment in two ways: by design (through matching) and by analysis (through correction of residual confounding differences which were unsuccessfully matched). The adjusted change was, therefore, an estimate of the Program effectiveness over and above secular trends in health determinants external to the Program (ie development, socioeconomic status, education, municipal services, and background health services).

The adjusted changes were consistently less than the AKU surveillance time-trends, which is consistent with the observed positive secular trends in other health determinants. The magnitude of adjustment was as follows: adjustment in nutritional indices was small but reversed in direction; child immunization improvement was decreased by 55%; maternal immunization improvement was reduced by 85%; contraceptive prevalence increases were halved; improvements in prenatal coverage change were reduced by 90%; and adequate prenatal care was unchanged in either estimate.

In summary, adjustment for secular trends in confounding determinants of health reduced the AKU surveillance estimates of Program effectiveness by 50-90%.

Table 6.14 Program Effectiveness, Health Status Changes Adjusted for Secular Trends in Health Determinants
Comparison of CRUDE Health Changes (MIS MINUS Pre-Program)
To the Secular Trend 'ADJUSTED' Health Changes found in the Study (Program MINUS Comparison)

INDICATOR	Pre-Program 1987	95 % CI	MIS 1992	95 % CI	CRUDE Change	ADJUSTED Change	95% CI
% children < 5 underweight	42	-3747	36	-3339	-6	6	-211
% children < 5 appropriately immunized	63	-5766	91	-8993	28	13	-818
% pregnant women, Tetanus immunized	17	-1221	94	-9395	77	11	-616
Contraceptive Prevalence	15	-1218	25	-2327	10	5	(-1,11)
Crude Birth Rate (per 1000 Population)	41	-2161	33	-2936	-8	2	(-3,5)
% any Prenatal Care (Prenatal Coverage)	54	-4860	80	-7288	26	4	(-1,9)
% Pregnant women, adequate Prenatal Care	35	-3040	27	-1836	-8	0	(-6,6)
Perinatal Mortality Rate (per 1000 Births)	34	-91	23	-541	-11	-15	(-38,7)
Infant Mortality Rate (per 1000 Live births)	93	-64122	50	-2477	-43	-12	(-25,26)

6.6 Secondary Analyses

6.6.1 Mortality

The mortality data were collected from the pregnancy histories of all women who had been pregnant in the last five years. The 1868 live births and 61 infant deaths reported over the five years prior to the survey (1989-1993) was just under the planned sample size. However, there were problems with this calculation.

There was substantial fluctuation in all three mortality rates between years, requiring some grouping to stabilize the rates, as has been suggested by others.[28] Moreover, it should have taken a few years from original implementation in 1987-8 for the program to impact on mortality.[150,164] Therefore, the data from the early program period (1989-90) provide an estimate of the pre-program status, and the period since 1991 provide an estimate of the post-program status, further reducing the effective sample size.

Problems with the mortality data were not limited to sample size. It has been noted elsewhere that Pakistani women often report children who die in the first day of life as stillbirths.[50] This would lead to under-reporting of the overall infant mortality rate. To deal with this problem, a 'maximum mortality' was calculated which reclassified all stillbirths as live births. This can be taken as the maximum reported infant mortality rate.

The analysis of mortality differentials was, therefore, limited by small numbers and by problems in reporting. However, these problems were equivalent in the two study areas, so there should not have been a bias for the rate differences. Furthermore, these small numbers (2-10 deaths per year) were of the same magnitude as, yet consistently 10-30% less than, the number of events AKU has used to calculate their surveillance time-trends.

The mortality data and resulting community rates are shown in APPENDIX VIII, grouped by year to show the fluctuation, by early program and late program to show

potential changes over time, and lumped together for the whole program period to maximize the sample size. There were no practical or statistically significant differences (especially after adjustment for matching variables) in all three mortality indicators in either the whole program estimates, or the early program estimates.

A second mortality analysis looked at time-trends over the period of the Program (1989-1992). Though there were decreasing trends in all three mortality indicators of 15 to 20 deaths per 1000, and a differential trend in favour of the Program area of 10-15 deaths per 1000, none of these trends were close to statistical significance, and all therefore had confidence intervals of the order (-120 to +60).

6.6.2 Morbidity

The study used two week maternal recall of the two main causes of childhood morbidity (diarrhea and pneumonia). The results are shown in TABLE 6.15, none of which are statistically or practically significant.

Table 6.15 Morbidity Results: Two Week Prevalences

Variable	Program Area	Comparison Area	CRUDE Difference	Adjusted Difference	95% CI
Illness	22 %	26 %	- 4 %	- 3 %	(-8 , 0.7)
Diarrhea	7.7 %	7.3 %	+ 0.5 %	+ 1 %	(-4 , 16)
Pneumonia	2.7 %	2.2 %	+ 0.5 %	+ 0.6 %	(-1 , 2)

6.6.3 Registered versus Non-Registered Population (Users versus Non-users)

A secondary analysis was carried out on data from the Program area alone, to assess whether there were differences between the 'registered' population, on which the AKU surveillance (MIS) is kept, and the 'non-registered' population. No direct indicator of registration was included in the study due to the potential to bias the interviewers, so an indirect indicator was required.

The MIS reports 85-90% registration and approximately 15% of users of the clinic services are from the surrounding non-registered population (some of whom are from within the Program area),[50] therefore, an index of any contact with the Program would overestimate registration. The chosen index for program registration was any woman who had remote or recent exposure to the AKU CHW, as registration implies acceptance of home visits. Eighty-six percent of women met this definition (shown in TABLE 6.4 as mothers using the AKU-CHW as a source of information or attending health meetings). Of women who had contact with the clinic, by this definition only 11 mothers who received family planning or diarrhea information, and 8 mothers who brought their children for consultation were deemed non-registered.

Using this index of registration, there were some differences in matching variables between the registered and non-registered subpopulation: the registered population had three years longer duration of residence, an average of 0.8 more ownership of the nine household items, and 0.7 years less maternal education. Ethnically, there were 17% more Urdu speaking Muslims, and 18% less Christians. The differences in matching variables between registered and non-registered Program area subpopulation were parallel to the differences between Program and Comparison communities, with the addition of longer duration of residence. Longer duration of residence in registrants would be consistent with less recent migrants being better settled, more urbanized, and thus having had more chance to be exposed to the Program. Taken as a whole, the matching differences were

small, so the study results were not biased by including an essentially dissimilar non-registered population in the Program area estimate.

In terms of health outcomes, crude and adjusted differences between registered and non-registered residents were calculated in a similar method to the primary analysis, adding the duration variable as an extra residual confounder for adjustment. The outcome differences were once again parallel to those between Program and Comparison areas. There were no differences in nutritional or fertility indices, diarrhea treatment was only different with respect to food during diarrhea (8% more with registrants), and colostrum feeding was 6% more in registrants. Immunization was 15-35% better in registered mothers and children [12-23 month complete immunization rates 81% and 40%, adjusted difference +28 percentage points, 95% confidence interval (8,48); and maternal tetanus 90% and 75%, adjusted difference +12 percentage points, 95% confidence interval (4,20)].

In summary, the MIS data were kept on a subpopulation which when compared to the Program's total target population had a better socioeconomic status and better health outcomes, even after adjustment for the residual confounding. The socioeconomic, ethnic and health outcome differences were similar to the differences between Program and Comparison areas, though the differences in immunization rates were double. The non-registered population, therefore, was found to be similar to the Comparison area in essentially all variables measured.

7. DISCUSSION

In this section, I discuss first the study methods, including data quality and the limitations and strengths of the study design. I then review the study results from a substantive perspective: answering the study questions about exposure, outcomes, confounding factors, and effectiveness. I conclude with the implications of the study and a summary of priority areas for PHC future research.

7.1 Quality of the Study Data

Participation in the survey was excellent, with a 94% response rate from people who were home, (or 91% of all potentially eligible households). The data were reliable as shown first, by negligible missing data or errors found in data editing, and second by excellent test-retest reliability for all variables save the anthropometric indices. Even the reliability of anthropometry was acceptable, with a 10% gross error rate and no net bias.[47]

In terms of internal validity, the questionnaire was almost completely composed of questions which had been previously validated in Pakistan, or elsewhere.[28] The questionnaire was field tested through three cycles and back translated twice to maximize construct validity. Interviewers included an ethnic mix from the study communities to facilitate acceptance and communication.[94] The similarity of the Program area data to the Aga Khan University service-based data (MIS) is evidence of concurrent validity. The consistently decreasing trend from knowledge through behaviour to impact indicators is evidence of content validity,[143] as were the lack of important logical inconsistencies found in data cleaning.

In terms of external validity, neither the Program area nor the Comparison area were as underprivileged as their squatter settlement status might suggest. In general,

Karachi is better on any economic or social indicator than any other part of Pakistan;[50] however, large pockets of under-privilege are often mentioned.[60,158] There are four sources of recent socioeconomic data for urban Pakistan,[41,50,67,158] and three sources of global socioeconomic estimates.[160,161,173] Assessment of socioeconomic status requires multiple measures,[27,100] which have been recently grouped onto four axes for Pakistan: wealth, housing, parental education, and occupation.[41] Comparing to the aforementioned sources, in terms of wealth, housing, and occupation both Program and Comparison communities were just above the mean for urban Pakistan, well above the mean for Pakistan as a whole, and at the mean for Asia and other developing countries. However, in terms of parental education, both communities were at the mean for urban Pakistan, but well below the mean for Asia and other developing countries. Comparing the study results to a recent survey of lower-middle class Karachi residents,[68] socioeconomic status was 20-30% worse. The study population can be described, therefore, as a low to lower-middle class urban population, representative of the mean for urban Pakistan, and much of urban Asia. The consistency of these socioeconomic indicators suggests that the study population may be socioeconomically similar to many rapidly urbanizing cities in Asia.[161,173]

There are a number of potential biases associated with cross-sectional survey results.[4,92,94,113,128,129,142] Four were potentially relevant to this study: interviewer bias, recall bias, bias from unmeasured community factors, and seasonality.

Every effort was made to reduce interviewer bias by crossing over the interviewing teams at the survey mid-way point, and by careful training and field supervision of the interviewers. After data collection, the outcome and re-test results were analyzed by interviewer. No differences were found. Though efforts were made to blind the interviewers to the study hypothesis, they could not be blinded to the area they were in.

Recall bias due to self-reporting[92] is a potential problem with all cross-sectional surveys. Respondents have been shown to be biased towards culturally desirable

responses with respect to behaviours,[47,94] and to under-report health service utilization by up to 50%.[71] Recall has been shown to be sub-optimal beyond 6-12 months for more than very salient events.[129] Most of the study indicators required one year recall, but the breast feeding, fertility, and mortality indicators required three year recall to stabilize fluctuating rates due to the rarity of events. Three year recall has been utilized elsewhere,[51] and up to five year recall has been routinely used in the World Fertility Surveys.[28,50,158,161] Despite these potential problems, it is unlikely that there was differential recall bias between the Program and Comparison area, minimizing the effect of recall bias on the study results.

Community organization and participation are notoriously difficult to measure.[31,73,104,119,180] Reliable quantitative variables, especially cross-culturally appropriate ones, have not been defined.[126,141] In the Program area, the presence of the Aga Khan University Primary Health Care Program may have provided impetus for community organization and development, which would have created a positive study bias. Other health service providers and educators were also likely less utilized in the Program area, which would have caused an indeterminate bias based on the (unmeasured) relative quality of the Program and other service providers.

Both populations were highly mobile and included some seasonal labourers. A cross-sectional survey in the winter months may have not reflected the socioeconomic[94] or health situation[86,106] of the entire year round population. For seasonality (or any other potential biases) to have seriously affected the study conclusions, the effect would have to have been differential between the two studied communities.

Finally, many other potential sources of bias are listed in the program evaluation literature.[53,57,61,122] While bias affecting the magnitude of some estimates cannot be ruled out, in either the qualitative or quantitative surveys I do not find evidence of differential bias across the two study areas. I believe that the risk difference between communities was reasonably unbiased, and that the survey data were of good quality both in terms of reliability and validity.

7.2 Study Limitations

The main study objective was to assess Program effectiveness controlling for confounding secular trends. Taken as a whole, the new study data combined with the AKU surveillance data comprised repeated (pre- and post-) cross-sectional surveys in one Program community, ongoing service-based reporting in one Program community, and a single post- survey in a *post hoc* matched Comparison community. As argued previously, this approach was the best possible given the field situation. However, the method was not without limitations.

The main study limitation was limited community and household sample size. In essence the survey was a one-to-one comparison of only two matched communities. These communities were not randomized in either the original Program location or the community match. Though every effort was made through qualitative and qualitative investigation to measure known confounders of health impact, differences between the communities in variables that were not measured cannot be guaranteed, nor can the extrapolation of study results to other Program and non-Program sites. The study thus had limited generalizability, which is unfortunately common in program evaluation due to the many political and practical considerations in program implementation.[20,43,90,137]

The study was originally designed for two or three matched pairs of communities, or for more than one Comparison area for each Program area. The time required to match communities *post hoc*, the time constraint imposed by Ramadan, along with practical and financial constraints prevented the inclusion of more than one community pair. Using a conservative (or theoretical) approach, the study sample size would have been deemed to be only two (i.e. the number of communities).[89,108] Using a moderate approach, the study would have been considered as a matched-pair design, which has been shown to require a minimum of three to ten community pairs to provide reasonably stable statistical estimates.[40,90] Using a practical approach, families would be assumed to have randomly chosen their community of residence, and hence their exposure group, which would allow

inclusion of the total number of individuals surveyed in the sample size.[103,169] The last approach was used by all nine of the 13 observational PHC studies reviewed, by most preventive health assessments,[20,39,55,78,89] and by this study. To compensate for the theoretical limitation in sample size, differences in community means were deemed significant based on the magnitude of the difference rather than their statistical significance.[169]

Though the household sample size was the maximum allowed by time and financial constraints, it was nonetheless a study limitation for some variables. The original sample size calculation was erroneously based on infant mortality using all births over the last years, of which only the more recent were possibly indicative of effectiveness. The study sample size was, therefore, insufficient to find differences between the areas in infant mortality. The study results were also limited in morbidity (diarrhea and pneumonia) due to the inclusion of fewer cases than predicted. The design effect of clustering children within households also reduced the effective sample size for anthropometric indices (but not for immunization indicators). The study, therefore, had limited statistical power to find many of the hypothesized differences due to limitations in household and potentially community sample sizes.

The second important study limitation was the lack of baseline data on the Comparison area, any unknown dis-similarity between the two study areas prior to Program implementation cannot be adjusted for. The high quality of the match in terms of current demographic and socioeconomic similarity, along with the failure to identify differential history, development or health services on qualitative investigation, make it unlikely that there were substantial differences in the communities at the time of the study. Given that all of these variables should have been relatively stable over a decade[72,114,138] (or at least parallel in similar communities) it is unlikely that the communities were substantially different six years prior to the study. Therefore, though secular trends in determinants of health external to the Program cannot be contrasted due

to missing pre-program data for the Comparison community, there was no evidence to suggest that current similarity was an unreasonable proxy for pre-program similarity.

Over-matching the communities could have negated Program effects.[54,108] However, for over-matching to have biased the study results, the Program should have effected the other determinants of health (i.e. improving the water, sanitation, or education facilities of the Program area). The Program included no intervention in these areas save education on basic hygiene. It is thus unlikely that over-matching could have explained the lack of Program effectiveness found in the study.

For causal inference, cross-sectional surveys are potentially limited as both exposures and outcomes are measured at the same time without a guaranteed time course.[129] The study minimized the potential for reversing cause and effect by including repeated cross-sections over time.[4,35,92] The longitudinal MIS data (which included data on Program implementation) further substantiate exposures prior to outcomes. Furthermore, the survey inclusion criteria of one year of residence minimum was employed to ensure that potential Program exposure predated the recall period for most of the recorded outcomes.

Measurement issues also limited the study. Though exposure to the Program as a whole was easy to measure (i.e. community and duration of residence) measurement of Program coverage was problematic due to the multi-dimensional nature of the Program, the potential intermittent nature of the exposure, the possible exposure to competing health resources, and the attempt to blind the interviewers to the respondent's registration status. The consistency among the study measures of coverage, and their similarity to MIS coverage data, indicate that the study captured Program coverage reasonably well.[184]

Many of the outcome variables were found in qualitative investigation to have limited content validity (such as the ORT and maternity care indicators which did not capture exactly the concept they were meant to measure), despite their having been validated in previous surveys. The multitude of indicators raises the further possibility of a type I error, or statistically significant differences based purely on chance

occurrences.[129] However, all of the indicators and their subsequent analyses were chosen *a priori*, in consultation with AKU and the community, to represent the highest priority interventions. Furthermore, there was internal consistency of indicators in each GOBI-F domain from the conceptual framework (i.e. parallel values for multiple indicators in each category, and a negative gradient from knowledge through behaviour to impact indicators). Given the lack of obviously outlying results, and the few positive study results, a type I error was unlikely.

In summary, there were a number of limitations in the study design: both community and household sample sizes were sub-optimal; baseline data was unavailable on the Comparison community; and there were potential limitations in the measurement of exposure, outcome, and confounding variables. However, on the whole, efforts to minimize the limitations within the study resources were successful. None of the residual limitations prevented attainment of the study objectives.

7.3 Study Strengths

The main strength of the study was the ability to estimate Program effectiveness in a difficult field situation (i.e. *post hoc* and without baseline data in a comparison area). The important methods were: the qualitative community match; the identification and control for confounding influences in both design and analysis; the collaborative process which involved the Program's implementing agency (AKU); adjustment for clustering within households; and the extensive efforts in quality control of the survey.

As would be the case in many developing countries,[164] there was no quantitative data to assist in identifying comparison communities. Matching was accomplished through a iterative process using local key informants to identify potentially similar populations. The method successfully identified a Comparison area which was essentially un-exposed to the Program or to other outreach health-care, yet was similar enough for

valid comparison to the Program area (i.e. there was minimal Program spillover, and no meaningful differences in known confounding influences which could be identified retrospectively).

Moreover, unlike any of the reviewed PHC studies, the survey included quantitative variables from the social geographic literature[21,22] to assess community similarity.[114,138] Both exposure and known confounding variables were measured at the household level, allowing crude outcome differences to be adjusted for residual confounding by community differences which had been inadequately matched. The common pitfalls of ecologic comparisons were thus avoided.[51]

A third strength of the study was adjustment for the design effect of clustering children within households. Such adjustment was not found in any of the reviewed PHC studies.

A forth study strength was its collaborative design and implementation. The survey complemented existing AKU surveillance data through the collection of much needed community-based estimates on variables of importance to the implementing agency. Collaboration was crucial in gaining access to the communities, providing me with cultural awareness and logistical support, and in helping to make the link between evaluation and action a bit shorter.

