Primary Health Care Initiatives (PHCI)

Evaluation of Utilization of Health Services Delivery and Health Status

February 2005

Prepared by

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PHCI
PRIMARY HEALTH CARE INITIATIVES

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Abstract

This report presents evaluation of Primary Health Care Initiatives (PHCI) project activities according to a set of selected indicators. The USAID funded project was implemented in cooperation of the Ministry of Health (MoH) over 5 years (September1999-December 2004). PHCI aimed at improving quality of primary health care and reproductive health services at MoH. The evaluation followed quasi-experimental design. Focal health centers (HCs) received most of the PHCI interventions, while non-focal centers received either few or no interventions. Users of MoH non-focal HCs served as the control (comparison) group while clients of MoH focal health centers served as the intervention group. A representative sample was selected using stratified two stage cluster sampling approach. A set of utilization of services and proxy health status indicators were chosen for evaluation. The indicators were based on timeliness of vaccination, growth and development monitoring visits, antenatal- postnatal visits, screening children and pregnant women for anemia, screening of adults for hypertension, contraceptive use, anemia among children and pregnant women, and status of control of diabetes and hypertension. Some variables were collected from records and others through cross-sectional surveys. Data for pretest was collected during October 2000, while posttest was carried out during June 2004. Comparing pretest and posttest figures, the findings showed that overall timeliness of vaccination improved insignificantly from 64.5% to 68.2% with no differences between focal and non-focal health centers. Appropriate growth and monitoring visits of 3-year old children dropped significantly from 21.6% to 16%. Deterioration was noticed for both focal and non-focal health centers. Appropriate number of antenatal visits did not change (57.7% to 57.3%), while attendance of postnatal care increased form 29.6% to 36.1%. Improvement in utilization of postnatal care was significant only for focal HCs. Family planning counseling during postnatal visits improved from 34.7% to 77.2% and was significant for both focal and non-focal HCs. The prevalence of modern contraceptives increased from 52.9% to 70%, while use of traditional methods dropped from 20.6% to 13%. Changes in contraceptive use were consistent across focal and non-focal centers. The seemingly high figures of contraceptive prevalence are due to excluding pregnant women and provision of MCH services at study HCs. Screening adults aged 40 years and older for hypertension changed insignificantly from 37% to 38.5%. Screening of children aged 6-24 months for anemia did not change over 4.5 year period (37.9% to 37.4%), while prevalence of anemia improved only insignificantly from 24.3% to 21.4%. Screening of pregnant women for anemia changed insignificantly from 88.2 to 90.5%, while prevalence of anemia was significantly decreased from about 25% to about 21%. The prevalence of uncontrolled diabetics increased insignificantly from 61.4% to 63.4%. ANCOVA showed significantly better figures of HbA1c in focal versus non-focal health centers. Controlled hypertensive patients showed increase from 11% to 22.3%. The improvement was statistically significant for both focal and non-focal HCs. Short maturity of PHCI interventions and absence of effective monitoring systems have contributed to the above findings that showed low impact of interventions.

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Acknowledgment

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Document Layout

- All numbers and proportions are weighted values to fit the multistage stratified cluster sampling design.
- This report starts with an abstract followed by an executive summary covering the introduction, methodology, results and recommendations.
- Section 1 describes the introduction covering background information, purpose and objectives of the study.
- Section 2 describes methodology covering the study design, sampling procedures, main variables, data collection techniques and tools, data collection plan and data analysis procedures.
- Section 3 describes the findings of the study. This section is organized in seven subsections (3.1-3.7) each describing one of the indicators or a group of related indicators based on the relevant variables. Each results subsection describes the relevant indicator, looks for possible effect of PHCI interventions, and provides predication of the main variable by the available independent variables.
- Section 4 offers the main conclusions and recommendations based on study findings.
- Annexes include data collection tools.

Executive Summary

Introduction

Primary Health Care Initiatives (PHCI) is a USAID funded project that has been implemented throughout the Hashemite Kingdom of Jordan by the international consulting firm Abt Associates, Inc. in cooperation with Ministry of Health (MoH). The lifetime of the project was 5 years (September1999-June 2004). The technical components of the project were extended for six months till December of 2004. It was designed to improve primary and reproductive healthcare through provision of an integrated package of services. The project had six main components namely; (a) quality assurance, (b) training, (c) reproductive health (d) health communication and marketing, (e) management information systems, (f) applied research, and (g) renovation and equipment. One of the main objectives of the Research component was overall project evaluation.

The purpose of this study is to evaluate the impact of various PHCI project activities on utilization of health services and health status of clients using MoH primary health care facilities.

Methodology

This study follows the "quasi-experimental design" in which there is random selection of study subjects as well as a pretest and posttest with a comparison group, but lacks the random allocation of subjects to either comparison or intervention groups.

The 200 primary and comprehensive heath centers (PHCs and CHCs) that received most of PHCI interventions were labeled as focal and considered as the intervention group. The rest of PHCs and CHCs that had hitherto received either few or none of PHCI interventions were labeled as non-focal and were considered as a comparison group. The selected indicators were measured at the pretest phase during October-November 2000 and re-measured during June-July 2004 as a posttest phase. It is worth mentioning that the study largely followed a separate pretest posttest design. This type of design carries the risk of having nonequivalence within each group since the same subjects were not followed up from pretest to posttest.

A stratified two-stage cluster sampling design was used. The three geographic regions of Jordan (north, center and south) and the two types of health centers (CHCs and PHCs) served as the basis for stratifying the sample into six strata. Health centers

were the Primary Sampling Units (PSUs) representing the first level cluster. Study subjects were chosen at random from the selected health care centers. For certain centers with expected low patient load, the first arrivals were selected to ensure finding a sufficient number of study subjects over the 2-4 day period of data collection. This issue was further dealt with by weighting.

Sampling frame for PSUs consisted of a total of 306 PHCs and CHCs that offer MCH services. The final number of selected health centers was 89 and 10 subjects were supposed to be selected in each health center. For two variables (diabetes and hypertension control) where paired observations on the same individuals were planned to be collected in the pretest and posttest, the number of subjects per cluster was increased to 13 during pretest instead of 10 to compensate for the expected attrition over a 4 year period. The 89 health centers selected at the pretest phase were divided into intervention and comparison centers as the only available choice without having separate samples. Relative weight was used to reflect the population from which the sample was drawn while keeping the sample size close to the original value. All numbers and proportions in the results sections represent the weighted values.

The study variables reflect important health issues such as the status of diabetes and hypertension control as proxy health indicators that the project activities were intended to improve. The study further examines other important utilization indicators like contraceptive use and screening for hypertension. Although contraceptive use has been widely researched in Jordan, studies examining contraceptive use by MoH users are not available. Finally, the study looks at some record based indicators of health status and utilization such as anemia of children and pregnant women, timeliness of vaccination, appropriateness of growth and monitoring visits for children and appropriateness of antenatal-postnatal care.

Three main Techniques of data collection were used in the study: 1) *using available information* for record based surveys on timely vaccination, growth and development visits, antenatal-postnatal visits, anemia of pregnancy, anemia of children and partly screening for hypertension, 2) *interviewing study subjects using questionnaires* was applied to get data on contraceptive use and partly for screening of hypertension, diabetes and hypertension control status, and 3) *measurements (observations)* that applies to measuring glycosylated hemoglobin, and blood pressure in diabetes and hypertension.

Findings

Timeliness of Vaccination

Timeliness for all doses combined increased insignificantly by 5.7% from 64.5% in the pretest to 68.2% in the posttest. There were some significant variations between the pre and posttest data for some individual doses but the difference was not consistent in favor of one stage. No statistically significant difference was noted for intervention focal health centers. This finding can be attributed to the fact that PHCI did not implement direct interventions that aimed at improving the timeliness of vaccination.

Pooled data showed that region, health center type and mothers education are significant predictors of timeliness of vaccination. North and central regions were 2 and 1.7 times more likely to have appropriate timing of vaccination than the south. The results were in favor of the CHCs, where the records of timeliness were 41% more likely to be higher than the PHCs. As for mothers' education, the illiterate women were 3.1 times less likely to get their children timely vaccinated than those with higher education. Other factors such as sex of the child, family income and father's education did not show significant prediction.

Growth and Development Visits and Anemia of Children

Overall, the appropriateness of growth and development visits made at MoH health centers decreased significantly from 21.6% to only 16%. The trend was also noted for the appropriateness of first and second year visits. The data for the first and second years went down from 63.4% and 37.1% during the pretest to respectively 55.4% and 27.7% during the posttest. The deterioration in the appropriateness of growth and development visits was noted for both focal and non-focal health centers, yet less pronounced in the focal centers. Logistic regression analysis did not reveal any worth mentioning results.

Screening for anemia among children aged 6-24 months showed no change during the two phases of the study (37.9% and 37.4%). Hemoglobin testing is compulsory at the age of one year for all children utilizing MoH facilities. Nevertheless, figures are still profoundly low with no change over time. Those screened for anemia showed about 2.3 times more appropriate visits for growth and development monitoring than those not screened. As for anemia an insignificant decreased was noted for children aged 6-24 months (24.3% to 21.4%). These figures are close to those available in the MoH

database as far as they have the same source. It is worthwhile mentioning that anemia results should be interpreted with caution as representation of children is considered low at less than 38%.

Antenatal-Postnatal Visits and Anemia of Pregnancy

Percentage of women with appropriate number of antenatal visits made at the same MoH health center did not change over the intervention period. The figure changed insignificantly from 57.7% during the pretest to 57.3% during the posttest.

The prevalence of appropriate postnatal visits improved significantly from 29.6% during the pretest to 36.1% during the posttest. The changes were significant only for users of focal health centers. Family planning counseling during postnatal visits improved from 34.7% during the pretest to 77.2% during the posttest ($p=<0.005$). The improvement was noted for both focal and non-focal health centers. Decision to use family planning methods based on counseling did not change significantly between the pre and posttest phases.

Study phase, appropriateness of antenatal visits, age, health center type and woman's educational level were shown to be significant predictors of appropriateness of postnatal visits. Regional differences were absent. Paying an appropriate number of antenatal visits was the most predictive factor of coming to at least one postnatal visit. If a pregnant woman attended 4 or more antenatal visits she is about 2.8 times more likely to be seen at the postnatal clinic than those women paying less visits. Pregnant women were 1.38 times more likely to pay at least one postnatal visit after delivery in the posttest than in the pretest ($p = 0.003$). CHCs were 1.4 times less likely to attract pregnant women to have postnatal care than the PHCs. Each year increase in age makes pregnant women 2% less likely to attend postnatal care after delivery.

Out of the available variables, family planning counseling was best predicted by the study phase and region. During the posttest pregnant women were 8.4 times more likely to be counseled for family planning during a postnatal care visit than the pretest. Women attending postnatal clinics in the north and central region were 5.4 and 2 times respectively more likely to be counseled for family planning than women attending clinics in the south.

Screening of pregnant women for anemia has improved from 88.2% to 90.5% during the pre and posttest respectively. Anemia among pregnant women has significantly

decreased by 20% from about 25% in the pretest to about 21% in the posttest (p=0.04). The logistic model did not show the study phase as a significant predictor. Anemia progressed from 9.8 g% during the first trimester to 18.5% during the second and reaching 27.6% during the third trimester for the posttest. These findings are consistent with course of pregnancy.

Use of Contraceptive Methods

The prevalence of use of various family planning methods was calculated for all married women of reproductive age visiting MoH health centers with MCH services excluding pregnant women. It is estimated that about 20% of women visiting health centers with MCH services are pregnant. Therefore, contraceptive prevalence rate among non-pregnant is expected to be higher than figures reported by DHS or other studies that include all women.

The use of modern methods increased from 52.9% during the pretest to 70% during the posttest. The prevalence increased significantly by 36% among users of focal health centers compared to 24% increase in non-focal. Parallel to the increase of use in modern methods, about 37% drop in the use of traditional methods from 20.6% during the pretest to 13% during the posttest was noted. As for individual methods use of condoms and injectables increased by almost 100% followed by use of pills by 51%, while use of IUDs remained unchanged.

Over the two phases of the study there was a noticeable increase by 30% of the source of family planning method being the local health center. The dependence on sources other than MoH centers was reduced by about 30% between the pretest and posttest.

The results of logistic regression for the pooled pre-posttest data showed that study phase, region, age, employment, education and number of male and female children were significant predictors of modern methods use. Modern contraceptive use was about twice more likely in the posttest compared to the pretest. Women in central and north regions were respectively 69% and 33% more likely to use modern methods than women in the south region. Women in the age group of less than 30 years were about 2.3 times more likely to use modern methods than those older than 40 years. Employed women were found to be about 1.8 times more likely to use modern methods as compared to the unemployed. Illiterate women were twice less likely to use modern methods than those with higher education. Women married to illiterate husbands were 2.8 times less likely to use modern methods when compared to those married to husbands with higher education.

Screening for Hypertension

This variable measures screening for hypertension among those aged 40 years and above. The overall screening took into consideration BP recordings in the medical file over the last year including the day in which the survey was conducted. It was found that screening for hypertension did not change significantly over more than 4 years. Screening increased by only 4% from 37% in the pretest to reach 38.5% in the posttest. No pre-posttest difference was noted for focal versus non-focal health centers.

Age and sex showed significant prediction for the hypertension screening variable. A male patient was 1.37 times less likely to have his blood pressure checked than a female patient. For each one year increase in age there was 1.2% more likelihood that the patient is screened for hypertension. The study phase, health center type, region and years of schooling did now show any significant prediction.

Status of Diabetes Control

Subjects with HbA_{1c} readings below 7% were considered as controlled diabetics. The prevalence of uncontrolled diabetics increased insignificantly from 61.4% during the pretest to 63.4% during the posttest. The change of the status of control of diabetes over the project lifetime was insignificant for both focal and non-focal health centers. Body Mass Index (BMI) showed that obese had also insignificantly decreased from 47.9% during the pretest to 43.8% during the posttest. The change in BMI for the focal centers between the two phases of the study was significant.

Region, age, years of schooling, disease duration and obesity had some prediction to diabetes control while study phase, health center type, sex and employment had no significant prediction. North was not different from the south while respondents from the central region were 29% more likely to have their diabetes controlled compared to respondents from the south. An increase of one year of schooling improved control of diabetes by 6%. With each year of increase in disease duration the possibility that a diabetic patient becomes controlled is about 6% less. Non-obese subjects are 1.34 times more likely to be controlled than obese subjects.

Overall, only 446 diabetic subjects out of the 1190 recruited in the pretest (37.5%) were followed in the posttest. The paired observations constituted about 39% of the posttest respondents. The final results of analysis of co-variance (ANCOVA) showed

that the marginal mean value of HbA1c for diabetics using focal health centers was significantly less at 7.97% as compared to non-focal health centers at 8.81% irrespective of the differences in the pretest readings.

Status of Hypertension Control

Controlled hypertensive patients showed significant increase from 11% during the pretest to 22.3% during the posttest. Improvement was noted also among the three grades of hypertension with more patients appearing in the first grade and less in the third grade during the posttest. The improvement was significant for focal and non-focal health centers. Prevalence of obesity had decreased insignificantly from 58% during the pretest to 55.6% during the posttest. The obesity results were consistent for focal and non-focal health centers.

Prediction of the status of control of hypertension was limited to study phase, years of schooling and obesity. The odds of hypertension control during the posttest were 2.2 that of the odds of the pretest indicating that hypertensive patients were over two times more likely to be controlled in the posttest than in the pretest. With each year of increase in schooling, a hypertensive patient was 5% more likely to be controlled. Normal weight hypertensive patients were significantly about 1.5 times more likely to be controlled than their obese counterparts.

Overall, only 371 hypertensive patients out of the 1148 recruited in the pretest (32.3%) could be followed in the posttest. The paired observations constituted about 34% of the posttest respondents. The final results of analysis of co-variance (ANCOVA) for systolic BP measurements showed that the marginal mean was 149.2 mm/Hg for focal health centers compared to 153.8 mm/Hg for non-focal health centers. The prediction formula showed better results among focal health centers only if pretest systolic BP exceeded 140 mm/Hg. The marginal mean for diastolic BP readings was 89.6 mm/Hg for the focal health centers compared to 90.3 mm/Hg for non-focal health centers when the pretest value at its mean of 94 mm/Hg.

Conclusions and Recommendations

1. PHCI as a large project with multiple diverse components reflecting a mixture of software and hardware activities had a relatively prolonged preparatory phase. During the first quarter of 2003 only five health centers had all the six PHCI components completed. Over the last two

years of the project most of the PHC related activities at health centers were accomplished with different periods of maturation. Even activities in some health centers did not start yet when this study was done. With such short period of interventions it was expected that PHCI activities would not affect most of the set impact indicators back in early 2000.

2. PHCI activities started its technical and non-technical components without the availability of satisfactory systems to sustain those activities. The absence of effective supervisory system at the MoH and engrossment of PHCI with completion of the delayed planned activity had led to few if any changes over the last two years of project implementation of PHCI activities. Furthermore, PHCI project was more output oriented without clear measurable outcome indicators related to various activities. The PHCI vague monitoring and evaluation plan had contributed to weak impact of project interventions.

3. Ways to improve the postnatal care at MCH facilities should be considered including outreach programs. Furthermore, missed opportunities for family planning during postnatal visits have to be considered seriously.
4. Improve the utilization of growth and development monitoring visits for children during second and third year of life. This can be achieved by improving health awareness of the community towards growth monitoring needs and benefits. Developing the outreach program at the MOH can add considerable value to this particular intent.
5. Improve the quality of maternal and child health care services in order to ensure high quality care delivery. Developing follow up mechanisms is a necessary step for modifying maternal and child health services.
6. Review and institute policies and procedures necessary for early detection of anemia both during pregnancy and early childhood. Developing procedures and protocols to be used for correct diagnosis and treatment of anemia and its underlying causes is recommended.
7. Record keeping systems should have clear evaluation schemes in order to facilitate correct monitoring of health problems. Documentation of procedures and findings in patient’s medical records has to be improved. Failure of recording BP in 43% of cases screened for

hypertension shows the negligence of physicians that might be occurring with other procedures.

8. Create a management system whereby a set of standards is provided and ensured. Standards that cover all areas of primary health care service delivery should be reviewed and updated as needed. These standards should be made available to all health care providers and used in monitoring service provision.
9. A national strategy for chronic non-communicable diseases is urgently needed to improve the status of awareness, counseling, treatment, and control levels among hypertensive and diabetic populations
10. Screening mechanisms for hypertension among those aged 25 years and above have to be established with no delay. Screening is a simple procedure that can be applied to a prevalent disease in order to enable the prevention of serious complications. Effective treatment schedules can be made readily available once the disease is discovered.
11. Assist the MOH in developing a health promotion schemes that target common health problem such as anemia, diabetes, hypertension and low use of pills in face of almost 100% availability.

1. Introduction

1.1 Background

In cooperation with the Hashemite Kingdom of Jordan, USAID/Jordan has developed a program to improve basic primary health care through an integrated package of family health services in which reproductive health, child health, adult health and health prevention and promotion that was delivered by a health provider teams at primary health care settings. This project, called the Primary Health Care Initiatives (PHCI), had been implemented throughout the country by the international consulting firm Abt Associates, Inc. in cooperation with Ministry of Health. The original life time of the project was 5 years (September1999-June 2004). The technical components of the project were extended for six months till December of 2004.

The project had seven interventions and included: (a) quality assurance, (b) clinical training, (c) reproductive health (d) health communication and marketing, (e) health management information systems, (f) applied research, and (g) renovation and equipment. One of the main objectives of the research component of PHCI was the overall project evaluation. The combination of the various inputs that were designed to increase the quality of health care services in MoH based primary health care facilities in Jordan namely, primary and comprehensive health care centers (CHCs and PHCs). The five-year life span of this project presented an opportunity to empirically test the validity of this assumption. This evaluation study uses mainly outcome measures to help identify gaps in the current system and to evaluate the quality and impact of the various PHCI programs. Furthermore, information from the pretest phase of the evaluation process was used to refine proposed PHCI activities.

For more details on PHCI activities, please refer to the end of project situation analysis report.

1.2 Purpose & Significance

The purpose of this study is to evaluate the impact of the various PHCI project activities on utilization of services and health status. Methodologically, the study uses quasi-experimental design with pretest, posttest and control group. The pretest phase took place in October-November 2000, while the posttest was conducted in June-July of 2004.

The indicators of utilization and health status used in the study were selected with involvement of various stakeholders over two roundtable sessions during the first quarter of 2000. The two roundtable workshops were attended by specialists from MoH, PHCI, Universities, USAID and some visiting Abt consultants.

The purpose of this report is to inform MoH and USAID in addition to other stakeholders of the change of some primary health care utilization and proxy health status indicators that came about over the period of evaluation of about 4.5 years .

The study covered users of MoH primary health care system. It looked for such important health issues as the status of diabetes and hypertension control as proxy health indicators that the project activities were intended to improve. The status of control of these two major chronic diseases that lead to significant morbidity and mortality has never been done in MoH facilities on a national scale. The determinants of the above indicators extend well beyond the traditional boundaries of the health care system such as socio-economic status. Nevertheless, it is believed that these indicators provided a good appraisal of quality health care.

The study further examines some utilization indicators like screening for hypertension and contraceptive use rate. Contraceptive use has been well researched in Jordan but no figures were available for MoH users. Finally, the study looks at some record based indicators of health status and utilization such as anemia of children and pregnant women, timeliness of vaccination doses, appropriateness of growth and development monitoring visits for children and appropriateness of antenatal-postnatal care. The current report provides a strong foundation for decision making and activity planning that can positively affect future projects and programs in Jordan.

1.3 Objectives

In light of the above background and purpose, the overall primary objectives of this evaluation study are the following:

- To measure and assess change in a set of selected utilization of services indicators in PHCs and CHCS over the period from October 2000 to June 2004.

- To measure and assess change in a set of selected proxy health status indicators in PHCs and CHCS over the period from October of 2000 to June of 2004

2. Methodology

2.1 Study Design

This study follows the "quasi-experimental design" in which there is a pretest and posttest, a set of interventions and a comparison group with random selection of study subjects but lacks the random allocation of subjects to either control or intervention groups. This is illustrated as follows:

Study Groups	Assignment	October 2000	Intervention	June 2004
Focal MoH facilities (intervention group)	[N]	O_1	X	O_2
Non-focal MoH facilities (comparison group)	[N]	O_1		O_2

where,

N Non-random assignment of the intervention to

O_1 = The pretest measurements of the selected utilization and proxy health status indicators for intervention and comparison groups .

X PHCI interventions

O_2 = The posttest measurements of the selected utilization and proxy health status indicators for intervention and comparison groups.

It is worth mentioning that during the early design stages, clients using all MoH PHCs and CHCs were considered as intervention group while clients attending United Nations Relief Works Agency for Palestinian Refugees (UNRWA) clinics represented the comparison group. Users of UNRWA did not represent a close match to MoH users by all means, nevertheless they were the best available at that stage. The pretest was carried out in 2000 with users of UNRWA health centers as intervention group. UNRWA had only 13 health centers serving the refugee camps mainly in the central region as compared to the ministry with over 350 primary and comprehensive health centers distributed all over the country. After completion of the pretest UNRWA launched programs to improve MCH and non-communicable diseases services. In

September of 2001 the project was amended and the mandate was reduced from all MoH PHCs and CHCs to only 200 health centers. Those 200 health centers were called "focal-health centers" in contrast to the rest of the health centers that were labeled as "non-focal". During the posttest, it was decided to consider non-focal health centers as the comparison group while the focal as the intervention group. Nevertheless, the new comparison group was not a perfect choice but rather the best available. The 200 focal health centers represented 80% of the workload at the ministry. Users of the comparison group were contaminated with various PHCI interventions such as renovation, training and quality assurance. Mass media campaigns implemented by the communication and marketing component of the project were designed nationally and for all sectors.

This stresses the fact that the proposed design is a non-equivalent groups design. It is worth mentioning that all tools but the status of control of diabetes and hypertension, the design is a separate pretest posttest. This kind of design carries the risk of having nonequivalence within each group since the same subjects are not followed up from pretest to posttest. With all the above mentioned pitfalls, the design was still the best that fitted the situation as described..