Furthermore, the data provide descriptive information on a segment of the population which is thought to be poorly represented in aggregated National data.[181,184] Such information is valuable given the limited health data in most developing countries,[83] including Pakistan.[50,158]

Finally, reliable and valid data were collected for essentially the complete Program and Comparison areas, due to the quality control measures described above. The data were collected rapidly, with minimal cost, for a relatively large sample size.[92,137] Repeated cross-sectional survey is the most efficient technique for the collection of quantitative data on exposures, outcomes and exposures at a household level when there are competing health care providers.[164] Health surveys remain an important assessment

tool even in developed countries.[128,139] The study data were thus community-based, including information on non-users of the Program,[28] and on proximal, intermediate and distal indicators of effectiveness (i.e health knowledge, healthy behaviours, and health impacts).

In summary, the study method met the objective of obtaining reliable and valid estimates of effectiveness indicators in a difficult field situation. The study was designed to address priority questions for the Department of Community Health Sciences at the Aga Khan University within time and financial constraints.

In the next section, I will turn to discuss the substantive aspects of the results using the study questions as a framework.

7.4 Exposure: Was the Program Successfully Implemented?

The Program consistently achieved 85% or more community coverage by any of the three composite indices, which was better than for most preventive health programs in developing countries or developed countries.[3,61] The average number of contacts per capita was well in excess of the minimum 3-4 postulated for the success of preventive care.[58]

There has been a substantial financial input into the Program, totalling over one million United States Dollars per year, or just over $2 per person-year.[75] The financial input figures do not include private sector expenditures,[163] which have been found to be substantial in Karachi.[147] The per capita cost of the Program was just over 25% of the projected cost for the World Bank's Essential Clinical Service package (which is meant to decrease the global disease burden by one third).[173] The Program's financial inputs have, therefore, been consistent with the targeted health outcomes.

In summary, given the community coverage, and the extensive support and monitoring, I consider the Program to have been successfully implemented in accord with its objectives.[37,75]

7.5 Outcome: Have there been Health Improvements at the Community-Level?

Within the Program area, the study provided an opportunity to compare service-based longitudinal data (MIS) with the study's community-based cross-sectional data. The data were drawn from slightly different populations: the MIS excluded non-registered families (10% of the total population) whereas this study excluded women resident for less than 1 year (27% of the total population). Moreover, population mobility (5% in-migration and 10% out-migration)[6] excluded some residents from both methods. There were also different recall periods between the two monitoring systems: the MIS used monthly or more frequent collection of data, and the study survey used 1-5 year recall. Other factors were equivalent: both data sets reached approximately 90% of eligible respondents; both had potential biases of the data collectors; and both systems had provisions to check reliability and quality assurance. Putting the data attributes together, it is likely that the shorter recall made the MIS more accurate than the study estimates, and that the small MIS positive bias of excluding the less healthy non-residents was more than balanced by the study's potential positive bias of excluding recent urban migrants.[70,170,184] The similarity of the study outcome estimates to the MIS current estimates is, therefore, evidence of concurrent validity of study estimates.

Unfortunately, the data collected in the MIS were limited by its service-based orientation. This highlights the need for supplemental surveys.[4,90,139] The pre-Program (baseline) survey differed from the current survey in two ways:[24,47,128] the interviewers were medical and nursing students introducing possible positive (medicalization and

communication) biases,[92,94] and many of the demographic variables were collected using a one year recall period, introducing possible negative bias (telescoping of events into the period of recall).[150] These biases, operating in opposing directions on the magnitude of estimates, should have to some extent cancelled each other out, so a direct comparison to the study's current results to assess time-trends was reasonable.

The improvements in health status noted in the AKU surveillance data were substantiated at the community-level, within the limitations of the pre-Program survey. The community effect is consistent with the minimal health advantage of Program users over non-users in the Program area. Therefore, the AKU surveillance system (baseline survey and subsequent service-based reporting) was shown to be a reasonable means of assessing community health status.

7.6 Confounding Factors: Were there other health interventions and secular changes in other known determinants of health)?

The above reported health improvements are consistent with reported improvements in the 14 PHC evaluations reviewed, and the older PHC evaluations reviewed by Berman.[20] However, comparison to other Pakistan data sources suggested that adjustment for country-wide secular trends could account for half of the improvements, and adjustment for secular trends in urban data could account for all of the improvements excepting immunization. Therefore, adjustment for confounding secular trends in the study areas was also shown to be imperative in an assessment of Program effectiveness.

The study included three sources of information on potentially confounding factors: networking with governmental and non-governmental sources to retrospectively identify interventions in the study areas since Program implementation; qualitative investigation with local key informants to assess the degree of local exposure to the

identified interventions, and socioeconomic changes; and quantitative comparison of socioeconomic determinants in the baseline and study surveys.

Networking revealed health education through the mass media and extensive ORT, immunization, family planning and maternal service interventions. Interventions targeting breast feeding and nutrition were less well implemented.

Qualitative investigation revealed marked exposure to the mass media, along with the existence and utilization of many competing health services (especially family planning and maternal services) which were mostly from the private sector. Up to 60% improvements were reported in access to municipal services (including water and sanitation) and education. However the communities were not found to be dissimilar in these health exposures and secular trends, so the community comparisons were not confounded.

Quantitative comparison of the Program area baseline and study surveys revealed a 20% improvement in real income, a doubling of the number of houses with private water taps, a 15% improvement in sanitation (to essentially universal access to running water and modern toilets), a reduction in the percentage of houses with temporary construction (20% to less than 1%). In essence, during the period of Program implementation, socioeconomic status improved by approximately 20% in terms of wealth and 60% in terms of access to water and sanitation, but did not improve in terms of education.

Therefore, all three sources of information were consistent with marked positive changes in determinants of health external to the Program including: health education, health services, wealth, and living situation (including water and sanitation). Adjustment for these confounding influences was certainly required in an assessment of Program effectiveness.

7.7 Control for Confounding Factors: GOBI-F Effectiveness

7.7.1 Growth Monitoring: Children's Nutritional Status

Anthropometric (impact) indices were collected on 1731 children under five years of age. Weight-for-height is an indicator of acute malnutrition or 'wasting' (which has been associated with failure to gain weight, or loss of weight).[178] Height-for-age is an indicator of chronic malnutrition or 'stunting' (which has been strongly associated with socioeconomic and housing standards, as well as the infection-malnutrition cycle).[66,81,178] Weight-for-age is an indicator of both chronic and acute malnutrition, or 'under nutrition'. All three indicators should have responded to a nutritional intervention.

Substantially more undernourished and stunted children were identified in the Program area, though the number of wasted children was equivalent. These differences were seen in the mean or median z-score (an index of the whole population's nutrition), or in the proportion malnourished (an index of the proportion of children faltering). No differences were found when the data were age or sex dis-aggregated. The study results were opposite to the study hypothesis: children in the Program area were found to be more malnourished than children in the Comparison area.

In terms of data quality, the anthropometric indices were the only indicators in the study which were free of potential recall bias. Though other biases were possible, (such as seasonality, measurement and interviewer bias),[14,66] they were unlikely to have affected the difference between the two areas.

A further problem with the anthropometric data was the difficulty in attaining reliable measurements, as the interviewers were previously inexperienced. Accurate weight and length measurement was addressed by utilizing well-calibrated scales and solid measuring sticks, along with extensive training and re-training of interviewers.[121] Ages of children were verified in the field by comparing the reported date of birth to a local events calendar and to households records (such as growth monitoring or

immunization cards). Ages were further verified by checking the internal consistency of reported age in the introduction table with age in the pregnancy history, and with the spacing between pregnancies reported on either side of the index child. Finally, questionnaires were re-examined for written errors on any children with outlying anthropometric indices (more than six standard deviations from the mean). Where discrepancies existed, the reported age was taken to be more accurate than the reported date of birth.[59] In Pakistan there is a cultural tendency to over-report age,[50,81] which combined with the presence of more written records (such as growth and immunization cards) in the Program area, could have biased the results towards finding a Program effect (with over-reporting of stunting and underweight children in the Comparison area).

In terms of total observations: missing data (due to refusal) were less than 1% of observations (compared to 10-20% reported for other Pakistan surveys);[50,81] gross outliers (most likely due to reading Imperial rather than metric units on the spring scales) were less than 2%; inconsistencies in age totalled 7%; and anthropometric outliers were a further 2%. This total of 12% problematic data was evenly distributed by area and interviewer. After careful editing, less than 2% of the data could not be corrected logically, and were thus re-coded as missing. Analysis of the data with problematic data removed or corrected produced identical conclusions. Adding the 10-11% gross discrepancy rate found on reweighing to the 12% problematic data could have resulted in inaccuracy or misclassification of the anthropometric results. However, it is unlikely that the study conclusions were biased, save towards the null hypothesis of finding less of a difference than existed in reality.[129]

The comparison of study results to other anthropometric data was reassuring. Since Program implementation, the MIS has shown a stable 38% of children under five to be underweight, which was compatible with the study finding of 35%. Both estimates were somewhat better than other estimates for urban Pakistan.[50,158] The MIS did not contain length data for comparison. However, the study's stunting and wasting estimates were slightly better than urban Pakistan estimates, when adjustment is made for their use

of percentage cutoffs rather than z-scores.[50,161] The study's anthropometric estimates were, therefore, compatible with the socioeconomic status of the studied communities, and with AKU's surveillance data.

No association was found between exposure to the Program's extensive nutritional intervention (as measured by ever or recent growth monitoring) and nutritional status. A number of interpretations of these results are possible.

One interpretation of the study finding is that no nutritional intervention was implemented. Though competing nutritional interventions were not identified on qualitative investigation, over 80% of children in the Program area were ever growth monitored, and 55% have been monitored in the last three months. Growth monitoring was a major focus of the Program as a method of identifying children with mothers in need of nutritional education and support (though food supplementation was not implemented). The CHWs claim that a large proportion of their time is spent weighing children, then plotting them on a chart to track progress. Expenditures on growth monitoring are equivalent to immunization, both more than double any other GOBI-F Program element.[75] In fact, AKU has published more on the importance of growth monitoring than on any other aspect of the Program.[148,149] Growth monitoring and nutritional education were, therefore, well implemented and priorized.

A second interpretation is that the CHWs were not trained well enough in nutritional education for growth monitoring to be effective. The CHWs received extensive training and retraining in UNICEF's prime messages,[156] and nutritional education has been the subject of repeated seminars. Qualitatively the CHWs were all able to communicate the nutritional messages to me. Thus, lack of nutritional knowledge on the part of CHWs is an unlikely explanation.

A third interpretation is that the CHWs imparted appropriate information, but the mothers were either unwilling or unable to change their feeding habits accordingly. This was the explanation related by the CHWs.[6,75] Such an interpretation would suggest that

growth monitoring and nutritional education alone was insufficient to improve nutritional status. Such a hypothesis has recently been suggested in the literature.[56,130]

A reasonably well designed study in rural India showed that growth monitoring itself had no nutritional impact over and above nutritional education.[56] Another study showed that nutritional information mediated improved nutrition only in wealthy households.[130] The World Development Report claims that nutrition information works mostly through breast feeding changes,[173] which were not observed as a Program effect. In short, a number of studies suggest that growth monitoring and nutritional education are insufficient to improve children's nutritional status.

Though there have been many growth monitoring and nutritional education programs implemented over the last 30 years, only two have published positive nutritional impact: the Narangwal Project in India[82]; and the Iringa Project in Tanzania.[15] In both programs, the communities were mobilized to redistribute food resources, which has not been accomplished by AKU or most other growth monitoring programs.[14,66] Of the interventions proven to improve nutritional status (control of infectious disease, breast feeding and nutritional education, supplementary feeding, micronutrient fortification, micronutrient supplementation, and food subsidies),[173] the Program includes only the first two. A recent study has generated hypotheses for other major determinants of nutritional status (gender discrimination in child care, hygienic use of milk supplements, treatment of diarrheal disease, maternal empowerment, and family wealth).[136] The last of these (socioeconomic status) was found to be the main determinant of nutritional status in a recent Pakistani study.[81] Clearly the Program's intervention addresses only a fraction of the known nutritional determinants.

In summary, the study results, showing that the Program has implemented extensive growth monitoring and nutritional education without successful growth promotion, are plausible. The lack of nutritional effectiveness is consistent with AKU's surveillance data and with the literature on nutritional interventions. Further evaluation of the effective components of growth promotion are necessary.

7.7.2 Oral Rehydration Therapy: Diarrhea Treatment

Information was collected on oral rehydration therapy education and service coverage, knowledge, and usual feeding behaviour from all 1161 mothers, along with more detailed information on feeding and health-seeking behaviour from 128 mothers whose children had suffered diarrhea in the previous two weeks. The results indicated substantial Program coverage: the Program's CHWs were the main diarrhea treatment resource utilized by mothers in the Program area, among many sources of diarrhea information and services in both study areas. In terms of outcome, most indicators favoured the Program area though the actual differences were unsubstantial: knowledge of diarrhea symptoms and treatment was essentially identical and well over 90% in both areas; diarrhea related behaviours were also similar, with the exception of a four percentage point difference in the maintenance of food during diarrhea.

The quality of the diarrhea data was reasonable. Reliability of responses on re-interview was good for all but oral rehydration therapy (ORT), possibly because mothers had utilized ORT in the interval since the first interview. There was internal consistency in feeding practices reported for usual and recent diarrhea. Though the seasonality of diarrhea was a potential problem,[49] winter months in Pakistan have more acute than chronic diarrhea.[106] Both ORT and the diarrhea treatment score were most appropriate for acute diarrhea which totalled over 75% of the reported cases.

There were two problems, however, with the diarrhea data: sample size and content validity. The sample size attained in the survey for recent diarrhea was, unfortunately, too small to infer differences, though the diarrhea prevalence was consistent with elsewhere in Pakistan,[106] and the average of 2.7 annual diarrhea episodes for Asia.[49] In terms of content validity, cereal-based ORT, rather than sugar-salt-solution (SSS, packaged or homemade), was advocated by the Program, which most likely was not captured well in the ORT question. When children fed additional food are re-coded as users of ORT, the differences in diarrhea behaviour reversed to favour the Program area.

This theory would explain the differential maintenance of food during diarrhea as a reflection of the Program area's preferential use of cereal-based ORT over SSS. Therefore, the diarrhea data were limited by sample size and problems capturing the use of ORT. Furthermore, no attempt was made to evaluate the quality of the ORT.

In short, differences in diarrhea knowledge and diarrhea related behaviours were minimal. The lack of Program effectiveness in diarrhea treatment likely reflects the high level of knowledge in both communities, which has found elsewhere in urban Pakistan.[106] In one study, 97% of urban women recognized the SSS package, and 83% had ever used it.[50] The study findings and the Pakistan literature support evidence for the effectiveness of extensive governmental and non-governmental ORT education campaigns,[60,158] rather than the Program.

I conclude that, despite limitations in the data, the effectiveness of the Program in the area of diarrhea treatment was found to be minimal. This finding is most likely due to high prevailing health knowledge, the result of many competing sources of ORT education. Oral rehydration therapy was, therefore, one Program component which was found to be minimally effective due to high background health knowledge and healthy behaviours.

7.7.3 Breast Feeding

The breast feeding behaviour information was collected on the most recent completed pregnancy during the last five years, for 1130 woman who had been resident more than one year. All breast feeding indicators were similar in the two study areas, with the exception of a ten percentage point colostrum feeding differential in favour of the Program area. There was no evidence for other time-trends in breast feeding, within the limits of sample size and recall.

Maternal pregnancy recall has been shown to be reasonable for up to five years in Pakistan[50,51] and elsewhere.[49,86] On the whole, the study utilized shorter recall: 35% of

reported pregnancies had ended in the last year, and less than 20% had ended more than three years ago. The test-retest reliability of breast feeding questions was excellent and internal inconsistencies were rare. The breast feeding data, therefore, were of good quality.

The results were similar in both study areas: minimal colostrum and exclusive breast feeding rates, moderate breast feeding with solids from 6-9 months, and prolonged overall breast feeding. These findings are consistent with Pakistani practices documented elsewhere.[10,50] It has been found that even physicians support the cultural avoidance of colostrum in Pakistan.[158]

Therefore, there is evidence of Program effectiveness in modifying only one breast feeding practices (i.e. colostrum feeding) I must conclude that overall the breast feeding intervention was a second program component with minimal effectiveness due to high background healthy behaviours.

7.7.4 Immunization

The immunization results consisted of knowledge indicators asked of 1161 mothers, the immunization status of 1731 children (carefully collected from maternal report or immunization cards where available), and the tetanus immunization status during the most recent pregnancy of 1130 women. All immunization indicators substantially favoured the Program area, with differences of 4 to 13 percentage points, essentially all of which were highly statistically significant.

One potential bias existed in the immunization data. In the Program area, over 80% of children had immunization cards, contrasted with less than 60% in the Comparison community. Though presence of immunization cards would be an indicator of Program coverage, it is also possible that immunization status was more accurately reported in the Program community. However, only 2% of children were reported to have had immunizations which were not recorded on the card, and the 20% difference between

areas with respect to children having immunization cards is consistent with the up to 15% differences in recorded immunization status. Furthermore, the immunization questions were all reliably answered on test-retest. The magnitude of the differences in immunization status are consistent among the maternal tetanus and childhood tuberculosis, diphtheria-pertussis-and-tetanus, polio and measles indicators. The results were also consistent when the data were dis-aggregated by age and sex. Therefore, the immunization data were internally consistent and reliable.

The data contrast favourably with other data sources in Pakistan. Despite the high media exposure documented elsewhere,[50] when contrasted with other Karachi estimates[76] immunization knowledge was better in the Program community and equivalent in the Comparison community. In terms of immunization behaviour, compared to the mean urban Pakistan estimates, the Program area had consistently 5-10% higher immunization rates, and the Comparison area had 2-5% lower immunization rates.[2,158] On a global scale, both areas were 20-30% above the means for least developed countries.[160,161] When compared with external data sources, therefore, the data are consistent with a Program immunization effect.

Therefore, the study provided evidence of substantial Program effectiveness in increasing the immunization of mothers and children. This effectiveness was noted, despite alternative sources of immunization in both areas, and despite relatively high background immunization status compared to elsewhere in Pakistan. Immunization represented the main Program success. This finding is consistent with immunization being the Program component where outreach home visits should have had a maximum effect (as CHWs actually brought children in need of immunization to the clinic on vaccination days).[6]

7.7.5 Fertility

7.7.5.1 Family Planning

Family planning exposure and behaviour indicators were collected from all women who had been pregnant in the last 5 years, which allowed the compilation of impact indicators for all women over the last 5 years. Program coverage was excellent, but there was utilization of many competing health resources. The family planning outcome results tended to favour the Program area. There were substantial (5 to 10 percentage point) differences in knowledge indicators, insignificant (2 to 5 percentage point) differences in behaviour indicators, and no differences in impact indicators.

Family planning is a sensitive issue in Pakistan, due to religious proscription.[74] The quality of self-reported family planning use has, therefore, been questioned,[158] substantiated by evidence of under-reporting.[50] Under-reporting may have been more prevalent in the less surveyed Comparison area, potentially biasing the study in a positive direction. Test-retest reliability was good for all of the family planning questions. The data, therefore, were reliable within the cultural limitations.