2.2 Sampling Design

2.2.1 Introduction

A stratified two-stage cluster sampling design was used. Since the study aimed at generalizing results according to the type of health care center and regional as well as national levels, three samples of PHCs and three samples of CHCs were selected proportionate to size from the three regions of Jordan, namely; north, central and south. Health centers in each stratum were then selected at random.

The primary and comprehensive health care centers constituted the primary Sampling units (PSUs) representing the first level clusters. Study subjects visiting the health centers were considered the secondary sampling units. Depending on indicator, either patients' medical files were randomly chosen or cross-sectional surveys were applied with random selection of subjects. For certain centers with expected low load of patients, the first arrivals were selected to ensure finding sufficient number of study subjects over the 2-3 day data collection period. This issue was further dealt with by weighting since centers with low load will definitely get lower weights.

2.2.2 Sampling Frame

Sampling frame for PSUs consisted of a total of 306 PHCs and CHCs that offer MCH services. All centers (about 70) that do not offer MCH services were excluded because three of the instruments used were designed to collect data on MCH related indicators. The sampling frame covered all 12 Governorates as well as the 20 health directorates. Table 2.1 summarizes the sampling frame. Users of the above centers constituted the sampling frame for the selected subjects

Table 2.1: Sampling frame for PSUs

Health Center Type	Number of Centers
Central CHC	20
Central PHC	97
Northern CHC	11
Northern PHC	115
Southern CHC	11
Southern PHC	52
TOTAL	**306**
Total CHC	**42**
Total PHC	**264**

2.2.3 Sample Size

Estimation of the sample size was based on the results of a study on contraceptive use in Jordan carried out in 1997. The prevalence of contraceptive use was about 0.4 and that would allow the maximum variability possible taking into consideration the estimates for other main variables**.** The calculated sample size was used for all other variables despite that some required a smaller sample size. The Coefficient of Variation (CV) was found to be 0.02 while the variance within each cluster (S^2w) was 0.041554 and the variance among clusters (S^2b) was 0.02726. The estimated variation for proportion V (p) was calculated for CV% of 5% to be 0.000692. The following formula was used to estimate the number of PSUs:

$\hat{V}(p) = S^2b/n + S^2w/mn$ where m is the sample size for PSUs and n represents the number of subjects to be selected in each cluster.

If “n” is considered 8 then we will end up with an m of 47 centers, if “n” is 10 then we need 45 centers and when “n” is 12 then the expected number is about 44 centers. It was decided to use 10 subjects per cluster, therefore a minimum of 45 centers were needed (Using 10 subjects per cluster lead to selecting 45 clusters). For certain variables (hypertension and diabetes control) where paired observations on the same individuals are to be collected in pre and posttests, the number of subjects per cluster was increased to 13 to compensate for the expected attrition over a 4.5 year period. As

a result, the minimum number of required subjects was 450 with 10 subjects from each of the 45 centers.

Data on annual number of visits and number of employees for 1999 was obtained from the MoH information centers. PSUs were selected with probability proportionate to size (PPS) within each stratum.

The size of each health center was calculated according to the following formula:

$$\text{Size of the center} = \frac{\text{capacity of center} \times \text{number of annual visits}}{2}$$

The capacity was calculated according to the following formula:

$$\text{Capacity} = \frac{\text{No. of clients per stratum} \times \text{No. of employees at a given center}}{\text{Number of employees per stratum}}$$

Table 2.2 shows the distribution of health centers by size for each stratum that was used to define the number of health centers in each stratum proportionate to size. The fifth column shows the adjusted number after selection with probability proportionate to size. As far as sampling from each stratum is separate the number of PSUs was inflated to allow sufficient number of health centers in each stratum. The inflation was done in an arbitrary way taking into account the number of the health centers in each stratum and the number calculated by PPS. The adjusted final numbers used in the sample are shown in the last column of Table 2.2. Within each stratum the PSUs were selected at random.

Table 2.2: Selection of Primary Sampling Units with Probability Proportionate to Size

Health Center	Size	Number of Centers	Rounded N with PPS	Adjusted Number
Central CHC	767883	20	7	**11**
Central PHC	1464292	97	13	**24**
Northern CHC	342858	11	3	**5**
Northern PHC	1503615	115	14	**28**
Southern CHC	330372	11	3	**5**
Southern PHC	526134	52	5	**16**
TOTALS	4935154	306	45	**89**

Finally, 89 (well distributed) health centers were selected over the six strata. The overall sample size was expected to be 890 for all the tools with 10 subjects from each health center. For diabetes and hypertension with 13 subjects from each selected health center, 1160 individuals were expected at least during the pretest phase.

It is worth mentioning that the study lacked separate samples for the intervention and comparison groups. This flaw happened because when pretest was conducted the users of MoH HCs were considered as the intervention group and users of UNRWA as the comparison group. During posttest, the original pretest sample of MoH users was used and divided into the intervention (63 HCs) and comparison groups (26 HCs) as the only available choice.

2.2.4 Calculating Weights

Weighting was done in the first place to reflect the population from which the sample was drawn. Relative weight was used to fit the design in various conditions.

- **Expansion weight** was calculated for each study subject in all tools according to the following formula: $EW=W1\times W2$ where, EW is the expansion weight, W^1 is the weight of a health center in the stratum and W^2 is the weight for the study subjects in the health center.

  W^1 was calculated as a reciprocal of the probability of selecting the health center in the stratum. Dividing the size of the health center by the total size in the stratum and multiplying the product by the number of health centers in the stratum calculated the probability of selecting a health center in that stratum.

  W^2 was calculated as the reciprocal of the probability of selecting one study subject in a given health center. Dividing the number of selected subjects at the health center by the total number of clients visiting the center during the study period equaled the probability of selecting a study subject.

  Expansion weight was used to calculate the relative weight.

- **Relative weight** was calculated by dividing the expansion weight for each subject by the average weight. The average or mean weight was calculated by dividing the total expansion weight for all subjects in the sample by the total number of subjects in the sample.

  The above mentioned expansion weight is suitable for inflation of the small samples at the stratum level in order to mirror the population that they represent. But when analysis at the national, regional or health center type levels is needed the inflation resulting from using the expansion weight will render the tests of statistical significance, with a standard statistical package like SPSS, almost meaningless. This happens simply because the computations do not reflect the actual number of observations and become too exaggerated ending up mostly with statistically significant relationships.

  Relative weights just downsize the expansion weights to numbers that are close to the actual sample size but still maintain the appropriate distribution of cases as produced by the expansion weight.

2.3 Main Variables and Indicators

Main variables are those used for calculation of utilization of services and proxy health status indicators. The variables were divided into two groups: a) utilization of services; and b) proxy health status variables. Each of the above groups was further divided into three categories. The first category deals with children up to three years of life, the second deals with women and the third with the adult population.

Table 2.3 shows the main study variables and their relevant indicators.

Table 2.3: Main Study Variables and Indicators

Utilization Variables: These are variables used to calculate some process and output indicators related to utilization of services at health care centers.	
Variables	**Indicators**
Children aged three years or less:	

Table 2.3: Main Study Variables and Indicators

Timeliness of Vaccination: Dates of vaccination for 2-year-old children.	**Proportion of children aged 2 years who were timely vaccinated.**
Growth and Development Visits: Number of growth and development visits made by 3-year-old children.	Proportion of 3-year-old children with appropriate number of growth and development visits (5, 2 and 1 visits for 1st, 2nd and 3rd year respectively).
Screening Children for Anemia: The presence of at least one hemoglobin reading in the child's record that was performed at the age 6-24 months.	Proportion of children aged 6-24 months with hemoglobin test that was done and recorded at least once.
Women:	
Antenatal Visits: Number of antenatal visits made by a pregnant woman and recorded in her medical file during her last completed pregnancy.	Proportion of pregnant women with at least 4 antenatal visits made at the selected health center at the end of pregnancy.
Postnatal Visits: Number of postnatal visits made by a pregnant woman after her last delivery.	Proportion of pregnant women with at least one postnatal visit within the first 6 weeks after delivery
Screening Pregnant Women for Anemia: The presence of at least one hemoglobin reading during last pregnancy in the antenatal record.	Proportion of pregnant women with hemoglobin test that was done and recorded.
Use of Contraceptive Methods: The status of using contraceptive methods by married women aged 15-49 years.	Proportion of women of reproductive age who were currently using any method of contraception.
Adults	
Screening for Hypertension: The status of screening of non-hypertensive adults aged 40 years and above of both sexes during the last year.	Proportion of non-hypertensive adults aged 40 years and above screened for hypertension during last year.

Table 2.3: Main Study Variables and Indicators

Health Status Variables	
Due to the relatively short lifetime of the project, measurable impact is not expected on major health indicators like infant mortality, maternal mortality and life expectancy nor on prevalence of main diseases like hypertension and diabetes. Instead, PHCI interventions were evaluated against a group of proxy health indicators an outcome measures.	
Children aged 6-24 months:	
Anemia of Children*: Hemoglobin readings made at 6-24 months of life.	Proportion of anemic children at 6-24 months of age.
Women:	
Anemia of Pregnancy*: Hemoglobin readings of pregnant women attending MCH centers.	Proportion of anemic pregnant women.
Adults	
Control of Diabetes: Glycosylated hemoglobin (HbA1c) readings for diabetic patients.	Proportion of controlled diabetics.
Control of Hypertension: Blood pressure measurements for selected hypertensive subjects.	Proportion of controlled hypertensives.

*Anemia of children and pregnancy indicators were added as proxy health status indicators because of the ease of getting data from the already surveyed medical records without anticipating that PHCI intervention are going to affect them.

The vaccination coverage in Jordan is very high; figures above 90% for individual vaccines are reported from different sources. Jordan is currently at the final stages of poliomyelitis eradication and the early stages of measles elimination. Given the population movement from other countries that are still behind Jordan in vaccination coverage, the timeliness of vaccination seems to be very important

Regular growth assessment of children during their first years of life is the single measurement that best defines the health and nutritional status. Certain socio-economic factors are beyond the control of the health team providing the service.

Nevertheless, there is a long list of health conditions affecting growth that can be corrected with appropriate growth monitoring visits to MCH centers including anemia.

Antenatal-postnatal care addresses both the psychosocial and the medical needs of the pregnant woman. Periodic health check-ups during the antenatal period are necessary to establish confidence between the woman and her health care provider, and to identify and manage any maternal complications or risk factors. Antenatal visits are also used to provide essential services that are recommended for all pregnant women, such as tetanus toxoid immunization and the prevention of anemia through nutrition education and provision of iron/folic acid tablets. Postnatal care is also essential for the early detection and adequate management of problems and disease emerging during the first 6 weeks after delivery in addition to being a good opportunity for offering family planning counseling.

Jordan has realized the discrepancy between the natural population growth rate and economic growth that poses increasing pressure on the public sector regarding education, health, employment and other aspects as well. Jordan's National Population Strategy calls for the expansion of family planning services throughout the Kingdom and seeks to increase rates of family planning use.

Despite the fact that contraceptive prevalence has been widely studied in Jordan with almost annual Jordan Population and Family Health Surveys over the last years, the current study is designed to gather information on users of MoH as far as the PHCI project is more facility based project. The results provided by nationwide household surveys are expected to be different from facility based surveys depending on type of facility under consideration. In our case the sample is biased towards more use of oral contraceptive as far as only health centers with MCH services were chosen.

Hypertension is a highly prevalent disease in Jordan. Jordan Morbidity Survey of MoH in 1996 pointed to an overall 32% prevalence of hypertension in those aged 25 years and above. The disease is the best example of secondary prevention. Screening for hypertension is a simple procedure applied to a prevalent disease with serious complications, easily prevented by the availability of very effective treatment schedules once the disease is discovered.

A mixture of health problems that is common in both developing and industrialized countries burdens the health care delivery system in Jordan. Hypertension occupies a major role in the etiology and development of coronary heart disease and stroke. It

specifically poses a major public health challenge to public health authorities in developing countries where the health system is already loaded with other more evident health problems. The severity of elevated blood pressure is directly related to coronary heart disease and stroke.

One of the most common chronic conditions prevailing in the Jordanian community is Diabetes. In 1998, the National Center for Diabetes, Endocrine and Genetic Diseases in Jordan reported a 13.4% prevalence rate for diabetes mellitus[*]. Management and control of diabetes is essential for delaying complications.

2.4 Data Collection Methods

2.4.1 Data Collection Techniques

Three main Techniques of data collection were used in the study:

- **Using available information** was utilized for record based surveys on timely vaccination, growth and development visits, antenatal-postnatal visits, anemia of pregnancy, anemia of children and partly screening for hypertension. The necessary data was transcribed from existing records to survey instruments. One form was used to fill out each record.

- **Interviewing study subjects using questionnaires** was used to get data on contraceptive use and partly for screening of hypertension, diabetes and hypertension control status.

- **Measurements (observations)** that apply to measuring glycosylated hemoglobin and blood pressure in diabetes and hypertension.

2.4.2 Data Collection Tools

2.4.2.1 Timeliness of Vaccination

Data for the timeliness of vaccination was obtained from records of MCH centers for sampled subjects. Annex 1 shows the form used for data collection on timeliness of

[*] Ajlouni K, Jaddou H, Batieha A. Diabetes and impaired glucose tolerance in Jordan: prevalence and associated risk factors. J Intern Med 1998 Oct;244(4):317-23.

vaccination. The tool was used to transfer data from records on dates of vaccination and other available background variables of two-year-old children. The six categories of parents' education were brought down to four during data analysis by combining elementary and secondary to become "less than secondary" and the last two categories to become "higher education".

Data was collected on vaccination dates for doses of hepatitis B, DTP, polio, measles and MMR. Children who were registered for the first time during the period from 1/1-30/4/1998 constituted the sampling universe for the pretest phase of the study. . Children who were registered for the first time during the period from 1/1-30/4/2002 constituted the sampling universe for the posttest phase of the study.

The required number of records (10) was selected by systematic random sampling from the total number of children who registered for the first time during the above-specified dates. Children were expected to register when they were 2 months old and vaccination records were traced for about two years after registration. Children were expected to be 2 years of age by 1/4/2000 and 1/4/2004 for the pretest and posttest phases respectively

A vaccination dose was considered timely if the child was brought to the clinic on the scheduled date (Table 2.4). For the first three doses of hepatitis, DTP and polio an additional one-month was allowed between doses. If the time between two subsequent doses was less than 28 days, the visits were labeled as inappropriate. First measles dose was considered appropriate even when given up to three months after the proposed age of 9 months. The second dose of measles as well as the booster doses was considered appropriate if given between 15 and up to 24 months of age.

Table 2.4: Definition of Timeliness of Vaccination for Different Doses

Vaccine Dose	**Age of Children**				
	Hepatitis B	**DTP**	**Poliomyelitis**	**Measles**	**MMR**
1st	8-12 weeks	8-12 weeks	8-12 weeks	9-12 months	15-24* months
2nd	30-60 days from first	30-60 days from first	30-60 days from first	15-24* months	
3rd	30-60 days from Second	30-60 days from Second	30-60 days from Second		
Booster		15-24 months	15-24 months		

- The second dose of measles was looked for only if MMR was not given.

2.4.2.2 Growth and development visits, and anemia of children

Data for these variables was obtained from MCH records of selected subjects. Annex 2 shows the instrument that was used for data collection. The data for growth and development visits, screening for anemia and the anemia of children variables appeared in the same tool as far as they are available in the same patient's record.

Growth and development visits were collected from a sample of children who were registered to get the service for the first time during the period from 1/1-30/4/1997 for the pretest while it the period was from 1/1-30/4/2001 for the posttest. Children were expected to register at 2 months of age; they were traced until the age of 3 years. The number of growth and development visits was recorded for the first, second and third years of life separately.

Appropriate was considered 5 or more visits during the first year of life, 3 or more visits for the second year and 1 or more visits for the third year of life.

Anemia of children was calculated based on the hemoglobin test that is routinely done at about one year of age. Children having hemoglobin (Hb) or packed cell volume (PCV) readings any time between 6 and 24 months of age were considered screened for anemia. Anemia was considered to be present when Hb was less than 11 g/dl according to WHO criteria. Anemia was considered mild, moderate and severe when Hb was 10 –11 g/dl, 7/10 g/dl and less 7 g/dl respectively

2.4.2.3 Antenatal, postnatal visits, and anemia of pregnancy

Data for the above three main variables was obtained from the records of subjects of selected sample of health centers. Annex 3 shows the instrument for data collection for the main variables as well as some background and control variables.

Antenatal care was measured by noting the number of antenatal care visits made by a pregnant woman in the selected sample whose registration date lied within the period from 1/1/-30/4/1999 for the pretest and 1/1-30/4/2003 for the posttest. Any notes found to indicate incomplete pregnancy disqualified the women from being included in the study. All pregnancies labeled as "risk pregnancies" were excluded from the sample to reduce the bias of frequent visits in such situations. Risk pregnancies as defined by MoH are those with essential hypertension, diabetes, proteinuria, heart disease and abnormal fetal positions. Visits not related to pregnancy were not counted.

Paying 4 or more antenatal visits during the period of a completed pregnancy was considered appropriate for normal uncomplicated pregnancy.

Attending a postnatal clinic once within the first 6 weeks after delivery was considered appropriate.

Screening for anemia of pregnancy in the same sample for antenatal-postnatal visits was considered appropriate if at least one Hb reading was available in the record. Anemia was calculated based on the last available Hb or PCV readings as described under anemia of children.

2.4.2.4 Use of Contraceptive Methods

Data on the current use of contraceptives was collected through an exit interview at the selected health care center for a sample of women in the age group 15-49. Annex 4.1 shows the questionnaire on the use of contraceptives.

Variables related to the use of any method whether modern or traditional were included in the questionnaire. Some questions on the source of contraceptive methods as well as problems related to the use of contraceptive methods were also included.

2.4.2.5 Screening for Hypertension

Data for screening hypertension was collected through an exit interview using the questionnaire shown in annex 5. Data was collected on a sample of non-hypertensive adults aged 40 years and above of both sexes during the study period.

The questionnaire contains variables that test the screening practice for hypertension on the day of the survey as well as over the period of the last year from the date of the survey.

The patient was considered screened for hypertension when the medical file showed that blood pressure was recorded at least once over the last year including the day of the survey. To look for the discrepancy between checking BP and recording the result in the patient's file, the data collected on the day of the survey was used. The patient was first asked about checking his/her BP and the response was compared to what was recorded in the medical file.

2.4.2.6 Status of Diabetes Control

Data on Diabetes control was collected using the questionnaire shown in annexes 6.1 and 6.2. Blood specimens were obtained for a sample of diabetic subjects for measuring glycosylated hemoglobin (HbA_{1c}). The American Diabetic Association criteria were used to determine the status of control of diabetes[*]. Only readings of HbA_{1c} below 7 were considered controlled. For purpose of standardization, the test was done at the Central Laboratories at the MoH during the pre and posttest phases. It is worth mentioning that in the pretest report different less stringent criteria were used.

As far as this study is not intended to look in depth for factors affecting diabetes control, only few independent variables were collected such as weight, height and disease duration.

Data was collected on weight and height to calculate the body mass index **(BMI)**. Known for its simplicity, the index correlates to fatness and can be applied to both men and women. BMI was calculated using the conventional formula (weight*10,000 /height^2) where weight is in kilograms and height in centimeters. BMI of 30 Kg/m^2 was considered the cutoff point between obesity and non-obesity. BMI of 25 Kg/m^2 was considered the cutoff point between normal and overweight. BMI was calculated for those who were above 17 years of age.

Table 2.5: Definition of BMI Categories

Category	**Value (Kg/m^2)**
Underweight	<18.5
Normal	18.5-24.99
Overweight	25-29.99
Obesity	≥30

As mentioned earlier 13 patients were selected in each health center to allow for the expected attrition and deaths in 4 years from the pretest. Patient's name, address and phone number were collected to facilitate locating them at the posttest stage. Patients were selected as for all other tools using systematic random sampling depending on the load during the 2-4 days of the survey in the target health centers.

2.4.2.7 Status of Hypertension Control

Data was collected using the questionnaire shown in annex 7. In addition to recording systolic and diastolic blood pressure, data on some additional independent variables

[*] American Diabetes Association. Standards of Medical Care for patients with diabetes mellitus. Diabetes Care [Suppl] 18/1/1995; 8-15

was collected similar to the previous tool on diabetes. Number of subjects selected at each health center was 13 as for diabetes.

Using standard mercury sphygmomanometer, 2 seated blood pressure measurements were recorded in both arms, and the higher measurement was recorded. Korotkoff phases 1 and 5 established the levels of systolic and diastolic pressures, respectively.

Blood pressure readings below 140 and 90 for systolic and diastolic pressure respectively were considered as controlled. All readings above the given figures were labeled as uncontrolled. Further classification of degrees of uncontrolled hypertension were done at the analysis stage, using the criteria shown in table 2.6 based on WHO 1999 guidelines[*].

Table 2.6: Definition of Blood Pressure Levels

BP Readings in mm/Hg		**Category of Control**
Systolic	**Diastolic**	
<140	<90	**Controlled Disease**
140-159	90-99	Mild Disease (Grade1)
160-179	100-109	Moderate Disease (Grade 2)
>179	>109	Severe Disease (Grade 3)

2.4.3 Data Collection Plan

2.4.3.1 Personnel and Logistics for Data Collection

Teams from MoH staff served as data collectors during both the pretest and posttest phases with about 80% of the data collectors in the posttest being the same as in pretest. Data collection was carried out by 15 teams consisting of three data collectors each. A team consisted of one general practitioner, a midwife or a nurse who was working in MCH facilities and a certified nurse, capable of drawing blood or a lab technician capable of drawing blood as a substitute. In addition to his work as data collector, the GP in the group was assigned as a team leader. Since the time needed to fill in various forms and questionnaires was expected to vary greatly in different facilities, the team leader was asked to assure equitable involvement of all team members taking into consideration that annex 4 on contraceptive use was filled only

[*] 1999 World Health Organization-International Society of Hypertension Guidelines for the Management of Hypertension

by a female nurse or midwife. Each of the 15 teams collected data from one health care facility at a time and the average stay in one health center was 2-3 days.

To facilitate data collection, three teams collected data form the south, six teams from the north and six teams from the central region. Team members were selected exclusively from their relevant region. Each team of data collectors was assigned a central supervisory team consisting provided guidance in addition to supervision.

Detailed tasks for each of the data collectors and their field supervisors were described in a comprehensive training manual that covered all issues from greetings to details in sampling patients and records to transporting blood and filled questionnaires. Following final checking and pre-entry cleaning, a team of four persons entered data at PHCI office using the data SPSS builder.

Transportation and cellular phones were provided to each team of data collectors and supervisors to provide easy communication with the investigators as well as with supervisors. Collected blood from diabetic patients was transported irrespective of the closeness of the center to the central lab upon completion of data collection at the health center. Working 6 days a week, data collection started on 28th of October and finished on 22nd of November 2000 for the pretest and from 20th of June till the 17th July for the posttest.

2.4.3.2 Ensuring quality of collected data

Ensuring both accuracy and reliability of the collected data was of prime concern throughout the study. The following measures were carried out to ensure quality:

- The sampling plan detailed earlier was followed very strictly giving minimal chance for deviation and after consulting with the investigators at the pretest stage.
- Data collection tools were pre-tested on several occasions including training of interviewers. Finally, all questions in the forms and questionnaires raised no ambiguity and open-ended questions were set at the minimum possible.
- About 5% of selected health facilities were revisited for validation of data collection on tools that are record based.
- All sphygmomanometers for measuring BP and balances and heighteners were new and from the same provider

- Glycosylated hemoglobin was done in one laboratory where quality assurance methods were applied.
- A fieldwork-training manual was developed. It provided all the details regarding the work to be done by data collection teams.
- Research teams received training before the actual data collection including field-testing of all instruments.
- Adequate supervision was provided for all teams with double-checking for quality control.
- Data entry started the third day of data collection and due efforts were exercised to clean the data during the data entry stage.