In terms of internal consistency, few women reported being both pregnant and using contraception. Family planning was reported as currently being used by 20% of women whose last child was born less 12 months ago, 30% of women whose last child was born 12-23 months ago, and 40% for women whose last child was born 24 or more months ago.

It is difficult to assess the external validity of the family planning knowledge and behaviour indicators, as the study population was not typical. The study excluded women who have not yet had children and women who have finished having children. As a percentage of total women, family planning information was not available for 63% of women age 15-30 (18% of whom are married), and 59% of women age 31-49 (90% of whom are married). Given that women age 15-30 represented 65% of total women age 15-49, and the fact that contraceptive use is unlikely in unmarried Pakistani women, the

study estimates most likely overestimated the true community contraceptive prevalence. As such, the study family planning knowledge and behaviour results were likely 5-15 percentage points higher in both study areas than other urban Pakistan estimates[50,158] and equivalent to estimates for other developing countries.[160,161]

Birth intervals and fertility measures (the family planning impact indicators) are externally comparable, to the extent that data was biased by excluding women who had not been resident for more than 1 year. The birth intervals were identical to other urban Pakistan estimates.[50] The crude birth rate and total fertility rates were slightly lower than other estimates for urban Pakistan[50,158] and 20-30% lower than the average for developing countries.[160,161] Both the behaviour and impact indicators support a 5-10 percentage point higher contraceptive utilization in this population, compared with the norm for urban Pakistan.

The population's higher than average contraceptive utilization was not found to be substantially different between the two study areas. This observed lack of Program effectiveness is not due to differentials in terms of the proximate determinants of fertility.[50] Age at first marriage (mean 18.5 years and median 18 years) and duration of breast feeding (mean and median 17 months) were equivalent in the two study areas. Both were slightly lower than estimates for urban Pakistan,[50,158] yet higher than estimates for middle-class Pakistan.[67,68]

Therefore, the Program was found to be moderately effective in increasing contraceptive knowledge and minimally effective in increasing contraceptive behaviour, yet not effective in the impact measures birth spacing and fertility.

One explanation for the lack of substantial Program behaviour or impact effectiveness in family planning is the prolonged time which is likely required to change family planning behaviour. However, the study area's high background contraceptive prevalence relative to other estimates for Pakistan indicate that behaviour change has already begun. The more likely explanation for Program ineffectiveness is therefore the many competing sources of family planning education and services. For example, over

the past 10 years there has been an extensive government program in the social marketing of condoms[158] and education through the mass media.[50]

In summary, family planning was a third Program component which was found to be relatively ineffective due to high background health knowledge and healthy behaviours.

7.7.5.2 Maternity Care

The maternity care indicators were collected in a manner similar to the breast feeding data. Prenatal care was found to be unsubstantially higher in the Program area (0 to 4 percentage points), and delivery care was no different. The data were similarly reliable, and internally consistent.

The study results were consistent with other estimates for urban Pakistan. In both study areas use of prenatal care was 15-20% higher, adequate prenatal care was double, yet the delivery care indicators were equivalent.[50]

These results may well reflect content validity limitations of the study data. It is possible that the study questions did not capture home prenatal care offered by Program traditional birth attendants, but rather included only prenatal care at a health center. The study did not distinguish trained from untrained traditional birth attendants (because of problems in definition), nor were there measures of safe versus unsafe maternity care. The study results therefore may well have had important negative bias preventing it from capturing Program effects.

There are two other possible explanations, however, for the apparent lack of effectiveness. First, the Program's trained traditional birth attendants (TTBA) service less than 25% of women delivering in the Program area, which represents under half of all women delivered by TTBA. Second, maternity care was the health sector in which the majority of competing providers were working.

In summary, the data suggest a consistent yet unsubstantial Program effect in prenatal care, yet no difference in delivery care. Maternity care would appear to have been a fourth component where the Program was relatively ineffective due to high background knowledge and practices. However, the data must be interpreted with caution due to potential problems in content validity.

7.7.6 Mortality and Morbidity

The study mortality data were collected in full pregnancy histories from 1161 women who had been pregnant in the last five years. The study mortality results were inconclusive due to large confidence intervals, as was expected due to the small sample size.

Contrasting the Program and Comparison areas, the perinatal mortality rates for children born in 1991-3 were 24 and 44 respectively, for an adjusted difference of -15, and 95% confidence interval of (-38,7). The infant mortality rates for children born in 1991-2 were 31 and 35 for an adjusted difference of 0, and 95% confidence interval (-25,26). Time trend analysis of all births in the last 5 years showed consistent yet small decreases in both mortality indicators over time, which were greater in the Program area than the Comparison area. None of these differences were statistically significant due to the limited study sample size for stratified analysis, so the results must be interpreted with caution.

Comparison to outside estimates for urban Pakistan during the Program period (1988-1993) show decreasing infant mortality from approximately 100-110 to 80-90.[2,133,157,158,160] However, other than AKU data from the Management Information System MIS[6,75] and Maternal and Infant Mortality Survey (MIMS) of 1989,[51,52] comparable perinatal mortality data were unavailable because stillbirths were not collected in major Pakistan surveys.[50,133] The MIMS data are consistently between the pre-Program and

study estimates, yet the MIS and urban Pakistan mortality estimates are consistently 50 to 120 percent higher than the study estimates. There are three explanations for the discrepancies: random variation, the Program could have been effective, or there may have been under-reporting in the data.

There is evidence for under-reporting of mortality in the study results. Test-retest interviewing showed under-reporting of abortions and some stillbirths, but not of live births. The number of live births reported for 1989 (in both study areas) were 20% less than from 1990 or 1988 (despite the exclusion from the study of women who had last been pregnant before 1989). This was likely due to the interviewer's bias in aging children over 5 when in doubt, to save completion of the child health portions of the survey, which has been found in another survey in Pakistan.[50] The study's mortality estimates fluctuated widely, a finding which elsewhere has lead to proposals for the aggregation of mortality estimates only every 3-4 years.[28] A further potential data problem lies in maternal definition of live birth, as many early neonatal deaths may have been reported as stillbirths.[51,52] The adjusted infant mortality, assuming all stillbirths were actually misreported live births was calculated as 'maximum mortality', and these estimates are higher than both the MIS and urban Pakistan estimates. Therefore, within the study data itself, there was evidence for some under-reporting and misclassification.

The character of the population studied points to potential explanations for under-reported mortality. The study excluded women who have been resident for less than one year, a full 27% of the population. Recent migrants have been shown in many studies to have higher mortality rates than more long term residents,[50,86] which may partly explain the low study mortality estimates. Furthermore, a high proportion of women return to their home village for the delivery of their child and the subsequent 40 day Muslim period of seclusion.[67] This factor cannot be assessed for the study as actual place of birth was not recorded;[88] however, to the extent that the Program area was composed of more Muslim families (in whom the tradition is more common), this could have biased the crude Program estimates, but should not have biased the adjusted estimates.

The study method involved potential under-reporting. Though pregnancy history has been found to be more accurate than direct 1-3 year recall,[23] the world fertility surveys[86] have shown selective omission of early neonatal deaths, and misreporting of the dates of birth and death with upward bias in ages.[49] Pakistan surveys have noted similar problems, along with response errors, enumeration biases, coverage, and sampling errors.[50,51] The study did not include indirect mortality estimates as they would include observations which antedate the Program.[153]

In summary, given all of these potential problems the reliability and accuracy of the study mortality estimates were limited.[23] Though differences between study areas were unlikely to have been biased and small differentials (including a time-trend analysis) were consistently in favour of the Program area, there was considerable overlap of the confidence intervals for all estimates. The study, therefore, did not have the power to make firm conclusions and the mortality results must be interpreted with caution.

The study also included data on childhood illness, diarrhea and pneumonia morbidity. the estimates of which were equivalent in the two study areas. These findings were consistent with stable morbidity indicators over time in the AKU surveillance data (MIS). Given that the study was not designed (due to limitations in sample size) to measure differences in mortality and morbidity, their absence of statistical significance is not surprising.

7.8 Overall Program Effectiveness: How Plausible are the Study Results?

Overall, in testing for Program effectiveness the study findings were mainly negative. The health improvements observed in surveillance data alone were diminished by 50 to 90 percent when adjustment was made for confounding secular trends through

post-hoc matching of a Comparison community. In essence, the Program was found to be only minimally effective when adjustment was made for background secular trends.

These findings might be disappointing to AKU and other agencies which have implemented similar PHC programs. It therefore is important to carefully examine the question of how plausible the findings are. To address this question, I discuss four potential explanations for the negative findings, four considerations which suggest that the direction of adjustment for confounding secular trends is reasonable, and two arguments which support the degree of adjustment.

First, limitations of the study method have been mentioned previously. Given the field situation, the method was the only way to obtain estimates before the Program was to be restructured and expanded. The study method was successfully implemented with a good community match, yielding reliable and valid results which are plausible given the Program's health-resource rich environment and the PHC literature. Study limitations do not, therefore, explain the negative findings.

Second, a number of Primary Health Care programs elsewhere have been ineffective due to problems in the functionality of the Community Health Workers.[11,13,20,107] To be effective, CHWs require motivation, good training, supervision, logistic support and a well functioning referral system.[167,173,177] The Program included all of these, with the possible exception of a working referral system.[6] Poor CHW functionality, therefore, was unlikely to have been an explanation for the negative study findings.

Third, the Program duration (six years) may have been insufficient for the Program to have had a measurable effect,[164] since the time required for Primary Health Care program effect is unknown.[28,134] This hypothesis would be supported by the consistently larger effect on knowledge than on behaviours or impacts. However, the secular tends in this study and in the other Pakistan data sources suggest that six years was sufficient for health change. Moreover, only one of the 14 PHC studies reviewed included as long a follow-up period. Given the high background health knowledge and

healthy behaviours, along with the many other PHC resources, it is hard to conceive of a much larger Program effect over time.

Fourth, the Program could have been relatively ineffective due to being implemented in the wrong environment. This is the most plausible explanation for the negative study findings, as the study tested the marginal benefit of the Program over-and-above an already high level of background PHC and development activities. This is not to say that the Program was ineffective at bringing about some of the adjusted for confounding health improvements, but simply that the private health care sector also brought about parallel improvements, without needing the AKU subsidization. In other words, if AKU had not been there, the Program area would likely have attained similar health improvements, save the 10-15% improved family planning and immunization knowledge scores, the 10-20 percentage-point higher maternal-child immunization rates, and the 10 percentage-point improved colostrum feeding rate.

There are four additional considerations which would suggest that the direction of adjustment was reasonable.

First, the study results are consistent with the conceptual framework: a consistent negative gradient from knowledge through behaviour to impact indicators. Effectiveness was consistent yet small for improvements in health knowledge: immunization and family planning scores were increased by 5-10%; though diarrhea treatment knowledge equivalently high in both communities. Effectiveness was inconsistent with regard to healthy behaviours: the only meaningful effects were a 10-20% increase in maternal-child immunization rates and a 10% increased colostrum feeding rate. No significant effects were found in diarrhea treatment, other breast feeding, family planning or maternal practices. Effectiveness was not found in health impacts: nutritional status and fertility.

Second, the study findings are consistent with the large number of alternative health service providers and PHC activities. In populations similar to the study areas, extensive PHC exposure has already been documented.[50,147] In both Program and Comparison areas, this study documented significant exposure to health education

through the mass media (85% of residents in both communities owned a television and 75% owned a radio) and utilization of many other health service providers. The only health services which were offered by the Program but not other providers were outreach health care and growth monitoring, neither of which have been shown in the literature to have significant impact. The Program was effective only in program elements where other agencies and interventions were minimal: in immunization and colostrum feeding other health resources were less mobilized, and background health knowledge and healthy behaviours were accordingly low. Conversely, in ORT, maternal services and family planning the Program was ineffective as other health resources were plentiful and background health knowledge and healthy behaviours were accordingly high. The exception to this pattern was growth monitoring which was found to be ineffective at promoting growth, despite the lack of growth monitoring by other health services.

Third, in addition to the expanding private health sector, which other secular trends might have effected health status since Program implementation? Comparing the study results to the pre-program survey, improvements were noted in socioeconomic status, water and sanitation services: all of which are major determinants of health improvements.[13,20,26,43,44] Urbanization and education, to which residents of both communities would have been increasingly exposed over time, have also been strongly linked to health improvements.[5,45,70,170,184] The secular trends in both the health and non-health sectors represent potential confounding variables for Program effectiveness, which must be adjusted for, before health status changes can be attributed to the Program.

Fourth, the qualitative and quantitative evidence for the degree of secular changes in confounding factors were consistent with each other. Secular trends in health determinants should all have led to improvements in health status, therefore, the negative adjustment in surveillance estimates was plausible. In my analysis, the negative adjustment occurred in two steps. Adjustment was first made in the study design: effects were reported as rate differences between two matched communities. This resulted in a large reduction in the apparent effectiveness of the Program. Small additional adjustments

were made for residual confounding (i.e. meaningful differences in matching variables) using multivariate analysis. The consistent direction of adjustment (diminishing the apparent health status advantage of the Program area) was compatible with the possible positive study bias caused by socioeconomic differences.

Unfortunately, moving from the recognition of secular trends to assessment of the degree of confounding is not easy. Though many health determinants are known, they have not been successfully ranked, nor have the causal links between interventions and changes in determinants been proven.[150] Neither the expected magnitude of change, nor their interaction are known.[163] However, 15-70% improvements have occurred in water and sanitation, which is the health determinant with the best evidence of impact (including infant and child mortality decreases of 20-55%).[43,44] There also were 10-20% improvements in socioeconomic status (the determinant most targeted by some development strategies).[173] Therefore, it would not be unreasonable to expect a 20-30% improvement in health status simply as a result of changes outside the traditional health sector. If competing health sector interventions are also considered, the estimated 50 to 90% diminishment in AKU surveillance estimates of effectiveness found by this study would appear to be reasonable.

Furthermore, both the Program and Comparison areas health status estimates are substantively consistent with the Pakistan Demographic and Health Survey urban Karachi estimates.[50] This fits with the finding of socioeconomic similarity between the study population and average urban Karachi residents. For the variables which the two studies have in common, my conclusions would not be different if the PDHS data were used as a comparison for the Program area: effectiveness would be 10-15% higher immunization rates; and no effectiveness on nutrition, family planning or prenatal care indicators.(see TABLE 3.2) Therefore, the study findings of minimal Program effectiveness, and effectiveness essentially only on immunization are plausible and consistent with other evidence.

7.9 Study Implications

The study essentially tested the marginal benefit of CHW home visits and growth monitoring over-and-above substantial background PHC exposure. Though the study findings do not suggest that a similar program could not have been effective in an environment with fewer PHC resources, in the study population the Program was only minimally effective. There are five implications of the negative study findings: the Program was essentially ineffective because of competing private health care providers; the study findings may be generalizable to other parts of urban Asia; a selective approach to PHC design may be more appropriate; confounding influences must be controlled for in an assessment of Program effectiveness; and health development priorities for the study areas likely lie with the private health and the non-health sectors.

I believe that the Program was an example of a "type III error": a potentially efficacious program which was implemented in a population which was inappropriate for the intervention.[12,61] The Program's intensive outreach activities were designed to reach women living in *purdah* (Muslim seclusion), who were thought to have minimal access to health information and services. The comprehensive GOBI-F strategy was originally designed to efficiently implement Primary Health Care in rural populations with little access to allopathic health services.[13,20,31,168,174] The high background health fluency and healthy behaviours in both study areas demonstrate substantial access to and utilization of numerous other health resources. There was little room for additional Program effect over-and-above the effects of existing PHC and other health interventions. Given the minimal Program effectiveness, its cost-effectiveness in the target population was likely to have been poor. Furthermore, the Program required large financial inputs, including payment of the CHWs, which limited its sustainability.[20,168] The Program's intensive outreach and comprehensive GOBI-F strategy may not, therefore, have been the most appropriate models for an intervention in the target population.

This Program was a well implemented, supported and monitored comprehensive PHC intervention[20,174] in an average (lower-middle class) urban Karachi setting. The study population is socioeconomically similar and has similar health status to other populations in urban Asia. The study findings may thus be generalizable to other parts of urban Asia.

A major finding of the study is the importance of assessing existing health resources before implementing health interventions in urban Asia. Clearly the health needs of the study population are different from the predominantly illiterate rural populations for which the comprehensive GOBI-F strategy was developed.[31,174] The study population does not need PHC access alone, but rather augmentation of existing health knowledge and conversion of knowledge into healthy behaviours, which should ultimately lead to health impact. To facilitate further health improvements in similar populations, culturally- and site-specific selective PHC interventions need to be developed.

The study demonstrates the importance of controlling for confounding factors in assessing the effectiveness of PHC interventions. The publication of longitudinal surveillance data which implied program effectiveness due to marked decreases in morbidity and mortality indicators in the program area alone[75] was clearly misleading. In populations with access to other information and health resources, assessment of confounding secular trends is mandatory. Secular trends can only be assessed with information on health trends in comparable yet unexposed populations, despite the difficulty of matching communities. Therefore, in similar environments to the study population a selective approach to Program design with carefully researched and monitored health targets would be strongly advised.[119,125,166]

7.10 Directions for Future Research

There are five directions for future research suggested by the study: scientifically valid and practical study designs should be utilized in PHC evaluation; PHC measurement issues need further qualitative and quantitative clarification; the role of CHWs in urban Asia needs to be defined and clarified; the indications for health outreach need to be further explored; and the cost-effective directions for health development need to be elucidated.

Scientifically valid and practical study designs need to be utilized in PHC evaluation. The ideal PHC program effectiveness study design would be to randomize communities. If full randomization was not possible, the slow phasing-in of all included communities over time would avoid excluding populations from effective interventions. If randomization is not possible, (i.e. for logistic or political reasons) then a full pre- and post- quasi-experimental design on at least three (and ideally ten) matched-pairs of communities, should be used to test future PHC interventions. Repeated cross-sectional surveys can supplement longitudinal surveillance data. The mixed-model ANOVA analysis for any of these study designs has been well described.[40,89]

The difficult measurement issues in PHC evaluation of exposure, outcome and confounding factors have been highlighted by the study. How should Program exposure be defined: at the community level to include non-users; or at the individual level to look for a dose-response and thus exclude non-users whose under-use may have important program implications? How should outcome be measured, and how long does it take to convert health education and service into health outcome? In future evaluations, fewer outcome indicators to test fewer more specific hypotheses should be included to make data collection more precise and efficient, as should more specific indicators of knowledge, and some observational measures of healthy behaviours. Cost-effectiveness indicators such as the disability adjusted life year[173] should also be included to allow external comparison with other interventions. What non-health sector factors influence

health outcome to what degree, and thus what confounding community factors should be controlled for in PHC program evaluation with what implications? Furthermore, what are the best indicators of a community's health, and of community similarity? Many of these measurement issues can only be clarified with qualitative investigation followed by quantitative definition of variables. Some of the results of such investigation may be culture- and site-specific.