2.5 Data Analysis

Data entry for SPSS was used to enter collected data. The program was used to create forms (entry screens) that had almost the same design as the original questionnaires with all necessary validation rules, checks and skips to minimize errors. The data entry screens were largely devoid of coding. All coding was dealt with at the stage of building the data entry forms, defining and labeling variables. Even multiple response questions were imaged on the data entry screens as in the questionnaire or form. The very few open-ended questions posed no problem later at the analysis stage.
SPSS 10 was used to analyze data taking into consideration that the above mentioned data entry forms stored data directly in SPSS format.

Frequencies were calculated for simple descriptions of the results (means, medians, 95% confidence intervals etc.) Cross-tabulations showing relationships of main variables with control and background variables were used with various types of χ^2. Independent-sample t test was used to compare means of continuous numeric variables for various groups. Logistic regression was used to study the predicting ability of the available independent factors. Pooled data from the pre and posttest was used to run logistic regression. Analysis of co-variance (ANCOVA) was used for paired observations of diabetes and hypertension.

All counts and proportions are presented in the report as weighted numbers using the relative weight.

3. Results

3.1 Timeliness of Vaccination

3.1.1 Description of the sample

Table 3.1.1 shows the distribution of missing values for the main vaccine doses. A missing dose does not necessarily mean that the child missed the vaccine shot. It rather indicates that the child was not brought to the respective clinic to receive the dose. The child might have taken the dose at another MoH clinic or by other provider. The appropriateness of the dose is calculated for the valid values only which brings the number of the respondents down when combining doses.

In the pretest, data was collected form 878 records from the all sampled health centers. In the posttest, 857 records were collected from 86 health centers with 3 centers showing no records for children less than 2 years of age.

Table 3.1.1: Distribution of Valid and Missing Cases by Vaccine Dose

Vaccine Dose	Pretest		Posttest	
	Valid	Missing	Valid	Missing
1st Dose of DPT, Polio and Hepatitis B	878	0	857	0
2nd Dose of DPT, Polio and Hepatitis	876	3	857	0
3rd Dose of DPT, Polio and Hepatitis	872	6	845	12
Primary Doses Combined	872	6	845	12
1st Dose of Measles	838	40	815	42
2nd Dose of Measles	728	150	737	120
Booster Dose of DTP and Polio	788	90	740	117
All Doses Combined	726	153	735	122

Table 3.1.2 summarizes the demographic variables available in the children's records. About 45% of the sample came from the central region while about 18% came from the south. About 31% of the sampled children came from CHCs.

The male female ratio was almost 1:1. The mean monthly family income was 175 JDs with almost 72% of the children coming from families with a reported income of less than 200 JDs a month. Over 22% of both mothers and fathers of the selected children had higher education with less than 6% illiteracy rate. Significant differences between the pretest and posttest results of the demographic variables were noted only for income and mothers' education as judged by t test and logistic regression. The change in mean income from 161.2 JDs in the pretest to 189.7 JDs in the posttest was also reflected in the income categories. The difference was most probably due to expected

increase in income over 5-year period. As for mothers' education, the significant change was between secondary and higher educational categories with a notable increase in the former category.

Table 3.1.2: Overall Sample Characteristics

Variable	Pretest		Posttest		Pooled	
	N	%	N	%	N	%
Total	878	100.0	857	100.0	1735	100.0
Region						
North	314	35.7	336	39.2	650	37.4
Central	406	46.2	374	43.6	780	44.9
South	159	18.1	147	17.2	306	17.6
HC Type						
CHCs	255	29.0	284	33.1	539	31.1
PHCs	623	71.0	573	66.9	1196	68.9
Sex						
Male	454	51.7	430	50.2	884	51.0
Female	424	48.3	427	49.8	851	49.0
Income*						
<100	62	8.4	43	6.1	105	7.3
100-199	516	70.1	411	58.4	927	64.4
200-299	108	14.7	142	20.2	250	17.4
≥300	50	6.8	108	15.3	158	11.0
Education (Mother)*						
Illiterate	62	7.5	36	4.3	80	4.8
Less than Secondary	294	35.4	234	27.8	565	33.8
Secondary	297	35.7	379	45.0	658	39.3
Higher Education	178	21.4	194	23.0	371	22.2
Education (Father)						
Illiterate	51	6.1	29	3.4	98	5.9
Less than Secondary	311	37.5	254	30.1	528	31.5
Secondary	300	36.1	358	42.4	676	40.4
Higher Education	168	20.2	203	24.1	372	22.2

* Statistically significant difference between the pre and posttest

3.1.2 Analysis of Timeliness of Vaccination

Table 3.1.3 summarizes results of timeliness of vaccination for the 13 vaccine doses according to the phase of the study. Despite that timeliness for all doses combined increased by 5.7% from 64.5% in the pretest to 68.2% in the posttest, the level of increase was insignificant. There were some significant variations between the pre and posttest for some individual doses but the difference was not consistent in favor of one stage.

Despite that timeliness for all doses combined was relatively low, it was higher for individual doses. Second dose of measles and booster doses had the highest prevalence of timeliness (more than 94%) because of more loose criteria as opposed to the more stringent criteria for the primary shots.

Table 3.1.3: Distribution of Timeliness of Different Vaccine Doses by Study Phase

Vaccine Dose	Timeliness				
	Pretest		Posttest		p value
	n	%	n	%	
1st of DPT, Polio and Hepatitis B	870	82.0	729	85.1	0.086
2nd of DPT, Polio and Hepatitis	800	91.3	807	94.2	0.023
3rd of DPT, Polio and Hepatitis	784	89.9	761	90.1	0.917
Primary Doses Combined	616	70.6	639	75.6	0.02
1st Measles	741	88.3	729	89.4	0.446
2nd Measles	710	97.5	699	94.8	0.007
Booster of DTP and Polio	763	96.8	706	95.3	0.119
All Doses Combined	468	64.5	502	68.2	0.13

Table 3.1.4 displays at the distribution of timeliness of administering vaccine doses by the study phase for focal and non-focal health centers. Surprisingly the non-focal centers showed some significant improvements for the second and third primary doses as well as for all doses combined. The only significant difference for the focal health centers was observed for the second dose of measles, but with decreased prevalence.

Table 3.1.4: Distribution of Timeliness of Different Vaccine Doses by Study Phase and Intervention

Vaccine Dose	Timeliness			
	Focal %		Non-Focal %	
	Pretest	Posttest	Pretest	Posttest
1st of DPT, Polio and Hepatitis B	83.9	87.0	76.5	79.9
2nd of DPT, Polio and Hepatitis	91.9	93.9	89.5*	94.9
3rd of DPT, Polio and Hepatitis	92.0	89.0	83.6*	93.3
Primary Doses Combined	73.4	77.3	62.7	71.2
1st Measles	89.8	89.6	84.0	89.1
2nd Measles	97.8*	94.2	96.7	97.0
Booster of DTP and Polio	96.8	94.8	96.9	96.6
All Doses Combined	66.7	68.0	57.9*	68.8

* Statistically significant

The evident absence of any improvements among users of focal health centers as compared to non-focal is mostly related to lack of clear intervention regarding this

indicator. Absence of emphasis on counseling regarding timeliness of vaccination and short period of maturation of various interventions for most health centers should have played a role leading to no change.

Table 3.1.5 shows the logistic regression results for timeliness of vaccination as the dependent variable and the phase of the study variable in addition to demographic variables as covariates. Keeping all other variables constant, the odds for timeliness of vaccination were 11% higher in the posttest as compared to the pretest. This increase was not found to be statistically significant with a high p value at more than 0.4.

Table 3.1.5: Logistic Regression of Timeliness of Vaccination for All Doses Combined*

Variable	Coefficient	OR	Sig.
Study Phase			
Posttest	0.10	1.11	0.425
Pretest	-	-	-
Region			
North	0.70	2.01	<0.005
Central	0.53	1.69	0.003
South	-	-	-
HC Type			
CHCs	0.34	1.41	0.021
PHCs	-	-	-
Sex			
Male	0.20	1.22	0.114
Female	-	-	-
Income	0.00	1.00	0.866
Education (Mother)			
Illiterate	-1.12	0.32	0.003
Less than Secondary	-0.32	0.73	0.100
Secondary	0.20	1.22	0.263
Higher Education	-	-	-
Education (Father)			
Illiterate	0.00	1.00	0.992
Less than Secondary	0.36	1.43	0.066
Secondary	0.18	1.20	0.306
Higher Education	-	-	-

*Dependent Variable - Comparison Group

Overall, the timeliness of vaccination was significantly better in the northern and central regions as compared to the south. The results were in favor of the CHCs, where the records of timeliness were 41% more likely to be higher than the PHCs. As for mothers' education, it seems that only the lowest category had a significant 3.1 times lower likelihood of getting their children timely vaccinated than the highest education category.

Child's gender, income and father's education had no significant differences on timeliness of vaccination. The regression results just hints to fact that PHCI intervention did not affect the timeliness of vaccination even after controlling for possible confounding factors.

3.2 Growth Monitoring and Anemia of Children

3.2.1 Description of the sample

The number of health centers with records on growth and development monitoring for the three-year old children went down form 87 in the pretest to 80 in the posttest (Table 3.2.1). This was reflected on the total records reviewed in the posttest (802) compared to the pretest (867). It seems that inadequate supervision played a major role for missing records in over 10% of the sampled health centers during the posttest. In some health centers the staff blamed the PHCI renovation as the cause of misplacing the records. It is worth mentioning that moving from and to the renovated center was the responsibility of the MoH.

Table 3.2.1 shows the missing values for other variables. The growth and development visits variables had no missing values. Anemia of children aged 6-24 months showed that only about 38% of the records in both pretest and posttest showed valid values. This figure increased only by 2% when all children in the sample are included. Despite that screening for anemia is compulsory at one year of age; the figures are extremely low even when adopting a wider age definition. Absence of labs in the health centers, lack of awareness from the child's parents or negligence of the provider especially in documenting the lab results could have contributed to this outcome. This problem did not show any improvement over more than 4 years. It is worth mentioning that the results of anemia will not be representative not only because of the sample size but also because the socio-demographic attributes of non-respondents might be different from those of respondents.

Table 3.2.1: Distribution of Valid and Missing Cases for Main Variables

Variables	Phase of the Study			
	Pretest		Posttest	
	Valid	Missing	Valid	Missing
Number of Health Centers	87	2	80	9
First Growth and Development Visit	867	0	802	0
Second Growth and Development Visit	867	0	802	0
Third Growth and Development Visit	867	0	802	0
All Growth and Development Visits	867	0	802	0
Anemia of Children Aged 6-24 Months	329	538	300	502
Anemia of Children aged 3 Years or Less	352	515	320	481

Table 3.2.2 summarizes demographic variables available in the sampled records. About 47% of the sample came from the central region, 35% from the north and about 18% came from the south. About 32% of the sampled children came from CHCs. The male female ratio was 1.13:1. The mean monthly family income was 165 JDs with over 77% of the children coming from families with a reported income of less than 200 JDs a month. Over 20% of both mothers and fathers of the selected children had higher education with about 5% illiteracy rate. Significant differences between the pretest and posttest results of the demographic variables were noted only for income and fathers' education as judged by t test and logistic regression. The income mean changed from 158.9 JDs in the pretest to 172.2 JDs in the posttest (p=0.012). The difference was most probably due to inconsistent reporting of income rather than real increase. As for father's education the significant change was between secondary and higher educational categories with a notable increase in the former category.

Table 3.2.2: Overall Sample Characteristics

Variable	Pretest		Posttest		Pooled	
	N	%	N	%	N	%
Total	867	100	803	100	1669	100
Region						
North	293	33.8	289	36.4	582	35.0
Central	429	49.5	356	44.8	785	47.3
South	145	16.7	149	18.8	294	17.7
HC Type						
CHCs	280	32.3	257	32.3	537	32.3
PHCs	587	67.7	538	67.7	1125	67.7
Sex						
Male	455	52.5	428	53.8	883	53.1
Female	412	47.5	367	46.2	779	46.9
Income*						
<100	89	13.1	38	6.0	127	9.7
100-199	452	66.4	441	69.7	893	68.0
200-299	91	13.4	100	15.8	191	14.5
≥300	49	7.2	54	8.5	103	7.8
Education (Mother)						
Illiterate	44	5.7	34	4.5	78	5.1
Less than Secondary	274	35.3	254	33.2	528	34.3
Secondary	297	38.3	293	38.4	590	38.3
Higher Education	161	20.7	183	24.0	344	22.3
Education (Father)*						
Illiterate	39	5.0	32	4.2	71	4.6
Less than Secondary	298	38.3	247	32.3	545	35.3
Secondary	284	36.5	325	42.5	609	39.5
Higher Education	157	20.2	160	20.9	317	20.6

* Statistically significant difference between the pre and posttest

3.2.2 Appropriateness of Growth and Development Monitoring Visits

Table 3.2.3 shows that readings for appropriateness of growth and monitoring development visits were lower in the posttest as compared to the pretest. The appropriateness of all visits combined went down by about 26% form 21.6% to only 16%. The negative change was significant for all but for the third visit.