At a time when developed countries are moving to incorporate axillary health providers (i.e. nurse practitioners and midwives) to improve cost-effectiveness, this study suggests that the implementation of paid community health workers in urban Pakistan was not cost-effective. In urban Asia, what is the best role for auxiliary health providers (including community health workers) and how are they perceived by consumers in an urban Asian environment which already has numerous other health providers many of whom have more 'official' credentials? Would better training of new health professionals, and upgrading/regulation of existing health professionals not be more cost-effective than training more CHWs? The results of this study, along with other information collected by AKU, have already led to a change the AKU Program's direction towards integrating with and strengthening existing community and human resources. The methods for achieving such goals, and the degree of success need to be defined and assessed.

The study showed that health outreach added little to the private use of health services in urban Karachi. In the early twentieth century, public health nurses used to provide many of the outreach services offered by the AKU CHWs. These services were slowly decreased as public demand for services (such as immunization) grew to the point that outreach was no longer needed. In urban Asia then, what are the indications for outreach home visits and for which health needs is outreach most important?

The study points to the dilemma for governmental and non-governmental development agencies: which interventions lead to improvements in community health which would not otherwise happen, and which are most cost-effective? The study findings suggest that public health rather than individual health service interventions

would be priorities for future health development. Given that the study population utilized mostly private health services and few government services, it may be more cost-effective to improve the quality and or regulate private health care providers, than to create new parallel services.The non-health service components of the PHC model, such as water, sanitation, education (including the mass media), and economic development should also be considered in determining the most cost-effective health interventions.

These issues for future research can be summarized into four questions. What do health consumers in urban Asia need, and what do they perceive they need? What modifications to the GOBI-F model need to be made to fit the urban reality? What are the most efficient and cost-effective ways to provide and exchange health information? What facilitates the transition from health knowledge to healthy behaviours?

With the pace of third world urbanization and the resulting lack of basic health surveillance data, there is a great need to study interventions aimed at improving health. The Aga Khan University Primary Health Care Program was an excellent model, upon which modifications needed to be (and have been) made for its rapidly changing environment. I hope that the results of this study inspire other Primary Health Care researchers to be creative and to publish their results (even if negative), so the experience is not "published in internal reports with small circulation and...lost under piles of paper on someone's desk somewhere".[20](page 459) Careful program evaluation is clearly necessary to establish which Primary Health Care interventions are effective, in which populations, and why.

8. CONCLUSIONS

a. Over six years, the Aga Khan University Urban Primary Health Care Program (the Program) achieved 88% community coverage: 85% with outreach (preventive) health services, and 65% with facility-based (curative) clinical services.

b. The Program's surveillance system (a pre-implementation survey followed by service-based CHW reporting) documented substantial improvements in health status since Program implementation which were consistent with the study's community-based estimates. However, these surveillance estimates of effectiveness were incomplete and perhaps misleading in assessing Program effectiveness.

c. The study method (a cross sectional survey in one Program area and a matched Comparison area) would have been improved by a inclusion of a pre-implementation survey in the Comparison area, and by at least two more matched pairs of communities.

d. The community matching method (including iterative key informant interviews and qualitative community assessments) was an important tool in the *post hoc* identification of socioeconomically and ethnically matched communities.

e. Many confounding factors were identified including: mass media education; other health service providers; and improvements in water, sanitation, and socioeconomic status. The PHC services which were unique to the Program were community health worker outreach (home visits and educational meetings) and growth monitoring.

f. Adjustment for confounding factors, by calculating the risk differences between Program and Comparison areas, diminished the surveillance estimates of effectiveness by 50 to 90 percent. The amount of adjustment was plausible given the degree of confounding.

g. The Program was found to have been effective on most knowledge scores, some healthy behaviours, and no impacts.
Positive results included: increased immunization and family planning knowledge scores by 5-10%, higher maternal-child immunization rates by 10-20%, and greater colostrum feeding practice by 10%.
Negative results included: no additional diarrhea knowledge; no change in healthy behaviours towards diarrhea treatment, breast feeding, family planning or maternity care; no health impact on fertility or childhood nutritional status.

h. The Program's comprehensive PHC model would, therefore, be inappropriate for a new intervention in urban Karachi. Carefully researched and monitored selective PHC interventions would be better.

In summary, both the Program and a comparable non-Program population accessed other private health care providers and health education in the mass media. Over and above this significant background PHC exposure, the Program's outreach home visits were only minimally effective. The Program was unsuccessful in growth promotion despite very active growth monitoring and nutritional education.

This study demonstrates the necessity for comparison studies in PHC evaluation, to adjust for confounding secular trends in other determinants of health. Inappropriate attribution of crude changes in health status to specific interventions can thus be avoided.

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APPENDICES

APPENDIX I: Aga Khan University's Ongoing Program Surveillance: Indicators Compiled From Community Health Worker Reports

The AKU Management Information System (MIS)[75,134]

Process Indicators (Produced Quarterly)

1. # and % registered families monitored
2. # and % children weighed within 48 hrs of birth
3. # and % of under 5 children weighed
4. # and % of total married women identified as pregnant
5. Average antenatal contact per pregnant women
6. # and % women who delivered in last 3 mo, at least one prenatal contact
7. # and % women who delivered in last 3 mo, 1+ prenatal contacts 1st trimester
8. # and % of deliveries done by TTBA, other trained manpower
9. # and % of trained TTBA reporting deliveries
10. # and % of deliveries reported by dais within 48 hr of birth
11. Age and sex distribution of patients seen at the clinics
12. # of referrals from the health center
13. # of supervisory visits done by LHV/CHN per CHW
14. Number of continuing education classes held

Outcome Indicators (Produced Quarterly)

1. # and % of children weighed within 48 hr of birth who are <2.5 kg
2. # and % of under 5 children : gaining weight, no change, losing weight
3. # and % of under 5 children malnourished by weight for age--> degree
4. # and % of under 5 children with diarrhea, who are given ORS
5. # and % of < 5 children immunization: complete, appropriate for age, incomplete, none
6. # and % of married women <50 years old , receiving 2 doses of Tetanus toxoid
7. # and % of women who were delivered in last 3 mo, tetanus immunized
8. # and % of pregnant women at high risk
9. # and % of complications during deliveries
10. # and % of eligible couples practising family planning

Impact Indicators (produced quarterly/yearly)

1. Morbidity pattern of patients seen at the clinics
2. # and % of under 5 deaths caused by malnutrition, diarrhea, ARI, etc
3. Infant mortality mate
4. Crude death rate
5. Crude birth rate

Cost Indicators (produced yearly)

1. Annual per capita costs
2. Annual programme costs

APPENDIX II: Review of Primary Health Care Effectiveness Studies Published From 1985 to 1994

TABLE II.1: LONGITUDINAL STUDIES OF PRIMARY HEALTH CARE EFFECTIVENESS

AUTHOR Location/Date	INTERVENTION Type & Duration	STUDY DESIGN Sample Size & Data Collection	INDICATORS AND RESULTS	STUDY CRITIQUE Strengths and Limitations
Lechtig,A (1982) Guatemala Rural Data 1980-2	'SINAPS' a GOBI-F PHC Program home visit q2mo community meetings (6-9 mo)	RANDOMIZED CONTROLLED TRIAL in 17 districts, using before & after random surveys plus service-based reporting -comparing outreach SINAPS to regular government services	IMR-->NIL (appr 100 per 1,000 LB) U5MR-->POS non-sig ORT Use-->POS sig 5% to 38% FP Knowl-->POS sig 70% to 85% FP use-->POS sig 11-15 vs 13-15 Imm -->POS sig DPTP, NIL measles&TT nutr-->NIL	The analysis was done within exposed communities The comparison to controls was only descriptive No description of survey methods, or numbers except a statement that the power was sufficient for nutrition and contraceptives use Mortality rates fluctuated too much for a conclusion Late implementation of food supplement program (5 mo) Short duration for impact
Pandey,M.R. (1991) Nepal Rural Data 1986-9	Pneumonia active case-finding monthly home-visit by CHW's, 3 & 6 day followup of Rx (4 years)	longitudial study with RANDOMIZED phasing in of the program over 12 months in 18 subdistricts, 13,000 children -ennumeration of births & deaths -verbal autopsy of all < 5 deaths	Rel Risk < 5 death->POS sig decr 28% Rel Risk < 1 Death->POS sig (38-54%) Rel Risk ARI Death-->POS sig 30% Rel Risk Diarr death-> POS sign 56% Rel Risk Measles death-->POS sig 10% Mortality age 1-4-->POS non-sig	Well designed study of a program with much more intensive supervision and followup than happens in most PHC programs *Pneumonia intervention alone can decease all cause mortality Unfortunately cannot calculate IMR or U5MR from data Program effect increased over time, best 3rd year
Greenwood,A.M (1990 a & b) Gambia Rural Data 1983-7	CHW plus trained TBA (3 years)	longitudinal study with pre & mid surveys 15 intervention villages 26 comparison villages	prenatal coverage-->POS non-sig imm-->POS nonsigTT, NIL DPTmeasles trained delivery attend-->POS sig 52% PNMR, IMR, U5MR-->nil nutr-->Nil	Well designed study as part of ongoing cohort, possible bias as controls were chosen communites too small for the intervention potential for spillover to control communities referral system not documented
De Francisco,A. (1994) Gambia Rural Data 1983-89	CHW plus trained TBA (6 years)	longitudinal study with mortality surveillance 12 villages with CHN 60 villages with CHW & CHN 265 control villages	PNMR-->Nil IMR-->Nil U5MR-->Nil	Very large study with many villages extension of Greenwood (1990) study, similar comments
George,S.M (1993) India Rural Data 1987-90	Monthly Growth Monitoring in addition to PHC (3 years)	longitudinal study in 6 MATCHED community pairs all with CHW's-->1634 children data from independent anthropometry	Nutr-->all nil Wt-for-Age(3-23 mo)-->NIL to neg Wt-for-age(24-44mo)-->NIL Wt-for-age(45-59mo)-->NiL	Well designed study, examined the benefit of growth monitoring in addition to nutritional education, deworming, and rest of GOBI-F matching and power reasonable 10% refused monitoring, given cultural problem with weighing there may have been more education in non GM villages
Khan,A.J. (1990) Pakistan Rural Data 1985-88	Active Pneumonia case-finding and Rx by CHW's added to exisiting GOBI PHC intervention (4 years)	POST only longitudinal study with EXTENSION to controls at 18mo 31 intervention and 7 MATCHED control communities 5859 children verbal autopsy, surveys	BEFORE EXTENSION (all per 1000) IMR and Child Mort-->POS non-sig Pneumonia IMR/U5MR-->POS sig AFTER EXTENSION TO CONTROLS Immun-->POS sig 5% to 87% Use ORT-->POS ? sig	no baseline mortality estimates, and possible recall bias due to different mortality collection in intervention and controls controls were selected to match rather than randomized, but the criteria were inclusive, and time-trends in development claimed nil Contrasting to Pandey, other cause mortality Time-trends in non-pneumonia mortality nonsig due to sample size

TABLE II.2: CROSS-SECTIONAL STUDIES OF PRIMARY HEALTH CARE EFFECTIVENESS WITH EXTERNAL CONTROL GROUPS

AUTHOR Location/Date	INTERVENTION Type & Duration	STUDY DESIGN Sample Size & Data Collection	INDICATORS AND RESULTS	STUDY CRITIQUE Strengths and Limitations
Christensen,P. (1990) Peru Peri-urban Data 1986	Unpaid and Paid CHW's (3-5 years) -Evaluated 18 mo after end CHW Training Program	POST only cross-sectional survey with CONTROLS RANDOMLY sampled in 3 areas Neither 82 HH, Both 151 HH Paid CHW only 130 HH (20% systematic sample)	(No differences paid CHW vs BOTH) Comparing BOTH to NEITHER ORT Knowl-->POS sig 61% vs 40% ORT Use-->NIL both 21% Prenatal-->POS non-sign 54% vs 40% Imm (child)-->POS sig 67% vs 36% Health Literacy-->POS 'better'	main methods not described confouding by other CHW's working in the area for 5 years small sample size with insufficient power to test hypotheses claimed age, SES, and distance health center equivalent interviewer bias, 23 different interviewers, most of whom were the same health workers assessed
El Tom,A.R. (1989) Sudan Periurban Data 1980-87	Training of Midwives in GOBI-F (3-7 years of implemenation)	PRE & repeated POST cross- sectional surveys with a CONTROL in Pilot and Extensio areas, intervening mini-surveys, and service-based reporting	ORT use-->POS incr 15% to 87% Diarr fluid given-->POS sig 53% to 72% FP Use-->pos sig 10% to 28% (pilot) and POS sig 9% to 27% (extension)	No adjustment for evident time-trends comparing post- in the pilot area to pre- in the extension area No analysis of confounding SES, water, sanitation etc near city, no control for other exposures expensive, supervised by University
Iyun,F. (1989) Nigeria Periurban Data 1987	Hospital-based PHC with monthly outreach clinic Plus Paid CHW's (4 years)	POST cross-sectional survey with CONTROL Cenusus of women age 15-49 1 program and 5 comparison communities	Prenatal-->NEG sig 19-74% vs 65% Rx child-->NIL same as drug pedlars imm (child)-->POS sig 45-90% vs 9% mat TT-->POS sig 60-87% vs 37% FP approve-->POS sig 40-90% vs 30% FP use-->NEG non-sig 4% vs 9%	No information on community selection or comparability No statistical analysis, descriptive cross-tabulation only Program not cost-effective and had decreasing utilization Home visits are mostly to invite people to mobile clinic Education in Baptist Church, underused by Muslim population many alternative health-services, minimal preventive care
Akram,D.S. (1992) Pakistan Urban	Health Education by 10 CHWs to 10 women each (6 months)	(PRE &) POST cross- sectional surveys with ? selection 100 intervention and 100 CONTROL households	morbidity-->POS sig Incidence & Illness management for fever, ARI, and diarrhea-->POS sig	? household selection or comparability of study groups no definition of variables, no numeric results analysis was univariate, and of post- results only ? pre- was only socio-demographic, and post only Knowl
Rashid,A. (1991) Pakistan Urban Data 1990	GOBI-F CHW's plus community mobilization water & sanitation (6 years)	POST cross-sectional survey with CONTROL (2 communities, 165 randomly selected households in each)	Hygiene-->POS sig Diarrhea and disease Knowl-->POS Use of ORT-->POS sig 92% vs 9% Imm (child)--> POS sig (89% vs 42%)	Communities matched on location, occupation & basic services poor comparability in ethnicity, crowding and sanitation significant confounding a water and sanitation project No control of confounders in the analysis Small sample size, ? duration of recall, ? number of live-births

TABLE II.3: CROSS-SECTIONAL STUDIES OF PRIMARY HEALTH CARE EFFECTIVENESS WITH INTERNAL COMPARISON OVER TIME

AUTHOR Location/Date	INTERVENTION Type & Duration	STUDY DESIGN Sample Size & Data Collection	INDICATORS AND RESULTS	STUDY CRITIQUE Strengths and Limitations
Chahnazarian, (1993) and Taylor (1993) Rural Zaire Data 1984-8	CCCD Program* CHW providing Immunization ORT, malaria (4 years)	PRE & POST cross-sectional survey in 6 clusters of 840 women	IMR-->Nil U5MR-->POS sig 7% ORS Use-->POS Imm (measles)-->POS	well designed study which lost its control group due to a change in adminstrative boundaries an early (2yr) survey before control groups was exposed showed no immunization difference
Khun,L. (1990a) South Africa Rural Data 1987 & 1988	1 year GOBI-FFF Systematized CHW Program	PRE & POST cross-sectional surveys 1 year apart -Baseline EPI Cluster Method of 205 children under age 2 -then census of 372 children under 2 in 1259 households	ORT Knowl-->NIL ORT Use-->NIL nutr (Wt/Age)-->NIL FP use-->NIL BF 1YR-->POS sig 65% to 90% Imm (< 2)-->POS nonsig 70% to 76%	No measurement or control for confounding exposures sample size insufficient for nutrition and ORS variables baseline freely translated during interview CHW's did some of the interviewing only positive result is BF, short time and small sample size repeat survey planned for 1 yr later but not reported ? done
Khun (1990b)	SAME STUDY (1 yr intervention)	POST cross-sectional survey with HISTORICAL COHORT ANALYSIS RANDOM Sample	Imm (age 1-2)-->POS sign DPTP -->NEG sig measles BF-->POS med sign (non-parametric)	used the same data as Khun 1990 with a more sophisticated analysis of the two outcomes found to be significant above. Results similar to Khun 1990
Becker,S.R. (1993)	CCCD* (4 years)	PRE & POST cross-sectional cluster surveys	IMR-->pos sig 25% U5MR-->POS sig 32%	No control population no adjustment for secular trends external to the program

APPENDIX III: The Diarrhea Treatment Score Used for Children Suffering Diarrhea in the Last 2 Weeks

This treatment score was developed to measure compliance with diarrhea treatment advice given by the Aga Khan University Community Health Workers.

SCORE	-1	0	1	2
Use of Oral Rehydration Therapy		Never	after 24 hr	before 24 hr
Amount of Fluids Given	much less	less	same	more
Amount of Food/ Breast milk	much less	less	same	more
consultation if no danger signal*		before 3 days	3 to 7 days	after 7 days
consultation if danger signal		none	after 48 hr	before 48 hr
Self Treatment with antibiotic	Yes		No	
Self Treatment with anti-diarrheal	Yes		No	

Total Possible score = 10

* Diarrhea Danger Signals from the World Health Organization Project for the Control of Diarrheal Diseases Manual: [183] blood, persistent vomiting, severe diarrhea, frequent diarrhea , and persistent fever

APPENDIX IV:

THE STUDY QUESTIONNAIRE:

"THE *KATCHI ABADI* HEALTH SURVEY"

PAGE 1 سیکٹر Sector ___ گلی Gully ___ مکان نمبر House Number ___ ___ ___ ___ خاندان Apartment ___

کچی آبادی ہیلتھ سروے (معلومات) تعارفی فارم

KATCHI ABADI HEALTH SURVEY: INTRODUCTION PROFORMA

انٹرویو لینے والے کا نام Interviewer's Name _____

انٹرویو لینے والے کا شناختی حرف Interviewer's ID Letter ___

شناختی حرف ___

سپروائزر کا نام (موجود) Supervisor's Name (if present) _____

سپروائزر کا شناختی حرف Supervisor's ID ___

شناختی حرف ___

وزٹ کی تاریخ Date of Visit

پہلا وزٹ FIRST VISIT ___ (date) ___ (month) مہینہ تاریخ

دوسرا وزٹ SECOND VISIT ___ (date) ___ (month) مہینہ تاریخ

تیسرا وزٹ THIRD VISIT ___ (date) ___ (month) مہینہ تاریخ

علاقہ معائنہ

11 Area of the house (OBSERVE) ☐

اعظم بستی 1 Azam Basti

اختر کالونی 2 Akhter Colony

مشاہدہ کریں کہ گھر خالی ہے اگر آج کوئی گھر پر نہیں ہے

12a. IF NOBODY IS HOME TODAY----------> Does the house look vacant (OBSERVE) ☐

ہاں 1 Yes

نہیں 2 No

اگلے گھر پر جائیں

—> MOVE ON TO THE NEXT HOUSE

اگر کوئی گھر پر ہے تو پوچھیں کہ اس گھر میں کتنے خاندان رہتے ہیں

12b IF SOMEONE IS HOME, ask how many households are there in this building (defined by shared kitchen)? ___ (households)

اگر ایک سے زائد خاندان آباد ہیں تو ہر ایک کا معلومات کا فارم الگ الگ بھریں (اور اس پر A,B,C ڈالدیں)

—> IF MORE THAN ONE, THEN FILL IN ONE INTRODUCTION PROFORMA FOR EACH HOUSEHOLD, LABELLING THEM AS APARTMENTS ABOVE WITH LETTERS A,B,C,D

خاندان کتنے عرصے سے اس علاقے میں رہ رہا ہے (اختر کالونی/اعظم بستی)

13 How long has the family lived in (PICK ONE of Azam Basti/Akhtar Colony)? ___ ___ (completed years)

اگر رہائش کا عرصہ ایک سال سے کم ہے تو شکریہ ادا کریں اور انٹرویو ختم کریں۔

—> IF LESS THAN 1 YEAR, THEN THANK THE PERSON, AND END THE INTERVIEW.

میں گھر کے اس فرد سے بات کرنا چاہتی ہوں جو بچے کی دیکھ بھال کرتا ہو۔

I am interested speaking with the main care-givers of children in the household

کیا کوئی اور خاتون جنکی عمر پچپن سال سے کم ہو وہ گھر پر ہیں

Is she home, or is any other woman under the age of 55 home?

اگر بچہ کی دیکھ بھال کرنے والی خاتون گھر پر موجود نہیں ہے یا اس کے پاس ابھی وقت نہیں ہے تو ہم کب دوبارہ انٹرویو کرنے کے لئے واپس آئیں

If the woman or caregiver is not present today, ask when is the best time for us to return?

واپسی کا وقت بتایا گیا

SUGGESTED RETURN TIME

پہلا وزٹ FIRST VISIT	تاریخ Date _____	وقت Time _____
دوسرا وزٹ SECOND VISIT	تاریخ Date _____	وقت Time _____
تیسرا وزٹ THIRD VISIT	تاریخ Date _____	وقت Time _____

PAGE 2 Sector ___ Gully ___ House Number ___ ___ ___ ___ Apartment ___

14 If the woman or caregiver is present----------> (OBSERVE) Is she/he able to communicate in Urdu?

1 Yes ----------> READ THE INTRODUCTION TO HER/HIM

2 No

15 Can someone else in the house communicate in Urdu?

2 No ----------> THANK THE PERSON AND END THE INTERVIEW

1 Yes----------> CONTINUE THE INTERVIEW WITH HIM OR HER

READ THE FOLLOWING INTRODUCTION TO ALL WOMEN UNDER 35, OR CAREGIVERS WHO ARE FLUENT IN URDU

I am here today as part of a joint Canadian and Aga Khan University project called the Katchi Abadi Health Survey. The survey aims to obtain information about the health, health care and living conditions of mothers and children in Karachi katchi abadis. You will be asked a series of questions, and then any children under 5 will be weighed and measured. All information will be kept completely confidential. This means that your name and what you say will not be given to anyone, nor will they not appear in any report. Information collected from you, will be combined with information from the whole community for report. The survey forms will be kept in a safe locked place. (Azam Basti/Akhtar Colony) has been chosen to be representative of a number of katchi abadis, so participation of the whole community is important. Your usual health care will not be affected by answering or refusing to answer the questions. I would be very grateful if you would participate in the survey, but you need not do so. You have the right to refuse the interview, any specific questions, or to stop the interview at any time. No more than one hour of your time is needed. Are you willing to participate?

16 Does the person agree to participate?

2. No ----> END THE INTERVIEW

1 Yes

Is this a good time to talk? If not when would be best for me to return?

THEN FILL IN RETURN TIME ON PAGE 1, AND MOVE ON TO THE NEXT HOUSE

18 What is your religion?

1 Muslim
2 Christian
3. Hindu
88 Other (specify)_____

19 What is the main language spoken in the home?

1 Urdu
2. Baluchi
3. Sindhi
4 Punjabi
5 Pushto
6 Saraiki
7 Kalchi/Gujarati
8. Hindko
88 Other(specify)_____

PAGE 3 Sector ___ Gully ___ House Number ___ Apartment ___

خاندان — گھر نمبر — گلی — سیکٹر

HOUSEHOLD INFORMATION TABLE

گھرانے کے متعلق معلومات کا گوشوارہ

جواب دہندہ گھرانے کا ایسا فرد ہو جو ایک سال سے زائد عرصے سے رہ رہا ہو۔
To be asked of the main respondent in families present more than 1 year

HH1 How many persons usually live in this household? — اس گھرانے میں عموماً کتنے افراد رہتے ہیں۔ — افراد (persons)

Can you tell me about each person in the household (circle the respondent)? — کیا آپ گھر کے ہر فرد کے بارے میں بتا سکتی ہیں۔

FILL IN CHART — چارٹ مکمل کریں۔

ID نمبر شمار	Name نام	Relation رشتہ	Sex جنس	Age عمر	Duration (years) سال/ماہ/دن	For all above age 15 — 15 سال سے زائد عمر کے افراد کے لیے				Form فارم
						Marital Status ازدواجی حیثیت	Literacy خواندگی	Employment روزگار کی نوعیت	Occupation پیشہ	
1										
2										
3										
4										
5										
6										
7										
8										
9										
10										
11										
12										

Relation رشتہ — خاندان کا سربراہ 1 Head of household; شوہر/بیوی 2 Wife/Husband; ماں/باپ 3 Mother/father; ساس/سسر 4 Father-in-law/mother-in-law; داماد/بہو 5 Son-in-law/daughter-in-law; بیٹا/بیٹی 6 Son/Daughter; پوتا/نواسا/پوتی/نواسی 7 Grandson/granddaughter; دوسرے عزیز 8 Other relative; غیر افراد جیسے دوست وغیرہ 9 Non-relative

Sex جنس — 1 Male مرد/آدمی; 2 Female عورت/لڑکی

Duration: How long has the person themselves lived in Azam Basti/Akhter Colony (code in completed years) — آپ بذات خود اس علاقے میں کتنے عرصے سے رہ رہی ہیں؟ دورانیہ

Marital Status ازدواجی حیثیت — 1 Never-Married غیر شادی شدہ; 2 Currently-Married شادی شدہ; 3 Divorced/Separated علیحدگی شدہ/طلاق یافتہ; 4 Widowed بیوہ/رنڈوا

Literacy خواندگی — 1 Can read newspaper & write a letter اخبار پڑھ سکتا ہو۔ خط لکھ سکتا ہو; 2 Can only read newspaper صرف اخبار پڑھ سکتا ہو; 3 Cannot read or write نہ پڑھ سکتا ہو/نہ لکھ سکتا ہو

Employment: Does the person work for pay or profit inside or outside the home? — کیا کوئی فرد گھر کے اندر یا باہر منافع کمانے کی غرض سے کام کرتا ہے؟ روزگار کی نوعیت

1 Yes ہاں; 2 No نہیں

Occupation پیشہ — If employed, write main occupation — اگر برسرروزگار ہو تو اس کا پیشہ

HH2. Are there any ever married women under 55 who have lived in the household more than 1 year? — پچپن سال سے کم عمر کی شادی شدہ عورت جو ایک سال سے زائد عرصے سے یہاں رہ رہی ہو

1. Yes → put in an (X) in the chart and fill in a caregiver proforma for each ever married woman under 55 — اگر ہاں تو (X) کا نشان لگا کر نگہداشت کنندہ کا فارم ہر ایسی پچپن سال سے کم عمر شادی شدہ عورت کے لیے بھریں۔

2 No →

HH3 Are there any children under 5 who have lived in the household more than 1 year? — کیا اس گھر میں عرصہ ایک سال سے ماں کی نگہداشت کے بغیر پانچ سال سے کم عمر بچے موجود ہے؟

1 Yes → put (XX) in the chart and fill in the caregiver proforma with the children's main caregiver — اگر ہاں تو بچہ کی نگہداشت کا فارم (XX) لگا کر بھریں۔

2 No → — نہیں

سیکٹر SECTOR __ گلی GULLY __ __ گھرانہ کا نمبر HOUSE NUMBER __ __ __ __ API __

KATCHI ABADI HEALTH SURVEY: CAREGIVER (CG) PROFORMA

پانچ سال سے کم عمر بچوں کی نگہداشت کرنے والے اہم فرد کے لیے For main caregiver of children under 5 یا پچپن سال سے کم عمر پر شادی شدہ عورت کے لئے For each ever-married women < 55 years old OR

جواب دھندہ کا شناختی نمبر گھرانے کی معلومات کے گوشوارے سے دیکھ کر لکھیں
Respondent's ID from Household Information Table ____ نمبر (number)

جواب دھندہ کا نام
Respondent's Name _____

انٹرویو لینے والے کا شناختی نمبر
Interviewer's ID Letter __ نمبر (letter)

انٹرویو لینے والے کا نام
Interviewer's Name _____

سپروائزر کا شناختی نمبر
Supervisor's ID Letter __ نمبر (letter)

سپروائزر کا نام (موجودہ)
Supervisor's Name (if present) _____

انٹرویو کی تاریخ
Date of interview _____ تاریخ (date) _____ ماہ (month)

سوال نمبر CG2 پر جائیں

CG1 IF AGE DIRECTLY ASKED BEFORE ——> SKIP TO CG2 ——> اگر عمر براہ راست پوچھی ہے

IF AGE NOT DIRECTLY ASKED BEFORE, ASK what is your age? اگر پہلے عمر براہ راست نہیں پوچھی ہے تو پوچھیں کہ آپکی عمر کیا ہے؟ __ __ سال (years)

CG2. What is your relationship to children under age 5 in the household? اس گھرانے میں آپ کا بچہ / بچی سے کیا رشتہ ہے؟ ☐

1. Mother ماں
2. Father باپ
3. Grandmother دادی - نانی
4. Grandfather دادا - نانا
5. Aunt عمائی - چچی - خالہ - پھوپھی
6. Uncle ماموں - چچا - خالو - پھوپھا
7. Sister بہن
8. Brother بھائی
88. Other (specify) کوئی اور وضاحت _____

سوال نمبر CG9 پر جائیں

IF RESPONDENT IS NOT A WOMAN UNDER 55 ——> SKIP TO QUESTION CG9 اگر جواب دھندہ پچپن سال سے کم عمر عورت نہیں ہے

CG3. At what age were you married (if married more that once, pick first marriage)? شادی کے وقت آپکی عمر کیا تھی؟ اگر ایک سے زائد مرتبہ شادی ہوئی ہو؟ پہلی شادی کے وقت آپکی عمر کیا تھی؟ __ __ سال (years)

CG4 How many years were you/have you been married? آپ کی شادی کو کتنے سال ہو گئے ہیں؟ __ __ سال (years)

CG5. Have you been pregnant in the last 5 years? کیا آپ پچھلے پانچ سالوں میں حاملہ ہوئیں؟ ☐

1 Yes ——> SKIP TO QUESTION CG7 سوال نمبر CG7 پر جائیں ہاں

2 No نہیں

CG6. Are you the caregiver for any children under 5, whose mother is not resident or alive? کیا آپ پانچ سال سے کم عمر بچوں کی نگہداشت کرتی ہیں جنکی ماں زندہ نہیں ہے یا گھر پر موجود نہیں ہے یا یہاں رہتی نہیں ہیں ☐

1. Yes —> SKIP TO QUESTION CG9 سوال نمبر CG9 پر جائیں ہاں

2. No —> END THE INTERVIEW انٹرویو ختم کر دیں نہیں

CG7. How many years of schooling have you completed? آپ نے کس درجہ تک تعلیم حاصل کی؟ (99=Don't know) معلوم نہیں __ __ سال (years)

سیکٹر گلی گھر کا نمبر
SECTOR __ GULLY __ __ HOUSE NUMBER __ __ __ __ APT __

CG8 How many years of schooling did your husband complete? آپ کے شوہر نے کس درجہ تک تعلیم حاصل کی؟ معلوم نہیں (99=Don't Know) سال __ __ (years)

CG9 Could you please find growth cards and immunization cards for each child under 5, if they exist. کیا آپ مجھے اپنے ہر اُس بچے کا جو پانچ سال سے کم عمر کا ہے اُس کا نشوونما کا کارڈ اور حفاظتی ٹیکوں کا کارڈ دکھانا پسند کریں گی؟ اگر موجود ہے تو

I will talk about diarrhea often during this survey. What I mean by diarrhea is 3 or more loose or watery stools in a 24 hour period. اس سروے میں آپ سے ڈائریا (دستوں کی بیماری) کے بارے میں بات کروں گی (ڈائریا) دستوں کی بیماری سے میری مراد آپ دن کے اندر تین یا اُس سے زیادہ پتلی جیسے پتلے پاخانے (دست) ہے

CG10 If your child has diarrhea, compared to usual, how much fluid or breast milk do you try to give him/her? اگر آپ کے بچے کو دست ہو رہے ہوں تو آپ عام حالت کے مقابلے میں اُس کو کتنا پینے کو دینے کی کوشش کرتی ہیں یا اپنا دودھ پلانے کی کوشش کرتی ہیں

1 Much Less بہت کم مقدار
2 Less کم مقدار
3 Same اتنی ہی مقدار
4 More زیادہ مقدار

CG11 If your child has diarrhea, compared to usual, how much food do you try to give him/her? اگر آپ کے بچے کو دست ہو رہے ہوں تو آپ عام حالت کے مقابلے میں اُس کو کتنا کھانے کو یعنی (ٹھوس غذا) دینے کی کوشش کرتی ہیں

1 Much Less بہت کم مقدار
2 Less کم مقدار
3 Same اتنی ہی مقدار
4 More زیادہ مقدار

CG12 Once your child's diarrhea has stopped, compared to usual, how much food do you try to give him/her? جب آپ کے بچے کے دست بند ہو جائیں تو آپ عام حالت کے مقابلے میں اُس کو کتنا کھانے کو دینے کی کوشش کرتی ہیں

1 Much Less بہت کم مقدار
2 Less کم مقدار
3 Same اتنی ہی مقدار
4 More زیادہ مقدار

CG13 If your child has diarrhea, what symptoms typically lead you to consult a doctor or health worker? اگر آپ کے بچے کو دست ہو رہے ہوں تو آپ کو کن علامات ظاہر ہونے پر یعنی کس حالت میں بچے کو ڈاکٹر یا حفاظتی ورکر کے پاس لے جائیں گی

Write ALL spontaneous answers یہ تمام جوابات لکھیں جو آپ خود بتائیں

Which of these other symptoms would make you consult a doctor or nurse? PROMPT THE LIST نیچے دی ہوئی لسٹ میں سے پوچھیں کہ آپ ان میں سے کن علامات کے ظاہر ہونے پر ڈاکٹر یا نرس سے رجوع کریں گی

a)	The child has many watery stools	بچے کو پانی جیسے بے شمار دست ہو رہے ہوں a)
b)	The child vomits persistently	بچہ مستقل الٹیاں کر رہا ہو۔ b)
c)	The child complains of thirst	بچہ بہت پیاسا ہو رہا ہو۔ c)
d)	The child does not eating or drinking well	بچہ ٹھیک طریقے سے کھا پی نہ رہا ہو۔ d)
e)	The child has a fever for more than one day	بچے کو ایک دن سے زیادہ بخار ہو۔ e)
f)	There is blood in stool	بچے کی پاخانے میں خون آ رہا ہو۔ f)
g)	The child gets sicker with time.	بچے کی حالت بگڑ رہی ہو g)

متفق 1. agrees
غیر متفق 2. disagrees
معلوم نہیں۔ غیر یقینی 99. Don't know/unsure
خود بتا چکی ہیں 3 said before

سیکٹر ___ گلی ___ ___ گھر/رہنہ کا نمبر SECTOR ___ GULLY ___ ___ HOUSE NUMBER ___ ___ ___ ___ APT ___

آپ کو دست کے علاج کے بارے میں زیادہ تر معلومات کہاں سے حاصل ہوئیں؟
CG14 Who has been your main source of information on how to treat diarrhea?

صرف ایک لکھیں
Write ONE only ___

نیچے دی ہوئی لسٹ میں سے پوچھیں کہ دست کے علاج کے بارے میں معلومات کا اور کون سا ذریعہ ہے۔
Who else has been a source of information on how to treat diarrhea? PROMPT THE LIST

a) friends or family	سہیلی یا خاندان کا کوئی فرد	a) ☐
b) hakim or homeopath	حکیم یا ہومیوپیتھ	b) ☐
c) pir or faquir	پیر یا فقیر	c) ☐
d) chemist	کیمسٹ	d) ☐
e) Aga Khan Hospital health worker	آغا خان ہسپتال ہیلتھ ورکر	e) ☐
f) other health worker (specify) ___	دوسرے ہیلتھ ورکر (وضاحت)	f) ☐
g) Aga Khan Hospital doctor or nurse	آغا خان ہسپتال کا ڈاکٹر یا نرس	g) ☐
h) other doctor or nurse	کوئی اور ڈاکٹر یا نرس	h) ☐
i) radio or TV	ریڈیو اور ٹی وی	i) ☐
j) newspaper or magazine	اخبار اور رسائل	j) ☐

ہاں 1 Yes | نہیں 2 No | پہلے بتایا 3 said before

بچے کو کتنے ماہ کی عمر سے حفاظتی ٹیکے لگنے چاہئے؟
CG15. At what age should a child begin vaccinations? ___ ___ (days) ___ ___ (months) معلوم نہیں (99=Don't Know)

بچے کو کتنی ماہ کی عمر میں خسرہ کا ٹیکہ لگنا چاہئے؟
CG16 At what age should a child be vaccinated against measles? ___ ___ (months) معلوم نہیں (99=Don't Know)

آپ پچھلے تین مہینوں کے بارے میں سوچیں۔ اکتوبر۔ نومبر۔ دسمبر 1993
CG17. Think back to the months of October, November, and December 93

ان مہینوں میں کتنی مرتبہ آپ کے گھر کوئی ہیلتھ ورکر آیا ہے
How often did a health educator/health worker come to your home? ___ (number) نمبر (تعداد)

سیکٹر ___ گلی ___ ___ گھر/مکان کا نمبر ___ ___ ___ ___ APT ___

SECTOR ___ GULLY ___ ___ HOUSE NUMBER ___ ___ ___ ___ APT ___

کیا آپ نے کبھی ایسی میٹنگ میں شرکت کی ہے جہاں ہیلتھ ورکر صحت کے بارے میں معلومات دے

CG18 Have you ever attended a meeting where a health worker educates a group of people about health?