Table 3.2.3: Distribution of Appropriateness of Growth and Development Monitoring Visits by Study Phase

Growth and Development Monitoring Visits	Appropriateness				
	Pretest		Posttest		p value
	n	%	n	%	
First Visit	550	63.4	444	55.4	0.001
Second Visit	322	37.1	222	27.7	<0.005
Third Visit	310	35.8	264	33.0	0.23
All Visits Combined	187	21.6	128	16.0	0.004

The above decrease in the appropriateness of growth and development visits was noticed to be consistent for both focal and non-focal health centers (Table 3.2.4).

The evident absence of any improvements in focal health centers as compared to non-focal is mostly related to absence of clear interventions regarding this indicator. Apart from the effect of separate pretest posttest sample design, the negative change observed over 4-year period hints to true deterioration in services provided to children, poor documentation of provided services or to factors related to child's guardians. Most probably a combination of the above factors contributed to the results.

Table 3.2.4: Distribution of Appropriateness of Growth and Development Monitoring Visits by Study Phase and Intervention

Vaccine Dose	Appropriateness			
	Focal %		Non-Focal %	
	Pretest	Posttest	Pretest	Posttest
First Visit	64.6*	58.5	59.9*	47.3
Second Visit	37.4*	29.2	36.2*	24.1
Third Visit	37.4	29.2	36.2*	24.1
All Visits Combined	21.8*	17.3	20.8*	12.5

* Statistically significant

The pretest-posttest results of appropriateness of growth and development monitoring visits did not change when controlling for the available demographic variables using

logistic regression. The odds of appropriateness decreased in posttest by 1.6 times compared to the pretest (Table 3.2.5). The rate of appropriateness was found to be 2.2 times less likely in the north as compared to the south and 1.14 times more in the central region than the south. Data presented in table 3.2.5 should be considered with caution as far as Hosmer and Lemeshow goodness of fit test showed significant differences between the observed and predicted values of the appropriateness of visits variable.

Table 3.2.5: Logistic Regression of Appropriateness of Growth and Development Monitoring Visits

Variable		Odds Ratio	OR 95% CI		Sig.
			Upper	Lower	
Study Phase	Posttest	0.63	0.47	0.85	0.002
	Pretest	-	-	-	-
HC Type	CHCs	0.76	0.56	1.05	0.098
	PHCs	-	-	-	-
Region	North	0.46	0.30	0.71	0.001
	Central	1.14	0.78	1.66	0.501
	South	-	-	-	-
Sex	Male	1.06	0.80	1.42	0.679
	Female	-	-	-	-
Education (Mother)	Illiterate	0.77	0.26	2.30	0.639
	Less than Secondary	1.86	1.14	3.03	0.013
	Secondary	1.43	0.92	2.22	0.114
	Higher Education	-	-	-	-
Education (Father)	Illiterate	1.62	0.69	3.79	0.267
	Less than Secondary	1.09	0.68	1.76	0.713
	Secondary	1.44	0.95	2.19	0.087
	Higher Education	-	-		-
Income	Income	1.00	1.00	1.00	0.023

- Comparison Group Hosmer and Lemeshow Test: p =0.027

3.2.3 Anemia of Children Aged 6-24 Months

As mentioned earlier screening for anemia was shown to be very low at both pre and posttest. For children aged 6-24 months the figure was almost identical for both phases of the study at 37.9% and 37.4% (Table 3.2.6). Even increasing the age range to include all children age 3 years and less the figures did not change much. As far as the above results of screening for anemia among children are representative of MoH

data, one should be cautious about interpreting the anemia data available at MoH database. The latter conclusion is due to the fact of lacking detailed characteristics of over 60% of children who were not screened for anemia.

Table 3.2.6: Distribution of Screening for Anemia by Study Phase

Variables	Phase of the Study			
	Pretest		Posttest	
	n	%	n	%
Anemia of Children Aged 6-24 Months	329	37.9	300	37.4
Anemia of Children aged 3 Years or Less	352	40.6	320	40.0

Table 3.2.7 shows that the prevalence of the appropriateness of growth visits was 2.3 times higher among those screened for anemia compared to those not screened. This finding hints to the fact that screening a child for anemia is related to the pattern of utilization of MoH services by child's guardians rather than to providers.

Table 3.2.7: Distribution of Appropriateness of Growth and Monitoring Visits by Screening for Anemia

Appropriateness of Growth Visits	Screening			
	Yes		No	
	n	%	n	%
Yes	193	**28.64**	122	**12.26**
No	481	71.36	873	87.74

Complying with the screening period for anemia at around one year of age will end in less than 200 cases for both pretest and posttest phases of the study. Table 3.2.8 shows anemia categories for all children in the sample who had hemoglobin test done and documented and for a subset of children aged 6-24 months. The mean age of children tested for anemia was 12.5 months with a minimum of one and a maximum of 35.5 months. Mean hemoglobin increased from 11.4 g% in the pretest to 11.6 g% in the posttest. The increase was significant at $p = 0.038$. Nevertheless, no significant changes were noted for anemia categories as shown in table 3.2.8. The study phase variable as well as other demographic variables did not show any statistically significant predictive ability for the anemia variable.

Table 3.2.8: Distribution of Anemia Among Children by Study Phase

Anemia of Children < 36 Months Old	Study Phase				
	Pretest		Posttest		Sig.
	n	%	n	%	
Anemic	89	25.3	66	20.6	0.152
Non-Anemic	263	74.7	254	79.4	
Total	352	100.0	320	100.0	
Anemia of Children Aged 6-24 Months					
Anemic	80	24.3	64	21.4	0.386
Non-Anemic	249	75.7	235	78.6	
Total	329	100.0	299	100.0	

3.3 Antenatal Care

3.3.1 Sample Description

Missing values were absent for all main variables but screening for anemia. Valid values for screening for anemia minimally increased from 88.2% in the pretest to 91.5% in the posttest. Screening of pregnant women for anemia is much higher than that of children mostly because less attention is paid to healthy babies by both parents and providers.

Table 3.3.1: Distribution of Valid and Missing Cases For Main Variables

Variable	Pretest		Posttest	
	Valid	Missing	Valid	Missing
Number of Sampled Health Centers	88	1	87	2
Antenatal Care	840	0	861	0
Postnatal Care	840	0	861	0
Counseling for Family Planning*	248	0	311	0
Decision for Family Planning**	86	0	240	0
Screening for Anemia	741	99	779	82

* Number of those who attended postnatal care

* Number of those who were given counseling for family planning

Table 3.3.2 shoes that about 45% of the sample came form the north, 40.2 % from the central region and 14.7 from the south. About one third of sample came from CHCs and the rest form PHCs. The mean of reported income rose from 154 JDs to 174 JDs ($p = <0.005$). This finding was consistent for vaccination, growth monitoring and antenatal care. The true increase in income over about 5 years is possible but not definite.

Mean age for pretest and posttest phases was 26.3 and 27 years respectively with almost two thirds of the sample being in the age group 20-29 years. Illiteracy rate as judged by zero years of schooling for pregnant women and their husbands was found to be less than 5%, while the higher education rate was over 18% (Table 3.3.2).

Table 3.3.2: Overall Sample Characteristics

Variable	Pretest		Posttest		Pooled	
	N	%	N	%	N	%
Total	840	100	861	100	1701	100
Region						
North	384	45.7	384	44.6	768	45.1

Table 3.3.2: Overall Sample Characteristics

Variable	Pretest		Posttest		Pooled	
	N	%	N	%	N	%
Central	339	40.4	344	40.0	683	40.2
South	117	13.9	133	15.4	250	14.7
HC Type						
CHCs	266	31.7	285	33.1	551	32.4
PHCs	574.0	68.3	577	66.9	1151	67.6
Income*						
<100	47	7.3	42	5.7	89	7.3
100-199	498	77.1	457	62.2	955	77.1
200-299	70	10.8	191	26.0	261	10.8
≥300	31	4.8	45	6.1	76	4.8
Age Groups in Years*						
<20	74	8.9	58	6.7	132	7.8
20-29	550	65.9	540	62.7	1090	64.3
30-39	198	23.7	240	27.9	438	25.8
=>40	13	1.6	23	2.7	36	2.1
Education (Pregnant)						
Illiterate	39	4.7	32	3.7	71	4.2
Less than Secondary	255	31.0	224	26.1	479	28.5
Secondary	365	44.4	440	51.3	805	47.9
Higher Education	163	19.8	161	18.8	324	19.3
Education (Husband)*						
Illiterate	28	3.4	23	2.7	51	3.0
Less than Secondary	325	39.6	344	40.1	669	39.9
Secondary	298	36.3	352	41.1	650	38.7
Higher Education	170	20.7	138	16.1	308	18.4

* Statistically significant difference between the pre and posttest

3.3.2 Appropriateness of Antenatal and Postnatal Visits

The average number of antenatal visits in the pretest of 4.56 visits was almost similar to the average number of visits in the posttest phase at 4.35 visits (p=0.117). Table 3.3.3 shows similar results with appropriate number of antenatal visits being 57.7% and 57.3% for the pretest and posttest respectively. The appropriate postnatal visits showed a statistically significant improvement over the intervention period. It increased by over 22% from 29.6% at the pretest to 36.1% in the posttest. The percentage of offering family planning counseling during the postnatal visit increased by 123% in posttest compared to the posttest. Nevertheless, the decision on use of family planning methods did not change.

Table 3.3.3: Distribution of Main Variables by Study Phase

Variable	Phase				
	Pretest		Posttest		p value
	n	%	n	%	
Appropriate Number of Antenatal Visits	485	57.7	493	57.3	0.842
Appropriate Number of Postnatal Visits	248	29.6	311	36.1	0.004
Family Planning Counseling	86	34.7	240	77.2	<0.005
Decision to Use of Family Planning	62	71.3	152	63.6	0.197

When pretest-posttest results are broken further into focal and non-focal to reflect the effect of the more focused interventions, the appropriateness of antenatal visits did not show significant change. Despite that the postnatal care increased for both focal and non-focal health centers, the increase was significant only for focal health centers (Table 3.3.4). Family planning counseling showed significant increase for both focal and non-focal heath centers. Decision for family planning was shown to be consistently insignificant across focal and non-focal health centers. The above results point to a possibility of an effect caused by PHCI interventions on the provision of postnatal care.

Table 3.3.4: Distribution of Main Variables by Study Phase and Intervention

Variable	Intervention			
	Focal %		Non-Focal %	
	Pretest	Posttest	Pretest	Posttest
Appropriate Number of Antenatal Visits	58.3	58.5	55.7	53
Appropriate Number of Postnatal Visits	28.7*	35.5	32.4	34
Family Planning Counseling	37.4*	74.5	26.7*	85.5
Decision to Use of Family Planning	71.4	63.4	68.8	64.6

* Statistically significant

Table 3.3.5 shows logistic regression for the available demographic variables in addition to the study phase variable. The study phase variable has no predication of the appropriateness of the number of antenatal visits where the significance test is very close to unity.

Aside from monthly income, other available demographic variables showed no prediction ability of the main variable. Pregnant women coming from lower income categories were more likely to have appropriate number of antenatal visits. Higher

income pregnant women are more likely to use other providers including private sectors, thus making less visits to MoH health centers.