☐

نہیں 2 No ——> SKIP TO QUESTION CG21 سوال نمبر CG21 پر جائیں

ہاں 1 Yes

اگر ہاں تو پچھلے آخری تین مہینے دسمبر ۱۹۹۶ میں آپ نے کتنی مرتبہ میٹنگ میں شرکت کی ہے (تعداد لکھیں)

CG19 If yes, how often in October, November and December did you attend the meetings

___ نمبر (تعداد) number

یہ میٹنگ کن لوگوں نے کرائی تھی؟

CG20 Who conducted the meetings?

☐

آغا خان سینٹر 1 Aga Khan Clinic

کوئی دوسری وضاحت 88 Other (specify)_____

معلوم نہیں 99 'Don't know

پانچ سال سے کم عمر کے بچے کا ایک صحت کا فارم بھریں

CG21 IF RESPONDENT IS NOT A MARRIED WOMAN UNDER 55 ——> FILL IN ONE CHILD HEALTH PROFORMA FOR EACH CHILD UNDER 5

اگر جواب دہندہ کم عمر شادی شدہ اور پچپن سال سے کم عمر ہے

کیا آپ نے کبھی خاندانی منصوبہ بندی کے طریقوں کے بارے میں سنا ہے (مانع حمل اور وقفے کے بارے میں بتائیں)

CG22 Have you heard of any family planning methods? (EXPLAIN methods to avoid pregnancy, or to space births)?

کیا آپ وہ طریقے بتا سکتی ہیں جو آپ کو معلوم ہیں (سارے لکھیں جو وہ خود بتائیں)

Can you please list the methods you know? Write ALL spontaneous_____

_____

_____

جیسے دی ہوئی لسٹ میں سے پوچھیں کہ آپ نے ان میں سے اور کن طریقوں کے بارے میں سنا ہوا ہے

Which of these other methods have you heard of? PROMPT THE LIST

☐	a) Pill	a) خاندانی منصوبہ بندی کی گولیاں
☐	b) Injection	b) خاندانی منصوبہ بندی کا انجکشن
☐	c) IUCD	c) نسوانی چھلہ
☐	d) Condom	d) کنڈوم (مرد کا مذکر) خول
☐	e) Withdrawal/Rhythm	e) عین وقت پر علیحدگی
☐	f) Female sterilization (tubal ligation)	f) عورت کا بچے بند کرنے کا آپریشن
☐	g) Male sterilization (vasectomy)	g) مرد کا نس بندی کا آپریشن

ہاں 1. Yes نہیں 2. No خود بتا چکی ہیں 3. said before

اگر خاندانی منصوبہ بندی کے طریقہ نہیں جانتی تو

If NO family planning methods known ——> SKIP TO PREGNANCY HISTORY PROFORMA حملوں کی تاریخ کے فارم پر جائیں

گھرانے کا نمبر گلی سیکٹر
SECTOR __ GULLY __ __ HOUSE NUMBER __ __ __ __ APT __

CG23 If ANY family planning methods known ——> ASK who has been your main source of information on family planning?

اگر خاندانی منصوبہ بندی کے بارے میں جانتی ہیں ← تو آپ کے لیے خاندانی منصوبہ بندی کی معلومات کا اہم ذریعہ کیا ہے

صرف ایک لکھیں
Write ONE only_____

پھر دی ہوئی لسٹ میں سے پوچھیں کہ خاندانی منصوبہ بندی کے بارے میں معلومات کا اور کون سا ذریعہ ہے؟

Who else has been a source of information on family planning? PROMPT THE LIST.

a) friends or family	سہیلی یا خاندان کا دوسرا فرد	a) ☐
b) hakim or homeopath	حکیم / ہومیوپیتھ	b) ☐
c) chemist	کیمسٹ	c) ☐
d) Aga Khan health worker	آغا خان ہیلتھ ورکر	d) ☐
e) Family Planning worker (specify)_____	خاندانی منصوبہ بندی ورکر (کوئی اور صفات)	e) ☐
f) Aga Khan doctor or nurse	آغا خان کا ڈاکٹر - نرس	f) ☐
g) other doctor or nurse	کوئی دوسرا ڈاکٹر - نرس	g) ☐
h) radio or TV	ریڈیو یا ٹی وی	h) ☐
i) newspaper or magazine	اخبار اور رسائل	i) ☐

ہاں 1. Yes — نہیں 2. No — خود پہلے سے بتا چکی ہیں 3. said before

کیا آپ نے کبھی خاندانی منصوبہ بندی کے طریقہ استعمال کیے ہیں
CG24. Have you ever used a family planning method? ☐

نہیں 2. No——> سوال نمبر 26 ہاں پوچھیں SKIP TO QUESTION CG26

ہاں 1. Yes

کیا آپ آجکل کوئی خاندانی منصوبہ بندی کا طریقہ مستقل طور پر استعمال کر رہی ہیں
CG25. Are you now using any family planning method regularly? ☐

ہاں 1. Yes ——> سوال نمبر 28 ہاں پوچھیں SKIP TO QUESTION CG28

نہیں 2. No

کیا آپ آجکل حاملہ ہیں
CG26. Are you now pregnant? ☐

ہاں 1. Yes——> حملوں کی تفصیل معلوم کریں SKIP TO PREGNANCY HISTORY PROFORMA

نہیں 2. No حمل کا فارم بھریں

گھرانہ نمبر گلی سیکٹر
SECTOR __ GULLY __ __ HOUSE NUMBER __ __ __ __ API __

کیا آپ نے یا آپکے شوہر نے بچے بند کرانے کا آپریشن کروایا ہے۔
CG27 Have you or your husband had the sterilization operation?

ہاں
1 Yes ——> SKIP TO QUESTION CG29 سوال نمبر 29 پر جائیں

نہیں
2 No ——> SKIP TO PREGNANCY HISTORY PROFORMA حمل کی تفصیل کا فارم بھریں

آج کل آپ خاندانی منصوبہ بندی کا کون سا طریقہ کار استعمال کر رہی ہیں (ایک جواب بتائیں)
CG28 Which method of family planning are you currently using (one answer, do not prompt)?

1 Pill خاندانی منصوبہ بندی کی گولیاں
2 Injection خاندانی منصوبہ بندی کے انجکشن
0 None کوئی بھی نہیں
3 IUCD لوپ
4 Condom/Foam کنڈوم (رکاوٹ کا طریقہ) فوم
5 Withdrawal عین وقت پر علیحدگی
6 Female sterilization (tubligation) عورت کے بچے بند کرانے کا آپریشن
7 Male sterilization (Vasectomy) مرد کا نس بندی کا آپریشن
88 Other (specify)_____ کوئی اور وضاحت

آپ کتنے عرصہ سے مستقل یہ طریقہ استعمال کر رہی ہیں
بچے بند کرانے کا آپریشن کتنے عرصے پہلے کروایا تھا
CG29 How long have you been continually using this method/ how long ago was the surgery? __ __ (months) OR __ __ (years) مہینے سال

خاندانی منصوبہ بندی کی چیزوں کی خرید کا اہم ذریعہ کیا ہے
CG30 What is your main source of family planning supplies?

1 Aga Khan Center آغا خان سینٹر
2 Other Clinic کوئی اور کلینک
3 Government Hospital or Clinic سرکاری ہسپتال / کلینک
4 Private Doctor پرائیویٹ ڈاکٹر
5 Chemist کیمسٹ
88 Other (specify)_____ کوئی اور وضاحت

——> MOVE ON TO PREGNANCY HISTORY PROFORMA حمل کا فارم بھریں

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SECTOR __ GULLY __ __ HOUSE NUMBER __ __ __ __ APT __

سیکٹر گلی گھر نمبر

حملوں کی تفصیل کا فارم

PREGNANCY HISTORY PROFORMA

ان خواتین کے لیے جو پچھلے ۵ سالوں میں حاملہ ہوئی ہیں

for women who have been pregnant during the last 5 years

جواب دہندہ کا نام نمبر شمار گھرانے کے افراد کے گوشوارے سے لکھیں

Respondent's number from Household Identification Table — نمبر شمار (Number)

اگلے حصے میں آپ سے آپ کے تمام حملوں کے بارے میں ... پوچھوں گی

I will now ask questions on all of your pregnancies including ones which ended in a stillbirth or miscarriage

اگر آپ حاملہ ہیں تو کتنے مہینوں کے حمل سے ہیں

PH1 If pregnant now, how many months pregnant are you? — نمبر شمار (months)

آپ کا سب سے چھوٹا بچہ کتنے سال کا ہے اس کے بعد آپ حاملہ ہوئیں اگر ہوئیں تو کتنی بار

How old is your youngest child? How many pregnancies you have had after that? — FILL IN TABLE FOR ALL PREGNANCIES

تمام حملوں کی تفصیل گوشوارے میں لکھیں

Preg No حمل کا نمبر	Date of Delivery زچگی کی تاریخ Y سال	M ماہ	D تاریخ	Months Pregnant حمل کا دورانیہ (مہینوں میں)	Outcome حمل کا نتیجہ	Sex جنس	Alive بچہ/بچی زندہ ہے	Age now or when died موجودہ عمر یا وفات پر عمر Y سال	M ماہ	دن	Name بچہ/بچی کا نام	Age 1989-94 عمر 1989-94
A												
B												
C												
D												
E												
F												
G												
H												
I												
J												
K												
L												

زچگی کی تاریخ — حمل کا اختتام کب ہوا

Date of Delivery When did the pregnancy end?

CODE Y Year M Month D Day. If child is under 5 code as accurately as possible using the local events calendar

کوڈ: سال، ماہ، تاریخ۔ اگر بچے کی عمر پانچ سال سے کم ہے تو مقامی واقعات کیلنڈر کا استعمال کرتے ہوئے ٹھیک ٹھیک لکھیں

حمل کا دورانیہ (مہینوں میں) — حمل کے کونسے مہینے میں حمل کا اختتام ہوا — کوڈ: مکمل مہینے

Months Pregnant At how many months of pregnancy did the pregnancy end? CODE Completed months

حمل کا نتیجہ — حمل کا نتیجہ کیا تھا

Outcome What was the Outcome of the pregnancy?

کوڈ: حمل ضائع ہو گیا — مردہ پیدائش — آخری حمل کے بارے میں پوچھیں

CODE → 1 Abortion/Miscarriage OR 2 Stillbirth → ASK LAST PREGNANCY

زندہ پیدائش — جاری رکھیں

3 Livebirth → CONTINUE

جنس — بچہ/بچی کی جنس کیا ہے — کوڈ: لڑکا، لڑکی، نہیں معلوم

Sex What is the sex of the child? CODE 1 male 2 female 99 Don't know

زندہ ہے — بچہ/بچی زندہ ہے — کوڈ: ہاں، نہیں

Alive Is the child alive? CODE 1 Yes 2 No

عمر — بچہ/بچی زندہ ہے تو اس کی ... اگر انتقال ہو گیا ہے تو وفات کے وقت کیا عمر تھی۔ کوڈ: تاریخ، ماہ یا سال، ماہ

Age If the child is alive, what is the age? If child has died, age at death? CODE If < 1 month D days, otherwise M Months & Y Years

نام — اگر بچہ زندہ ہے تو اس کا نام اردو میں لکھیں

Name If alive, what is the name of the child? Write in Urdu

جب حملوں کی تفصیل مکمل ہو جائے تو ہر اس بچے کے نام کے آگے (×) کا نشان لگائیں جو ۵ سال سے کم عمر ہے اور ہر ایک کا صحت کا فارم بھریں

<5* WHEN THE PREGNANCY HISTORY IS COMPLETE. FOR EACH CHILD UNDER 5 (BORN 1989-1994) → PUT AN (X). THEN FILL IN ONE CHILD HEALTH PROFORMA

FOR THE MOST RECENT COMPLETED PREGNANCY (LIVEBIRTH OR STILLBIRTH), FILL IN MOST RECENT PREGNANCY PROFORMA

سب سے آخری مکمل حمل کے بارے میں تفصیلات معلوم کریں چاہے وہ (مردہ پیدائش ہو یا زندہ پیدائش) آخری حمل کے فارم میں لکھیں

PAGE 8 SECTOR ___ GULLY ___ ___ HOUSE NUMBER ___ ___ ___ APT ___

سب سے آخری مکمل حمل کا فارم
MOST RECENT COMPLETED PREGNANCY PROFORMA

سب سے آخری حمل کے بارے میں پوچھیں چاہے وہ مردہ پیدائش ہو یا زندہ پیدائش ہو۔

For the ONE most recent completed pregnancy (LIVEBIRTH OR STILLBIRTH)

بچے کا نام (اگر زندہ پیدا ہوا تھا) Child's Name_____

نشاندہی نمبر معلومات گوشوارے سے دیکھ کر لکھیں & ID Number from Household Information Table

نمبر ___ (ID number)

اگر بچہ مر گیا یا مردہ پیدا ہوا ہے تو حمل کی تفصیل کے فارم میں سے اس کا نمبر شمار دیکھ کر لکھیں

حمل کا نشاندہی نمبر

IF THE CHILD HAS DIED, OR MISCARRIED, put Pregnancy LETTER from the Pregnancy History Table ___ (Pregnancy ID letter)

کیا آپ آخری حمل کے دوران معائنہ کیلئے گئی تھیں

MRP1 Did you go for pregnancy checks during your last pregnancy? ☐

نہیں 2. No ----------> SKIP TO QUESTION MRP6 سوال نمبر MRP6 پر جائیں

ہاں 1. Yes

اگر ہاں تو معائنہ کی وجہ کیا تھی پوچھیں:

MRP2 If yes, did you go PROMPT_____? ☐

کیونکہ صحت کا مسئلہ تھا 1. Because of a health problem

صحت کے مسائل سے بچاؤ کیلئے 2. To prevent health problems

کوئی اور وضاحت 88. Other (specify)_____

نہیں معلوم 99. Don't Know

حمل کے دوران کس سے معائنہ کرایا تھا؟

MRP3. From whom did you get pregnancy checks? ☐

دائی 1. Dai

آغا خان سینٹر 2. Aga Khan Center

کوئی اور مڈوائف (مدد اکنف) 3. Other midwife

کوئی اور نرس 4. Other Nurse

دوسرا ڈاکٹر 5. Other Doctor

کوئی اور وضاحت 88. Other (specify)_____

حمل کے کونسے مہینے میں آپ پہلی مرتبہ طبی معائنے کے لیے گئی تھیں

MRP4. In which month of pregnancy did you first go for a check? معلوم نہیں (99=Don't Know) مہینے ___ (months)

آپ کتنی مرتبہ گئی تھیں

MRP5. How many times did you go? معلوم نہیں (99=Don't Know) تعداد شمار ___ ___ (number)

زچگی کہاں ہوئی تھیں

MRP6. Where did the delivery take place? ☐

گھر پر 1. home

میٹرنٹی ہوم یا کلینک 2. maternity home or clinic

ہسپتال 3. hospital

کوئی اور وضاحت 88. Other (specify)_____

SECTOR __ GULLY __ __ HOUSE NUMBER __ __ __ __ APT __

MRP7 Who attended the delivery?

1 No-one — کسی نے نہیں
2 Friend/Relative — سہیلی / رشتہ دار
3 Dai — دائی
4 midwife — مڈوائف
5 Nurse — نرس
6 Doctor — ڈاکٹر
88 Other (specify)_____ — کوئی اور وضاحت

MRP8. I am specifically interested in the tetanus (TT, *tashanuj*) injection. Did you have one in your last pregnancy?

2 No ——> SKIP TO QUESTION MRP10 — نہیں — سوال نمبر MRP10 پر جائیں

1 Yes — ہاں

MRP9 If yes, how many TT injections did you have in your last pregnancy? — (99= Don't know) — معلوم نہیں — __ (number) — تعداد

MRP10. In the last 5 years, how many TT injections shots have you had in total? — (99=Don't know) — معلوم نہیں — __ (number) — تعداد

MRP11. Did you give the baby colostrum (*Kees, pahile dudh gara dudh*)?

1 Yes — ہاں
2 No — نہیں
99 Don't know — معلوم نہیں

MRP12. At what age did you stop breast feeding? (77=still breast feeding) — __ __ (days) — دنوں میں — __ __ (months) — مہینوں

MRP13. At what age did you first give the child any fluids? (77=Not yet fed fluids) — __ __ (days) — دنوں میں — __ __ (months) — مہینوں

MRP14. At what age did you first give the child solid food? (77=Not yet fed solid food) — __ __ (days) — دنوں میں — __ __ (months) — مہینوں

IF CHILDREN UNDER 5 LIVE IN THE HOUSE——> FILL IN ONE CHILD HEALTH PROFORMA FOR EACH

IF NO CHILDREN UNDER 5 LIVE IN THE HOUSE—> MOVE ON TO FAMILY STATUS PROFORMA

سیکٹر گلی گھر کا نمبر
SECTOR __ GULLY ___ HOUSE NUMBER ____ APT __

بچہ / بچی کا صحت کا فارم
CHILD HEALTH PROFORMA

ہر اُس بچے کا بھرنا ہے جو پانچ سال سے کم ہے اور اسکی پیدائش (1989 - 1994) کے درمیان ہو
To be filled out for EACH child in the household under the age of 5 (Born 1989-1994)

بچہ کا نام
Child's Name_____ & ID Number from Household Information Table

شناختی نمبر
___ (ID number)

کیا آپ کے بچے کو کبھی حفاظتی ٹیکے لگے ہیں
CH1 Has your child ever been immunized?

نہیں
2 No-------> SKIP TO QUESTION CH9 سوال نمبر CH9 پر جائیں

ہاں
1 Yes

کیا حفاظتی ٹیکوں کا کورس مکمل ہے
CH2 Is the immunization completed?

ہاں
1 Yes

نہیں
2 No

معلوم نہیں
99 Don't Know

کیا آپ کے پاس بچہ کا حفاظتی ٹیکوں کا کارڈ ہے؟ اگر ہاں کیا آپ مجھے دکھانا پسند کرینگی
CH3 Do you have the child's immunization card? If yes, can you show it to me?

کارڈ دکھایا
1 Shows

نہیں رکھتی ہے
2 Does not have

نہیں مل سکا
3 Cannot find

کیا کبھی بچے کو کوئی حفاظتی ٹیکہ ایسا لگا ہے جو کارڈ میں درج نہیں ہے
CH4a Has the child had any immunizations that are not on the card?

نہیں
2 No-------> SKIP TO CH5 سوال نمبر CH5 پر جائیں

ہاں
1 Yes

کتنے حفاظتی ٹیکے ایسے ہیں جو کارڈ میں درج نہیں ہیں (اگر ہاں) تو
CH4b. If yes, how many immunizations are not entered on the card? (99=Don't know)

معلوم نہیں

تعداد — (number)

اگر کارڈ موجود ہے تو اس میں حفاظتی ٹیکوں کی تفصیل دیکھ کر لکھیں
اگر کارڈ موجود نہیں ہے تو حفاظتی ٹیکوں کی تفصیل بچہ کی ماں سے پوچھ کر لکھیں
CH5 FILL IN THE IMMUNIZATION QUESTIONS FROM THE CARD (OR FROM MOTHERS REPORT IF NOT CARD)

کیا آپ کے بچہ / بچی کو تپ دق سے حفاظت کا پیدائشی ٹیکہ لگا ہے
Has the child had the birth immunization against tuberculosis?

ہاں
1. Yes

نہیں
2 No

گھرانہ کا نمبر گلی سیکٹر

SECTOR __ GULLY __ __ HOUSE NUMBER __ __ __ __ APT __

کیا کبھی آپکے بچہ/بچی کو حفاظتی ٹیکہ انتظوریے جسکے ٹیکے میں (ڈی پی ٹی. ٹیٹنس اور پولیو)

CH6a Has the child had any immunizations with both injections and drops (DPT, tetanus and polio)?

سوال نمبر CH9 پوچھیں

2 No ..... SKIP TO QUESTION CH9

ہاں

1 Yes

اگر ہاں تو کتنی مرتبہ انجکشن اور قطرے ملا کر ایک سا تھ بچہ کو دیے گئے ہیں؟ معلوم نہیں

CH6b If yes, how many of these injections with drops has the child had? (99 = Don't Know) __ (Number) تعداد

کیا آپ کے بچے کو خسرہ سے بچاؤ کا ٹیکہ لگا ہے

CH7 Has the child had measles vaccination?

ہاں	نہیں	معلوم نہیں
1. Yes	2 No	99 Don't Know

کیا آپ کے بچے کو (ڈیڑھ سال کی عمر پر حفاظتی ٹیکہ لگتا ہے (بوسٹر) لگا ہے.

CH8. Has your child had the one and a half year booster immunization?

ہاں	نہیں	معلوم نہیں
1. Yes	2 No	99 Don't Know

کیا آپکے بچہ/بچی کا کبھی ہیلتھ ورکر، نرس، ڈاکٹر نے کبھی وزن کیا ہے.

CH9. Has your child ever been weighed by a health worker, nurse or doctor?

ہاں	نہیں
1. Yes	2. No

کیا آپ کے گھر میں بچہ کی نشوونما کا کارڈ ہے (مہربانی کرکے مجھے دکھائیں)

CH10. Do you have the growth card at home? If yes, please show it to me

کارڈ دکھایا	کارڈ نہیں ہے	کارڈ نہیں مل سکا
1. Shows card	2. No Card	3 Cannot find

اب میں آپ سے چاہوں گی کہ آپ پچھلے آخری تین ماہ اکتوبر، نومبر دسمبر 1993 کے بارے میں سوچیں کہ ان مہینوں میں کتنی دفعہ نرس، یا ہیلتھ ورکر نے آپکے بچہ کا وزن کیا ہے.

CH11. Think about October, November, and December. How many times was your child weighed by a health worker, nurse or doctor?

تعداد __ (number)

اکتوبر، نومبر، دسمبر میں آپ کتنی دفعہ اپنے بچہ کو آغا خان سینٹر لیکر گئی تھیں

CH12. In October, November, and December, how many times did you take your child to the Aga Khan Center?

تعداد __ (number)

کیا یہ بچہ/بچی پچھلے دو ہفتوں کے دوران بیمار ہوا تھا

CH13a. Has this child been ill in the last 2 weeks?

نہیں

2. No ——> SKIP TO QUESTION CH14 سوال نمبر CH14 کو پوچھیں

ہاں

1 Yes

اگر ہاں تو وضاحت

CH13b. If yes, specify illness_____

گھر کا نمبر ___ گلی ___ سیکٹر ___ SECTOR ___ GULLY ___ HOUSE NUMBER ___ APT ___

ڈائریا کی تعریف جسے میں نے آپکو پہلے بتائی ہے اسکو ذہن میں رکھیں۔ کیا پچھلے دو ہفتوں کے دوران آپکے بچے کو ڈائریا ہوا

CH14 Please remember the definition of diarrhea I read earlier. Has the child had diarrhea in the last 2 weeks?

ڈائریا کا فارم بھریں

ہاں
1 Yes ----------> FILL IN DIARRHEA PROFORMA

نہیں
2 No

☐

کیا آپ بچے کو پچھلے دو ہفتوں میں کھانسی یا سانس لینے میں دشواری (سینہ بند) تھا

نہیں ہوئی CH15a Has the child been sick with a cough or breathing difficulty in last 2 weeks?

نہیں
2 No ----> SKIP TO QUESTION CH16

سوال نمبر CH16 پر جائیں

☐

ہاں
1 Yes

اگر ہاں تو کیا پسلی چلنے کی اور تیز سانس کی شکایت تھی

CH15b If yes, did the child have chest indrawing or rapid breathing?

نمونیہ کا فارم بھریں

ہاں
1 Yes ----------> FILL IN PNEUMONIA PROFORMA

نہیں
2 No

سلام نہیں
99 Don't know

☐

بچہ کا نام

CH16 CHILD'S NAME _____

اگر پانچ سال سے کم عمر کے بچے ایک گھر میں ہیں تو ان کا صحت کا فارم پر کریں۔

IF THERE ARE OTHER CHILDREN UNDER 5, THEN FILL IN THEIR CHILD HEALTH PROFORMA

جب تمام فارم بچوں کی صحت کے بھر لیں تو انکا وزن کریں اور قد کی پیمائش کریں

WHEN FINISHED ALL THE CHILD HEALTH PROFORMAS—> DO MEASUREMENTS ON ALL CHILDREN UNDER 5

بچے کی پیمائش

MEASUREMENTS

وزن
CH17 Weight ___ ___ ___ کلوگرام (kilograms)

قد کی پیمائش
CH18 Length/height ___ ___ ___ سینٹی میٹر (centimeters)

☐

پیدائشی ٹیکہ کا نشان
CH19 BCG Scar?

ہاں 1 Yes | نہیں 2. No | غیر یقینی 99. Unsure

صحت کے فارم مکمل کرکے خاندان کی حیثیت کا

WHEN FINISHED ALL CHILDREN UNDER 5, FILL IN FAMILY STATUS PROFORMA

فارم بھریں

سیکٹر گلی گھر/احاطہ کا نمبر

SECTOR ___ GULLY ___ HOUSE NUMBER ___ ___ ___ ___ API ___

ڈائریا کا فارم
DIARRHEA PROFORMA

گھر کے سب سے چھوٹے بچے کے لئے جسے - پچھلے دو ہفتوں میں ڈائریا ہوا ہو

For the youngest child in the household with diarrhea in the last 2 weeks

اگر کسی بچے کو ڈائریا نہیں ہوا تو فارم
یہیں سے آگے بڑھ جائیں

Skip if there is no child with diarrhea

بچہ کا نام

Child's Name_____ & شناختی نمبر معلومات کے گھریلو شوارے سے دیکھ کر لکھیں ID Number from Household Information Table تعداد ___ (ID number) سر شمار

D1. How many days ago did the most recent episode of diarrhea begin? (99= Don't Know) اب سے پہلے کب دست ہونے شروع ہوئے تھے (یعنی آخری مرتبہ) معلوم نہیں ___ ___ (days) دن

D2. Was the diarrhea every day since then? کیا جب سے اب تک دست آتے رہے ہیں ☐

1 Yes ہاں 2 No نہیں

D3. How many days ago was the episode just before this one? (99= Don't Know) اس سے پہلے کب دست ہوئے تھے (یعنی آخری مرتبہ) معلوم نہیں ___ ___ (days) دنوں میں ___ ___ (weeks) ہفتوں میں

D4a. Does the child have recurrent diarrhea? کیا بچے کو بار بار دست ہوتے ہیں ☐

2. No——> SKIP TO QUESTION D5a سوال نمبر D5a پوچھیں نہیں

1. Yes ہاں

D4b. If yes, how often does the child get diarrhea? (99= Don't know) اگر ہاں تو تفصیل معلوم کریں کہ بار بار سے کیا مراد ہے پچھلے مکمل مہینہ میں کتنی دفعہ سال بھر کتنی دفعہ ہوتے ہیں معلوم نہیں ___ ___ (times per month) OR ___ ___ (times per year) ہفتہ میں کتنی بار سال بھر کتنی بار

D5a. Does the child have diarrhea today? کیا بچے کو آج دست ہو رہے ہیں ☐

1. Yes——> SKIP TO QUESTION D6 سوال نمبر D6 پوچھیں ہاں

2. No نہیں

D5b. If no, how many days ago did the diarrhea stop? (99= Don't Know) اگر نہیں تو کتنے دن پہلے دست رُکے ہیں معلوم نہیں ___ ___ (days) دنوں

D6. What is/was the average frequency of diarrhea per day? (99= Don't Know) ایک دن میں اندازاً کتنے دست ہو جاتے ہیں یا تھے معلوم نہیں ___ ___ (stools per day) دن میں کتنے دست

D7. Was the diarrhea severe? کیا دست شدید نوعیت کے تھے ☐

1. Yes ہاں 2 No نہیں 99 Don't know معلوم نہیں

کیا دستوں میں خون تھا؟

D8 Was there any blood in the diarrhea?

1 Yes (ہاں) 2 No (نہیں) 99 Don't know (معلوم نہیں)

کیا دست میں آؤں تھی؟

D9 Was there any mucous in the diarrhea?

1 Yes (ہاں) 2 No (نہیں) 99 Don't know (معلوم نہیں)

کیا بار بار اُلٹی ہوئی تھی

D10 Did the child repeatedly vomit?

1 Yes (ہاں) 2 No (نہیں) 99 Don't know (معلوم نہیں)

پہلے دن کے بعد کیا بچے کو بخار رہا تھا

D11 After the first day, did the child have a fever?

1 Yes (ہاں) 2 No (نہیں) 99 Don't know (معلوم نہیں)

کیا پانی کی کمی کو دور کرنے کے لیے کوئی محلول لیا تھا؟

D12 Did you use any rehydration solution?

2 No (نہیں) ——> SKIP TO QUESTION D16 سوال نمبر D16 پر جائیں

1 Yes (ہاں)

پانی کی کمی کو دور کرنے کے لیے کونسا محلول استعمال کیا تھا؟ پوچھیں

D13 Which type of rehydration solution did you use? PROBE

1 Cereal-based (چاول والا)

2 Packaged salt solution (پیکٹ والا نمکین محلول)

3 Homemade salt solution (گھر کا بنا ہوا نمک چینی کا)

88 Other (specify) (کوئی اور وضاحت) _____

پانی کی کمی دور کرنے کے لیے محلول استعمال کیا تھا تو بیماری کے کونسے دن سے شروع کیا تھا

D14 On which day of the diarrhea was rehydration solution first used?

___ (day of the diarrhea) دست کی بیماری کے دن

کہاں سے لیا تھا؟

پانی کی کمی دور کرنے کے لیے محلول

D15 Where did you get the rehydration solution?

1 Aga Khan Center (آغا خان سینٹر)

2 local chemist or doctor (مقامی کیمسٹ یا ڈاکٹر)

88 other (specify) (کوئی اور وضاحت) _____

عام حالات کے مقابلے میں کتنا سیال دیا تھا

D16 Compared to usual, how much fluid did you give?

1 Much less (بہت کم مقدار)

2 Less (کم مقدار)

3 Same (اتنی ہی مقدار)

4 More (زیادہ مقدار)

گھر کا نمبر گلی سیکٹر
SECTOR __ GULLY __ __ HOUSE NUMBER __ __ __ __ APT __

عام حالات کے مقابلے میں اپنا دودھ کتنا پلا پاتھا؟

D17 Compared to usual, how much did you breast feed?

بہت کم مقدار 1. Much less
کم مقدار 2 Less
اتنی ہی مقدار 3 Same
زیادہ مقدار 4 More
بالکل نہیں پلا پاتھا 5 Not breast feeding

عام حالات کے مقابلے میں کتنی خوراک غذا دی تھی؟

D18 Compared to usual, how much food did you give?

بہت کم مقدار 1 Much less
کم مقدار 2 Less
اتنی ہی مقدار 3. Same
زیادہ مقدار 4 More
بالکل کھانے کو نہیں دیا 5 Not feeding food yet

کیا بیماری میں ڈاکٹر نرس یا صحیلقہ ورکر سے رجوع کیا تھا؟

D19a Did you consult a doctor, nurse or health worker?

نہیں 2 No ------> SKIP TO QUESTION D20 سوال نمبر D20 پوچھیں
ہاں 1 Yes

اگر ہاں تو بیماری کے کس دن دکھایا تھا
D19b. If yes, on which day of the diarrhea did you first consult? معلوم نہیں (99=Don't know)
بیماری کے دن تک __ __ (day of illness)

کیا ڈاکٹر نرس ہیلتھ ورکر سے مشورہ سے پہلے خود کوئی دوا بچہ کو دی تھی۔

D20 Before consulting a doctor, nurse or health worker, did you give the child medicine?

نہیں 2. No——> SKIP TO QUESTION D25 سوال نمبر D25 پوچھیں
ہاں 1. Yes

کیا صحیلقہ ورکر نرس ڈاکٹر کو دکھانے سے پہلے پاؤڈر والی دوا دی تھی؟

D21. Before consulting a doctor, nurse or health worker, did you give the child a powder to mix?

ہاں 1. Yes (specify, name and description)_____
نہیں 2. No

کیا آپ نے تتی۔ صحیلقہ ورکر نرس، ڈاکٹر کو دکھانے سے کوئی گولی پیس کر دی تھی؟

D22. Before consulting a doctor, nurse or health worker, did you give the child a crushed pill?

ہاں نام اور تفصیل لکھیں 1. Yes (specify, name and description)_____
نہیں 2. No

سیکٹر ___ گلی ___ ___ گھر نمبر ___ ___ ___ ___ فلیٹ ___
SECTOR ___ GULLY ___ ___ HOUSE NUMBER ___ ___ ___ ___ APT ___

کیا کوئی پیکٹ سے بنا ہوا مشربت دیا تھا۔

D23 Before consulting a doctor, nurse or health worker, did you give the child a premixed liquid? ☐

ہاں نام اور تفصیل لکھیں
1 Yes (specify, name and description)_____

نہیں
2 No

کیا کوئی اور دوائی دی تھی؟

D24 Before consulting a doctor, nurse or health worker, did you give any other medicine? ☐

ہاں نام اور تفصیل لکھیں
1 Yes (specify, name and description)_____

نہیں
2 No

کیا اب بچہ بہتر ہے

D25 Is your child better? ☐

ہاں
1 Yes-------> RETURN TO PREGNANCY HISTORY

نہیں
2 No

کیا آپ نے بچے کی دستوں کی بیماری کے لئے کسی کو دکھانے کے لئے کہا تھا
یا کرنے کو سوچا تھا What do you plan to do for the child's diarrhea?

اگر بچہ بیمار ہے اور ماں کو پتہ معلوم کہ کیا کرنا ہے تو ڈسٹرکٹ کریم یا ڈسٹرکٹ ایس

If the child looks sick, and the mother has no plan then refer to Karim/Ian or Aga Khan Center.

کو دکھائیں یا آغا خان سینٹر بھیجیں اگر ہاں کہے تو - اگر ہاں کہے
کہ وہ خود بچے کو کسی ڈاکٹر کے پاس لے جا سکتی تو اصرار نہ کریں

---> RETURN TO CHILD HEALTH PROFORMA

بچہ کی صحت کے فارم پر جائیں

سیکٹر SECTOR __ گلی GULLY __ __ گھر کا نمبر HOUSE NUMBER __ __ __ __ APT __

نمونیہ کا فارم
PNEUMONIA PROFORMA

گھر کا سب سے چھوٹا بچہ جسکو پچھلے دو ہفتے کے دوران تیز سانس چلی ہو یا پسلی چلی ہو (اس بچہ کے لئے یہ فارم بھرنا ہے)
for the youngest child with rapid breathing or chest indrawing in last 2 weeks. If no child has, return to child health proforma

بچہ کا نام Child's Name_____ شناختی معلومات کے گوشوارے سے ریکارڈ نمبر & ID Number from Household Information Table شناختی نمبر __ (ID number)

P1 For how many days was the child sick with rapid breathing or chest indrawing? آپ کے بچہ کو کتنے دن سے تیز سانس یا پسلی چلنے کی شکایت تھی۔ ہے معلوم نہیں 99= Don't Know شمار نمبر __ __ (number)

P2 Did the child have a fever? کیا بچہ اپنی کو بخار تھا
1 Yes ہاں 2 No نہیں

P3a. Did you treat the child without consulting anyone? کیا آپ نے کسی ڈاکٹر کو بچہ کو دکھانے سے پہلے خود اس کا علاج کیا تھا؟
2 No ---------> SKIP TO QUESTION P4a سوال نمبر P4 پر جائیں
1 Yes ہاں

P3b If yes, what did you treat the child with? اگر ہاں تو خود کیا علاج کیا تھا اور کس طرح کیا تھا۔
First (name and description)_____ day of illness when treated بیماری کے کو نسے دن علاج کیا تھا
پہلی مرتبہ
Second (name and description)_____ day of illness when treated بیماری کے کو نسے دن سے علاج کیا تھا
دوسری مرتبہ
Third (name and description)_____ day of illness when treated بیماری کے کو نسے دن سے علاج کیا تھا
تیسری مرتبہ

P4a Did you seek consultation from a chemist, health worker, nurse or doctor? کیا آپ نے ڈاکٹر، کمپاؤنڈر، یا نرس سے صلاح مشورہ کیا تھا۔
2 No-------> SKIP TO QUESTION P5 سوال نمبر P5 پر جائیں
1 Yes ہاں

P4b. If yes, ask who they consulted, and put the day when each type of healer was FIRST consulted اگر ہاں، تو کس سے مشورہ کیا۔ اور دن لکھیں کہ کس سے پہلا مشورہ کیا گیا۔

a Chemist کیمسٹ a) __ (day of illness)
b Aga Khan health worker آغا خان ہیلتھ ورکر b) __ (day of illness)
c nurse نرس c) __ (day of illness)
d Aga Khan health center آغا خان ہیلتھ سینٹر d) __ (day of illness)
e Other health center کوئی دوسرا ہیلتھ سینٹر e) __ (day of illness)
f Doctor (private or government) پرائیویٹ اور سرکاری ڈاکٹر f) __ (day of illness)

P5. Is your child better? کیا آپکا بچہ بہتر ہے؟
1 Yes-------> RETURN TO PREGNANCY HISTORY
2 No

If the child looks sick, and the mother has no plan then refer to Kanmulan or Aga Khan Center----> RETURN TO PREGNANCY HISTORY
اگر بچہ بیمار نظر آتا ہے اور ماں کہیں اور جانے کا نہیں سوچ رہی تو اسے کنمولن یا آغا خان سینٹر جانے کو کہیں۔۔۔

سیکٹر گلی گھرانہ کا نمبر
SECTOR ___ GULLY ___ HOUSE NUMBER ___ ___ ___ ___ APT ___

خاندان کی حیثیت کا فارم

FAMILY STATUS PROFORMA

اب میں آپکے خاندان / گھرانہ کی حیثیت کے بارے میں کچھ سوالات پوچھنا چاہوں گی

I WOULD NOW LIKE TO ASK YOU SOME QUESTIONS ABOUT THE FINANCIAL STATUS OF YOUR FAMILY

آپ کے یہاں پینے کا پانی کا ایک ذریعہ کیا ہے

G1 What is your main source of drinking water?