Table 3.3.5: Logistic Regression of Appropriateness of Number of Antenatal Visits

Variable		Odds Ratio	OR 95% CI		Sig.
			Upper	Lower	
Study Phase	Posttest	0.99	0.79	1.24	0.942
	Pretest	-	-	-	-
HC Type	CHCs	0.83	0.65	1.05	0.119
	PHCs	-	-	-	-
Region	North	1.29	0.93	1.81	0.130
	Central	1.00	0.72	1.40	0.996
	South	-	-	-	-
Income	<100	1.36	0.71	2.61	0.361
	100-199	2.16	1.30	3.58	0.003
	200-299	1.87	1.09	3.18	0.022
	≥300	-	-	-	-
Education (Pregnant)	Illiterate	1.30	0.63	2.70	0.483
	Less than Secondary	1.16	0.82	1.66	0.403
	Secondary	1.03	0.76	1.40	0.833
	Higher Education	-	-	-	-
Education (Husband)	Illiterate	1.50	0.66	3.39	0.336
	Less than Secondary	1.40	0.99	1.97	0.057
	Secondary	1.04	0.75	1.43	0.829
	Higher Education	-	-		-
Age	Age	1.00	0.98	1.02	0.716

- Comparison Group Hosmer and Lemeshow Test: p =0. 313

Table 3.3.6 shows logistic regression for the postnatal care. Income was removed from the equation because of 321 missing values, which will affect the model. Income was kept in table 3.3.5, as the results did not change after its removal.

Pregnant women were 1.38 times more likely to pay at least one postnatal visit after delivery in the posttest than in the pretest (p = 0.003). The same table shows that out of all covariates in the model, paying appropriate number of antenatal visits was the most predictive of coming to at least one postnatal visit. If pregnant women attended 4 or more antenatal visits she was about 2.8 times more likely to be seen at the postnatal clinic (p<0.005).

Ironically, CHCs that are supposed to provide better primary health care were 1.4 times less likely to attract pregnant women to have postnatal care than the PHCs

(p=0.006). Each year increase in age makes pregnant women 2% less likely to attend postnatal care after delivery.

Table 3.3.6: Logistic Regression of Appropriateness of Number of Postnatal Visits

Variable		Odds Ratio	OR 95% CI		Sig.
			Upper	Lower	
Study Phase	Posttest	1.38	1.11	1.71	0.003
	Pretest	-	-	-	-
HC Type	CHCs	0.71	0.56	0.91	0.006
	PHCs	-	-	-	-
No. of Antenatal Visits	Appropriate	2.75	2.19	3.44	<0.005
	Inappropriate	-	-	-	-
Region	North	1.19	0.86	1.65	0.302
	Central	1.09	0.78	1.52	0.598
	South	-	-	-	-
Education (Pregnant)	Illiterate	0.65	0.34	1.26	0.200
	Less than Secondary	0.70	0.49	0.98	0.040
	Secondary	0.83	0.62	1.12	0.227
	Higher Education	-	-	-	-
Education (Husband)	Illiterate	1.17	0.56	2.44	0.667
	Less than Secondary	1.09	0.78	1.52	0.608
	Secondary	0.86	0.63	1.19	0.371
	Higher Education	-	-		-
Age	Age	0.98	0.96	1.00	0.039

- Comparison Group Hosmer and Lemeshow Test: p =0. 401

Table 3.3.7 shows logistic regression for family planning counseling. During the posttest pregnant women were 8.4 times more likely to be counseled for family planning during a postnatal care visit than during the pretest.

Women attending postnatal clinics in the north and central region were 5.4 and 2 times respectively more likely to be counseled for family planning than women attending clinics in the south. Overall, despite that the number of antenatal visits paid to MoH health centers did not change over the intervention period, the postnatal care has improved. A more prominent change was noticed with provision of family planning counseling.

Table 3.3.7: Logistic Regression of Family Planning Counseling

Variable		Odds Ratio	OR 95% CI		Sig.
			Upper	Lower	
Study Phase	Posttest	8.40	5.17	13.65	<0.005
	Pretest	-	-	-	-
HC Type	CHCs	1.48	0.87	2.52	0.145
	PHCs	-	-	-	-
Region	North	5.43	2.58	11.43	<0.005
	Central	2.06	0.99	4.26	0.052
	South	-	-	-	-
Income	<100	0.26	0.06	1.15	0.076
	100-199	0.76	0.23	2.47	0.643
	200-299	1.26	0.36	4.49	0.718
	≥300	-	-	-	-
Education (Pregnant)	Illiterate	0.55	0.11	2.75	0.469
	Less than Secondary	1.60	0.77	3.36	0.211
	Secondary	1.61	0.86	3.00	0.137
	Higher Education	-	-	-	-
Education (Husband)	Illiterate	1.30	0.25	6.74	0.753
	Less than Secondary	0.67	0.33	1.37	0.271
	Secondary	1.36	0.69	2.69	0.373
	Higher Education	-	-		-
Age	Age	1.00	0.95	1.04	0.911

- Comparison Group Hosmer and Lemeshow Test: p =0. 585

3.3.3 Anemia of Pregnancy

Table 3.2.8 shows that screening for anemia increased from 88.2% during the pretest to 90.5% during the posttest. The increase was insignificant with a p = 0.13. The same trend was noted for both focal and non-focal health centers.

Table 3.2.8: Distribution of Screening for Anemia by Study Phase

Screening for Anemia of Pregnancy	Phase of the Study			
	Pretest		Posttest	
	n	%	n	%
Yes	741	88.2	779	90.5
No	99	11.8	82	9.5

Mean hemoglobin increased insignificantly from 11.6 g% in the pretest to 11.7 g% in the posttest (p=0.122). Table 3.3.9 shows that anemia among pregnant women has

significantly decreased by 20% from about 25% in the pretest to about 21% in the posttest (p=0.04). Analyzing anemia status by intervention rendered the improvement insignificant for both focal and non-focal health centers.

Most of the anemia was mild in both pretest and posttest. Severe anemia was absent. The prevalence of mild and moderate anemia decreased during the posttest. Breaking down anemia into mild moderate and severe rendered the changes between the pre and posttest insignificant (p=0.069).

Table 3.3.9: Distribution of Anemia Among Pregnant Study Phase

Anemia of Pregnant Women	**Study Phase**					
	Pretest			**Posttest**		
	n	**%**	**%Cum.**	**n**	**%**	**%Cum.**
Mild Anemia	147	19.9	19.9	136	17.5	17.5
Moderate	40	**5.4**	**25.4**	27	3.4	**20.9**
No Anemia	553	74.7		616	79.1	

Table 3.3.10 shows the highly significant progression of anemia from 9.8 g% during the first trimester to 18.5% during the second and reaching 27.6% during the third trimester for the posttest. The pretest data was not shown because the trimester of screening for anemia was not available. The observed progression is consistent with findings from other studies.

Table 3.3.10: Distribution of Anemia by Trimester During the Posttest

Anemia	**Trimester**						**Total**	
	1st Trimester		**2ed Trimester**		**3rd Trimester**			
	n	**%**	**n**	**%**	**n**	**%**	**n**	**%**
Anemia	14	**9.8**	53	**18.5**	95	**27.6**	162	20.9
No Anemia	129	90.2	234	81.5	249	72.4	612	79.1
Total	143	100	287	100	344	100	774	100

Table 3.3.11 shows that pregnant women were about 1.3 times less likely to have anemia in the posttest as compared to the posttest. This change was found to be insignificant. Pregnant women in the north were over 2 times more likely to be anemic than those in the south while women in the south and central regions were more or less similar. These results were not different from those of the MoH database.

The observed 2% increase in likelihood of having anemia for every one year increase in pregnant woman's age was found to be insignificant. Women receiving their

antenatal care from CHCs were about 1.7 times less likely to be anemia than those attending PHCs. Women's education can predict anemia significantly. Illiterate pregnant women were about 3 times more likely to have anemia as compared to those with higher education.

Table 3.3.11: Logistic Regression of Anemia

Variable		Odds Ratio	OR 95% CI		Sig.
			Upper	Lower	
Study Phase	Posttest	0.78	0.59	1.04	0.090
	Pretest	-	-	-	-
HC Type	CHCs	0.59	0.43	0.81	0.001
	PHCs	-	-	-	-
Region	North	2.03	1.28	3.24	0.003
	Central	1.31	0.81	2.12	0.266
	South	-	-	-	-
Income	<100	0.84	0.35	2.01	0.687
	100-199	1.12	0.56	2.25	0.753
	200-299	0.79	0.37	1.67	0.530
	≥300	-	-	-	-
Education (Pregnant)	Illiterate	2.84	1.19	6.77	0.018
	Less than Secondary	2.59	1.62	4.15	<0.005
	Secondary	1.39	0.91	2.12	0.131
	Higher Education	-	-	-	-
Education (Husband)	Illiterate	0.84	0.35	2.01	0.687
	Less than Secondary	1.12	0.56	2.25	0.753
	Secondary	0.79	0.37	1.67	0.530
	Higher Education	-	-		-
Age	Age	1.02	1.00	1.05	0.089

- Comparison Group Hosmer and Lemeshow Test: p =0.039

3.4 Use of Contraceptive Methods

3.4.1 Sample Description

Table 3.4.1 shows that data was collected from all the 89 health centers in both the pretest and posttest. The same table shows absence of missing values for the main variables with very few missing for the demographic variables.

Table 3.4.1: Distribution of Valid and Missing Cases For Main Variables

Variable	Pretest		Posttest	
	Valid	Missing	Valid	Missing
Number of Sampled Health Centers	89	0	89	0
Use of Family Planning Methods	892	0	889	0
Source of Contraceptive Method*	506	0	595	0
Age	888	4	887	1
Male Children	892	0	889	0
Female Children	892	0	889	0
Employment Status	884	8	884	4
Woman's Education	892	0	889	0
Husband's Education	892	0	888	1

* Only for those using modern methods of family planning

Table 3.4.2 summarized the sample description where data was collected from 1781 non-pregnant women visiting MoH health centers that offer primary health care including maternity and childhood services.

Over 54% of the respondents came from the central region, about 35% from the north and less than 11% from the south. Over one third of the sample was from CHCs. The weighted distribution by region inflated the central region from about 39% to 54% while the north was deflated from 37 to 35% and south more drastically from 24% to about 11%. This reflects the reality of having more married women of reproductive age visiting the clinics in the central region. The same explanation applies to CHCs where the un-weighted proportion was 25% as opposed to about 36%.

Mean age in the pretest was 30.5 compared to 30.9 years in the posttest (p=. 0.198). Sampled women were almost equally distributed across the age groups below 30 years and from 30-40 years while only about 7% were in the age group above 40 years.

Mean years of schooling for respondents were 10.5 and 10.7 years in the pretest and posttest respectively (p=0.215). Husbands' mean years of schooling was 11.1 and 10.9 years in the pretest and posttest respectively (p=0.204) About 27% of both respondents and their husbands had higher education and only about 3% had zero years of schooling. The employment rate of the sampled women was about 16% increasing from 13.9% in the pretest to 17.6% in the posttest.

Average number of children per women was about 4 in both the pretest and posttest (p=0.245) with almost 2 males and 2 females. About 50% of women had 1-3 children and over 14% had more than 7 children.

Table 3.4.2: Overall Sample Characteristics

Variable	Pretest		Posttest		Pooled	
	N	%	N	%	N	%
Total	892	100	889	100	1781	100
Region						
North	314	35.2	308	34.7	622	34.9
Central	490	54.9	479	53.9	969	54.4
South	88	9.9	101	11.4	189	10.6
HC Type*						
CHCs	298	33.4	338	38.0	636	35.7
PHCs	594	66.6	551	62.0	1145	64.3
Age Groups in Years						
<30	419	47.2	400	45.0	819	46.1
30-40	410	46.2	423	47.6	833	46.9
>40	59	6.6	65	7.3	124	7.0
Education (Respondent)*						
Illiterate	28	3.1	30	3.4	58	3.3
Basic	304	34.0	243	27.4	547	30.7
Secondary	331	37.1	369	41.6	700	39.3
Higher	230	25.8	246	27.7	476	26.7
Education (Husband)						
Illiterate	19	2.1	22	2.5	41	2.3
Basic	295	33.1	261	29.4	556	31.2
Secondary	324	36.3	375	42.2	699	39.3
Higher	254	28.5	230	25.9	484	27.2
Employment *						
Employed	123	13.9	156	17.6	279	15.8
Not Employed	754	85.2	726	82.1	1480	83.7
Retired	8	0.9	2	0.2	10	0.6
No of Live Children						
0	2	0.2	3	0.3	5	0.3
1-3	428	48.0	420	47.3	848	47.6
4-6	315	35.3	355	40.0	670	37.6
=>7	147	16.5	110	12.4	257	14.4

* Statistically significant difference between the pre and posttest

3.4.2 Family Planning Use

Table 3.4.3 shows the distribution of main variables by the study phase. It is worth mentioning that the prevalence of use of various family planning methods was calculated for married women of reproductive age visiting MoH health centers with MCH services excluding pregnant women. Knowing that about 20-25% of women visiting health centers with MCH services are pregnant, the contraceptive prevalence rate among non-pregnant is expected to be higher than figures reported by DHS or other studies that include all women. Furthermore, in a facility based surveys where MCH services are provided the prevalence of contraceptive use is expected to be higher than in household surveys.