گھر میں نلکا — 1 Tap or pump in the house

کمپونڈ / احاطہ میں نلکا — 2 Tap or pump outside the house

ٹینکر — 3 Tanker

کنواں — 4 Underground well

کوئی دوسری وضاحت — 88 Other (specify)_____

آپ کے گھر میں کس طرح کی بیت الخلاء کی سہولت موجود ہے

G2 What type of toilet facilities does this house have?

کھلی جگہ — 1 Open Space

فلش کے ساتھ — 2 Flush Privy

فلش کے بغیر — 3 Without flush

بالٹی بیت الخلاء — 4 Bucket Latrine

کھدے والا بیت الخلاء — 5 Closed Pit

عوامی بیت الخلاء استعمال کرتے ہیں — 6 Use public latrine

کیا آپ کا گھرانہ اپنی ہے یا کرائے پر رہتے ہیں

G3 Does the family own the house?

ذاتی — 1 Yes

کرائے پر — 2. No, renting

کسی اور کے گھر میں انکے ساتھ رہتے ہیں (اور کرایہ نہیں دیتے) — 3 Living rent free in someone else's house

معلوم نہیں — 99. Don't know

کیا آپ کے پاس مندرجہ ذیل چیزیں ہیں الگ الگ معلوم کریں

G4 Does the family own any of the following? PROMPT THE LIST

a) Bicycle	a) سائیکل	☐
b) scooter/ motorbike	b) موٹر سائیکل	☐
c) Car	c) کار	☐
d) Radio/cassette recorder	d) ریڈیو کیسٹ ریکارڈر	☐
e) Television	e) ٹیلیویژن	☐
f) VCR	f) وی سی آر	☐
g) washing machine	g) واشنگ مشین	☐
h) refrigerator	h) فریج	☐
i) sewing machine	i) سلائی مشین	☐

CODE 1 Yes — ہاں

2. No — نہیں

گھرانہ کا نمبر گلی سیکٹر

PAGE 19 SECTOR __ GULLY __ __ HOUSE NUMBER __ __ __ __ AP1 __

اس گھر کی تعمیر کس قسم کی ہے؟ (مشاہدہ کریں)

G5 Type of Construction (Observe)

پکا (کنکریٹ کی دیواریں اور چھت) کچا پکا (کنکریٹ کی دیواریں/ایسٹاس/لکڑی)

1 Pucca (concrete) 2 Semi-Puccalconcrete walls, roof tin, asbestos, wood)

کچا (لکڑی/مٹی کی دیواریں/لکڑی یا گھاس پھوس کی چھت) لکڑی کا گھر

3 Katcha (wood/mud walls, roof not of solid material) 4 wooden structure

اس میں (باورچی خانہ، برآمدے/غسل خانے/بیت الخلاء اور اسٹور کے علاوہ) کل کتنے کمرے ہیں

G6. Number of Rooms the family lives in (excluding kitchen, veranda, bath/toilet/latrine, store) (Observe)

کمروں کی تعداد

__ (number of rooms)

یہ گھر کل کتنی منزلہ ہے

G7 Number of floors the family lives on

منزلوں کی تعداد

__ (number of floors)

اس پلاٹ/اپارٹمنٹ (مربع گز میں) کا رقبہ ہے

G8. Size of the plot or apartment (square yards)

مربع گز

__ __ __ __ (square yards)

کیا آپ اپنے گھرانے کی آمدنی کے بارے میں جواب دینا پسند کریں گے؟ (براہ مہربانی)

G9 Do you mind answering questions on family income?

ہاں خالوں کا شکریہ ادا کریں اور انٹرویو ختم کریں

1. Yes ------> THANK THE PERSON, AND END THE INTERVIEW

نہیں

2. No

گھرانے کی معلومات والے گوشوارے/ٹیبل سے خانہ ان کے ہر اس فرد کی آمدنی کی اپنے کام میں لکھ لیں جو برسرروزگار ہو

G10. From the table in household information, list the people who work for pay or profit, then fill in ONE WAGE COLUMN for each

ID NUMBER شناختی نمبر	DON'T KNOW نہیں معلوم	AVERAGE DAILY WAGE اوسطاً یومیہ آمدنی	AVERAGE WEEKLY WAGE اوسطاً ہفتہ وار آمدنی	AVERAGE MONTHLY WAGE اوسطاً ماہانہ آمدنی

APPENDIX V: RESULTS OF 5% RE-INTERVIEWS: 56 MOTHERS and 81 CHILDREN

For Variables with more than 1 of 56 responses different from the original interview

Q#	Categorical Variables	Number Different	Percent Different
Litr	Literacy	18	32%
CG10	Usual Fluids in Diarrhea	6	11%
CG18	Ever Attendance at Educational Meetings	2	4%
CG24	Ever Use of Family Planning	2	4%
CG25	Current Use of Family Planning	2	4%
MRP11	Feeding of Colostrum	4	7%
CH2	Maternal Percieved Complete Immunization	7	13%
CH9	Ever Weighted by Health Worker	2	4%
D13	Type of Oral Rehydration Solution	2	17%
G1	Source of Water	9	16%
G2	Type of Toilet	15	27%

				of those different	
Q#	Continuous Variables	Number Different	Percent Different	Totai Difference	Mean Difference
Age	Age of Household Members (years)	2	4%	2	1.0
Dur	Duration of Family Residence (years)	12	21%	88	7.3
HH1	Number in household	3	5%	5	1.7
CG8	Husband's Years of School	6	11%	28	4.7
CG22	Number of Family Planning Methods Know	6	11%	6	1.0
MRP5	Number of Prenatal Visits	24	43%	74	3.1
MRP10	Number of Tetanus Shots in Last 5 years	11	20%	17	1.5
MRP12	Duration of Breast Feeding (months)	9	16%	22	2.4
MRP13	Age Fluids First Fed (months)	6	11%	15	2.5
MRP14	Age Food First Fed (months)	5	9%	10	2.0
CH11	Number of Weights by Health Worker	9	16%	18	2.0
CH12	Number of Visits to Aga Khan Center	5	9%	8	1.6
CH17	Child's Weight-- any difference (kg)	32	36%	13.8	0.4
CH17	Child's Weight--more than 0.5 kg different	9	10%	11.8	1.3
CH18	Child's Height--any difference (cms)	26	29%	49.3	1.9
CH18	Child's Height--more than 1 cm different	10	11%	27.1	2.7
D6	Average Frequency of Diarrhea (times/day)	3	25%	7	2.3
G6	Number of Rooms in the House	6	11%	13	2.2
G7	Number of Floors the Family Lives on	5	9%	11	2.2
G8	Household Plot Size (square meters)	3	5%	350	117
G10	Monthly Wage per Worker (Pak Rupees)	8	14%	10,050	1256

APPENDIX VI : POTENTIAL CLUSTERING OF CHILDREN UNDER AGE 5

CALCULATION OF THE INTRA-CLASS (INTRA-HOUSEHOLD) CORRELATIONS COEFFICIENTS

TABLE VI.1 The Households with Multiple Children by Study Area

Number of Children in Household	Program Area N	Program Area %	Comparison Area N	Comparison Area %	TOTAL N	TOTAL %
Two	214	39.9%	192	40.2%	406	40.0%
Three	51	9.5%	42	8.8%	93	9.2%
Four	2	0.4%	4	0.8%	6	0.6%
Five	1	0.2%	1	0.2%	2	0.2%
Total HH with > 1 child	268	50%	239	50%	507	50%
Total HH with any children	536	100%	478	100%	1014	100%

$$\text{Intra-class Correlation Coefficient} = \frac{\text{VARIANCE (between households)}}{\text{VARIANCE (within HH) + VARIANCE (between HH)}} *$$

$$\text{VARIANCE (btw HH)} = \frac{[\text{Mean-Square(btw HH) - Mean Squares (within HH)}] \text{ X (\#HH-1)}}{\text{Total Children-[(sum of \# of children in each HH squared)/total Children]}} **$$

VARIANCE (within households) = Mean-Sum-of-Squares (within households)

Table VI.2 The Intra-Class Correlation Coeffients (ICC) for Child Variables in the Study

	VAR (btw)	VAR (within)	VAR (between)	ICC
Weight-for-Age Z Score	4.01	1.92	0.94	0.33
Weight-For-Height Z Score	9.42	5.31	1.85	0.26
Height-For-Age Z Score	8.22	4.25	1.79	0.30
Immunization	0.27	0.22	0.02	0.09

* Formula from Streiner D L, and Norman G R, "Health Measurement Scales", Oxford, 1989

** From "Handbook of Tables and Probabilities in Statistics, CRC Press, Cleveland, 2nd Ed, 1974

APPENDIX VII: RESULTS OF MATCHING THE PROGRAM AND COMPARISON AREAS

TABLE VII.1: Matching Variables Modified from the Canadian Study

VARIABLE	Program Area	Comparison Area	Difference (Program MINUS Comparison) CRUDE Difference	Lower 95 % C I	Upper 95 % C I	P Value Difference	
% Population age 0 to 4	14%	13%	0.6%	-0.5	1.8	0.13	
% Population age 5 to 14	31%	30%	1.2%	-0.4	2.8	0.17	
% Population age 60+	3%	4%	-0.6%	-1.2	0.3	0.47	
% of Households with 6+ Residents	59%	59%	0.2%	-1	1	0.54	
Annual Total Family Income per Capita (US Dollars	$ 1,475	$ 1,410	$ 65	-72	245	0.83	*1*
% Residents Over Age 15 Literate	66%	62%	4.5%	1.2	7.9	0.008 **	
% Heads of Household Employed in Production	33%	31%	2.3%	-3.1	7.6	0.22	
% Heads of Household Employment Professional	6%	5%	1.3%	-1.4	4	0.33	
% Families Muslim (rest were Christian)	87%	67%	20.0%	15	24	<0.001 **	
% Households Resident for Less Than 2 years	20%	23%	-3.0%	-7.6	1.5	0.18	

** statistically significant at p=0.05 with a substantial magnitude of difference

1 US $1=30 Pakistan Rupees and CAN $1 = 23 Pakistan Rupees at the time of the study

TABLE VII.2: Additional Demographic Variables Included in the Study

VARIABLE	Program Area	Comparison Area	Difference (Program MINUS Comparison) CRUDE Difference	Lower 95 % C I	Upper 95 % C I	P Value Difference	
Mean Age (years)	18.0 yrs	18.3 yrs	- 0.4 yr	(-1.1 , 0.9)		0.62	*1*
Mean Age (MALES) (years)	18.6 yrs	19.1 yrs	- 0.6 yr	(-1.7 , 0.5)		0.3	
Mean Age (FEMALES) (years)	17.3 yrs	17.5 yrs	- 0.1 yr	(-1.1 , 0.8)		0.78	
% Population Male	51 %	51 %	0.7 %	(-1.6 , 3)		0.55	
% Population over age 15 currently married	80 %	81 %	- 1.3 %	(-4 , 1.5)		0.64	
Mean Mother's Age (years)	28.9 yrs	29.6 yrs	- 0.8 yr	(-1.5 , -0.1)		0.02 *	
Mean Mother's Age at Marriage (years)	18.0 yrs	18.5 yrs	- 0.5 yr	(-0.9 , -0.1)		0.03 *	
Mean Mother's Years of Marriage (years)	10.8 yrs	11.0 yrs	- 0.3 yr	(-1 , 0.5)		0.55	
Mean Mother's Parity (# pregnancies)	4.2 preg	4.2 preg	0.04 preg	(-0.2 , 0.3)		0.78	
Mean Duration of Mother's Residence (years)	9.1 yrs	8.2 yrs	0.9 yr	(0.1 , 1.7)		0.19	
Mean Maternal Residence during Prog (1-6 years)	4.6 yrs	4.6 yrs	0.07 yr	(-0.2 , 0.2)		0.99	
Family Language (% Speaking Urdu)	44 %	21 %	22 %	(17 , 27)		<0.001 **	*2*
(% Speaking Punjabi/Saraiki)	32 %	59 %	- 28 %	(-33 , -22)		<0.001 **	
(% Speaking Pushtu/Hindko)	22 %	18 %	3.8 %	(-0.8 , 8.4)		0.1	
(% Speaking Other Languages)	2 %	3 %	- 0.9 %	(-2.6 , 0.9)		0.31	

* statistically significant at p=0.05 without a substantial magnitude of difference

** statistically significant at p=0.05 with a substantial magnitude of difference

1 Age distributions not-significantly different if categorized (chi-sq p=0.20) or sex disaggregated

2 When analyzed as a chisquare with 3 degrees of freedom, p<0.0000001

TABLE VII.3: Additional Wealth Variables Included in the Study

VARIABLE	Program Area	Comparison Area	Difference (Program MINUS Comparison) CRUDE Difference	Lower 95 % C I	Upper 95 % C I	P Value Difference	
Mean Monthly Income per Capita (Pak Rupees)	Rs 563	Rs 567	- Rs 4	(-8 , 3)		0.83	1
Mean Monthly Income per Worker (Pak Rupees)	Rs 2783	Rs 2771	Rs 12	(-212 , 237)		0.61	1
Mean Ownership of 9 Household Items	4.6 items	4.2 items	0.5 items	(0.3 , 0.7)		<0.001 **	2
% Ownership 5+ of 9 Household Items	53 %	46 %	7.6 %	(2 , 13)		0.008 **	3
% Ownership of House	72%	72 %	- 0.1 %	(-5 , 5)		0.97	
% Residents over age 15 Employed	46 %	47 %	-1.1 %	(-5 , 2)		0.52	
% Heads of the Household Employed	93 %	93 %	- 2.6 %	(-3 , 3)		0.86	
% Mothers Employed	7 %	10 %	- 3 %	(-6 , -0.1)		0.042 *	

* statistically significant at p=0.05 without a substantial magnitude of difference

** statistically significant at p=0.05 with a substantial magnitude of difference

1 Rs=Pakistan Rupees, US $1= Rs 30 and CAN $1 = Rs 23 at the time of the study

2 Ownership Distribution is non-normal, median 5 vs 4, mode 4 vs 6

3 Same result if dicotomized into 4 or more, versus 3 or less (72% - 64% = 8.2% DIFF, CI (2.8,13.6) p=0.003**

TABLE VII.4: Additional Education Variables Included in the Study

VARIABLE	Program Area	Comparison Area	Difference (Program MINUS Comparison) CRUDE Difference	Lower 95 % C I	Upper 95 % C I	P Value Difference
% Heads of Household Literate	70 %	66 %	3.4%	-2.1	8.8	0.23
% Mothers Literate	51 %	43 %	7.8%	2.1	13.6	0.005 **
Mean Maternal Years of Schooling	4.3 yrs	3.2 yrs	1.0 yr	0.5	1.5	<0.001 **
Maternal Education (% None)	48 %	58 %	- 10.5%	-16	-4.7	<0.001 ** 1
(% Primary 1-5 yrs)	15 %	13 %	1.5%	-2.5	5.5	0.47
(% Matriculation 6-10 yr)	31 %	24 %	6.5%	1.4	11.6	0.014 **
(% Bachelor 11yrs+)	6 %	4 %	2.4%	-0.1	5	0.06 *
Mean Paternal Years of Schooling	7.2 yrs	6.5 yrs	0.6 yr	0.05	1.2	0.03 *

* statistically significant at p=0.05 without a substantial magnitude of difference

** statistically significant at p=0.05 with a substantial magnitude of difference

1 When analyzed as a chi-square with 3 degrees of freedom p=0.003**

TABLE VII.5: Additional Crowding & Home Situation Variables Included in the Study

VARIABLE	Program Area	Comparison Area	Difference (Program MINUS Comparison) CRUDE Difference	Lower 95 % C I	Upper 95 % C I	P Value Difference	
Mean Number of Residents per Household	6.5 res	6.3 res	0.29 res	(-.01 , 0.6)		0.16	
Mean Rooms per Household	2.2 rm	2.1 rm	0.05 rm	(-0.1 , 0.2)		0.2	
Mean Living Density (residents per room)	3.9 res/rm	3.8 res/rm	0.07res/r	(-0.2 , 0.3)		0.96	
Mean Household Living Space (sq meters)	111 sqm	99 sqm	13 sqm	(3.5 , 22)		0.11	*
Mean Living Density (residents per sq meter)	0.09 res/	0.09 res/m	.005 res/	(-.01 , 0.02)		0.64	
% Houses with Solid Construction	62 %	64 %	- 2 %	(-7.8 , 3.4)		0.45	
% Households with Inside Water Tap	84 %	68 %	17 %	(12 , 22)		<0.001	*
% Households Inside or Outside Water Tap	99 %	98 %	1.2 %	(-0.2 , 2.5)		0.08	
% Households with Flush Toilet	69 %	72 %	- 2 %	(-7.5 , 3.3)		0.49	

* statistically significant at p=0.05 without a substantial magnitude of difference

APPENDIX VIII: INFANT AND PERINATAL MORTALITY, Rates and Raw Data

Area	Year	Live Births	Still Births	ENeon Deaths	Post Deaths	PNMR	IMR	Maximum Mort
Program	1993	185	3	1	3	21		
Comparison		172	3	4	4	40		
Program	1992	210	4	5	4	42	43	61
Comparison		198	6	4	4	49	40	69
Program	1991	227	2	0	6	9	26	35
Comparison		186	5	3	4	42	38	63
Program	1990	179	3	6	2	49	45	60
Comparison		212	4	4	4	37	38	56
Program	1989	176	2	4	6	34	57	67
Comparison		123	5	1	4	47	41	78
	LATE PROGRAM PERIOD							
Program	1991-3	622	9	6		24 *		
Comparison		556	14	11		44 *		
	LATE PROGRAM PERIOD							
Program	1991-2	437	6	5	10		34	47
Comparison		384	11	7	8		39	66
	EARLY PROGRAM PERIOD							
Program	1989-90	355	5	10	8	42	51	64
Comparison		335	9	5	8	41	39	64
	WHOLE PROGRAM PERIOD							
Program	1989-92	792	11	15	18		42	55
Comparison		719	20	12	16		39	65
Program	1989-93	977	14	16		30		
Comparison		891	23	16		43		

Live birth: Child Born alive Stillbirth: Child born dead at > 28 wk gestation
ENeon (Early-Neonatal) Death: Death of a Liveborn Child within 7 days of birth
Post(Late Neonatal+Postneonatal)Death:of a Liveborn Child between 7 days & 1 year of birth
Perinatal Mortality Rate (PNMR) = 1000X(Stillbirths+ENeon Deaths)/(Stillbirths+Live births)
Infant Mortality Rate (IMR) = 1000X(ENeon Deaths+Post Deaths)/(Live births)
Maximum Mortality=1000X(Stillbirths+ENeon Deaths+Post Deaths)/(Stillbirths+Live births)
the Maximum Infant Mortality if all Stillbirths were truly misreported live births

* crude difference -20, adjusted difference -15, 95% CI (-38,+7), p=0.06