Overall, use of any method increased significantly by about 13% over a 4.5-year period from 73.5% in the pretest to 82.8% in the posttest. A more drastic increase was noted by about 38% for using any modern method from about 53% in the pretest to 70% in the posttest. Parallel to the increase of use in modern methods, about 37% drop in the use of traditional methods from 20.6% to 13% was noted (Table 3.4.3).

Table 3.4.3: Distribution of Main Variables by Phase of the Study

Variable	Phase				
	Pretest		Posttest		p value
	n	%	n	%	
Any Family Planning Method	656	**73.5**	735	**82.8**	<0.005
Any Modern Method	472	**52.9**	622	**70.0**	<0.005
Pills	132	**14.8**	199	**22.4**	<0.005
IUDs	264	**29.6**	260	**29.2**	0.871
Condoms	49	**5.5**	97	**10.9**	<0.005
Injectables	16	**1.8**	32	**3.6**	0.018
Female Sterilization	11	**1.2**	17	**1.9**	0.249
Use of LAM	NA	NA	16	**1.8**	NA
Male Sterilization	0	0	0	0	0
Norplant	0	0	0	0	0
Any Traditional Method	184	**20.6**	116	**13.0**	<0.005
Breastfeeding	106	**11.9**	59	**6.6**	<0.005
Withdrawal	50	**5.6**	31	**3.5**	0.032
Abstinence	40	**4.5**	25	**2.8**	0.06
Diaphragm, Jell or Foam	2	**0.2**	1	**0.1**	0.595

Of the modern methods, use of injectables increased the most by about 100% followed by condoms, which increased by 98% in the posttest compared to the pretest. Use of pills increased by over 51% from (14.8% in the pretest to 22.4% in the posttest), while IUDs did not change over the intervention period. There was an insignificant increase in female sterilization. Data collected during the pretest did not allow calculating the prevalence of LAM among users, while it was 1.8% in the posttest. The decrease in use of traditional methods was observed for all methods. Use of breastfeeding as a contraceptive method decreased by about 80% from 11.9% to only 6.6% while abstinence and withdrawal decreased by 61% and 60% respectively.

Table 3.4.4 shows the breakdown of use of various family planning methods by study phase and intervention group. Overall, there was a significant increase in the use of any family planning method by 16% among users of the focal health centers while the increase of 3% among users of the non-focal health centers was insignificant. Using any modern method showed significantly increasing prevalence in the posttest as compared to the pretest among users of both focal and non-focal health centers. Nevertheless, the increase among users of focal was higher at 36% than users of non-focal at 24%.

Table 3.4.4: Distribution of Main Variables by Study Phase and Intervention

Variable	Intervention			
	Focal		Non-Focal	
	Pretest	Posttest	Pretest	Posttest
Any Family Planning Method	71.5*	82.9	80.0	82.1
Any Modern Method	51.8*	70.2	56.1*	69.4
Pills	13.5*	21.2	19.1*	27.0
IUDs	30.3	30.6	27.3	24.5
Condoms	5.1*	11.5	6.9	8.7
Injectables	2.0	3.3	1.0*	4.6
Female Sterilization	1.2	1.9	1.5	2.0
Use of LAM	0.0	1.9	0.0	2.0
Male Sterilization	0	0	0	0
Norplant	0	0	0	0
Any Traditional Method	19.7*	13.1	24.0*	12.8
Breastfeeding	11.1*	7.1	14.7*	5.6
Withdrawal	5.2*	3.0	6.8	5.1
Abstinence	4.9*	3.0	2.9	2.0
Diaphragm, Jell or Foam	0.3	0.0	0.0	0.5

The use of pills among users of focal health centers increased by 57% as compared to only 41% among users of non-focal. The most noticeable significant increase among users of focal health centers was in the prevalence of using condoms at 127% while the change was insignificant for users of non-focal health centers.

Overall, there was an increase in the prevalence of use of modern contraceptives over the PHCI lifetime. Despite of the presence of some support in favor of PHCI activities leading to improvement in contraceptive use, the evidence was not consistent. There are several country-wide initiatives supported by USAID and other donors aiming at improving the use of contraceptive prevalence in addition to the efforts exercised by the MCH directorate of MoH.

3.4.3 Source of Family Planning Methods

Table 3.4.5 shows about 30% increase in the prevalence of getting the method from the surveyed health center. The dependence on sources other than the ministry of health decreased by about one third from 34.2% during the pretest compared to 23.8% during the posttest.

Table 3.4.5: Distribution of Family Planning Source by Study Phase

Source	Pretest		Posttest		Total	
	n	%	n	%	n	%
This Health Center	219	**43.3**	336	**56.4**	555	50.4
Another MoH Health Center	114	22.5	118	19.8	232	21.1
Non-MoH Health Center	173	**34.2**	142	**23.8**	315	28.6
Total	506	100.0	596	100.0	1102	100.0

$p<0.005$

The positive change in the source of family planning was noticed for the main three modern contraceptive methods. Current health centers served as a source for getting pills in about 86% of pill users during the posttest compared to only 66% for the pretest. This was accompanied by a noticeable decrease in outside sources from 25.8% in the pretest to 10.1%. The same trend but to a lesser degree was noted for both condoms and IUDs.

Table 3.4.6: Distribution of Source of Selected Family Planning Methods by Study Phase

Source	Pills %		Condoms %		IUDs %	
	Pretest	Posttest	Pretest	Posttest	Pretest	Posttest
This Health Center	65.9	**85.9**	76.0	**84.4**	19.0	**25.5**
Another MoH Health Center	8.3	4.0	10.0	4.2	34.6	34.4
Non-MoH Health Center	25.8	**10.1**	14.0	**11.5**	46.4	**40.2**

Facing difficulties in getting or using family planning methods was mentioned by about 12% of users during the pretest. The figure went down significantly by over 45% during the posttest to reach only 6.5% (Table 3.4.7).

Table 3.4.7: Distribution of Difficulties Getting or Using Family Planning Methods by Study Phase

Study Phase	Response	Frequency	Percent
Pretest	Yes	**78**	**11.9**
	No	574	87.6
	Not sure	3	0.5
	Total	656	100.0
Posttest	Yes	**48**	**6.5**
	No	686	93.2
	Not sure	2	0.2
	Total	735	100.0

Table 3.4.8 shows that complications and side effects were the main type of difficulties identified by users. Figures of 5.4% and 5.2% of complications and side effects for pretest and posttest were very close and were seemingly not responsible for the overall reduction in the prevalence of difficulties among users. Non-availability of the service at the local health center and lack of provision for some services on daily basis were the kind of difficulties that were reduced during the posttest. It is worth mentioning that the latter types of difficulties were mainly related to IUD insertion. The "others" category included a variety of answers ranging from male provider, not knowing that the service is available and is free, far distance, long waiting time and method inconvenience.

Table 3.4.8: Distribution of Type Difficulties Getting or Using Family Planning Methods by Study Phase

Study Phase	Type of Difficulty	Frequency	Percent
Pretest	Complications and side effects	36	5.4
	Service is not provided daily	19	2.9
	Not Availability in local HC	16	2
	Others	7	1.1
Posttest	Complications and side effects	38	5.2
	Service is not provided daily	4	0.5
	Not Availability in local HC	4	0.5
	Others	1	0.1

3.4.4 Prediction of Contraceptive Use

As shown in table 3.4.9 women tended to use the modern contraceptive methods about twice more likely in the posttest compared to the pretest. Women in central and northern regions were respectively 69% and 33% more likely to use modern methods than women in the south region. Women users of CHCs were only insignificantly 2% more likely to use modern contraceptive methods. Women in the younger age groups were more likely to use modern methods. Women in the age group of less than 30 years were about 2.3 times more likely to use modern methods than those older than 40 years. While those in the age group of 30-40 years were about 1.9 times more

likely to use modern methods than the oldest age group. Employment was also found to be a significant predictor of modern family planning use. Employed women were found to be about 1.8 times more likely to use modern methods as compared to the unemployed.

Clearly, both pregnant woman's and husband's education had some predictive ability for the use of modern methods. Illiterate women were twice less likely to use modern methods than those with higher education. Women married to illiterate husbands were 2.8 times less likely to use modern methods when compared to those married to husbands with higher education.

With every additional male child, women were about 30% more likely to use modern contraceptive methods, while only 11% more likely to use such methods with every additional female child.

Table 3.4.9: Logistic Regression of Use of Modern Contraceptive Methods

Variable		Odds Ratio	OR 95% CI		Sig.
			Upper	Lower	
Study Phase	Posttest	2.10	1.72	2.58	<0.005
	Pretest	-	-	-	-
HC Type	CHCs	1.02	0.83	1.27	0.824
	PHCs	-	-	-	-
Region	North	1.33	1.06	1.66	0.013
	Central	1.69	1.16	2.46	0.006
	South	-	-	-	-
Age Groups	<30	2.29	1.40	3.74	0.001
	30-40	1.91	1.24	2.93	0.003
	>40	-	-	-	-
Employment	Employed	1.80	1.29	2.52	0.001
	Not Employed	-	-	-	-
Education (Pregnant)	Illiterate	0.49	0.25	0.95	0.035
	Basic	0.79	0.56	1.11	0.166
	Secondary	0.87	0.65	1.17	0.351
	Higher Education	-	-	-	-
Education (Husband)	Illiterate	0.36	0.17	0.75	0.007
	Basic	0.95	0.70	1.28	0.731
	Secondary	1.07	0.81	1.40	0.644
	Higher Education	-	-		-
Male Children	No. of Male Children	1.29	1.19	1.41	<0.005
Female Children	No. of Female Children	1.11	1.03	1.20	0.007

- Comparison Group Hosmer and Lemeshow Test: p =0.025

Table 3.4.10 shows that women in the posttest were about 1.7 times less likely to use natural methods compared to women in the pretest. Despite that the use of natural methods were more likely prevalent among the younger age groups, age did not seem to be a significant predicator for using natural methods. Furthermore, having one more male child made the women 1.2 less likely to rely on natural methods for family planning.

Employed women were about 1.9 less likely to use a natural method than their unemployed counterparts. Illiterate women and women married to illiterate husbands were more likely to use natural methods compared to those with higher education.

Table 3.4.10: Logistic Regression of Use of Natural Contraceptive Methods

Variable		Odds Ratio	OR 95% CI		Sig.
			Upper	Lower	
Study Phase	Posttest	0.60	0.46	0.78	<<0.0055
	Pretest	-	-	-	-
HC Type	CHCs	0.69	0.52	0.91	0.009
	PHCs	-	-	-	-
Age Groups	<30	1.13	0.57	2.22	0.730
	30-40	1.46	0.79	2.67	0.225
	>40	-	-	-	-
Employment	Employed	0.53	0.33	0.84	0.007
	Not Employed	-	-	-	-
Education (Pregnant)	Illiterate	1.92	0.90	4.10	0.091
	Basic	1.01	0.65	1.56	0.960
	Secondary	1.14	0.78	1.66	0.510
	Higher Education	-	-	-	-
Education (Husband)	Illiterate	3.10	1.42	6.76	0.004
	Basic	1.14	0.77	1.69	0.498
	Secondary	1.15	0.81	1.63	0.450
	Higher Education	-	-		-
Male Children	No. of Male Children	0.83	0.74	0.92	0.001
Female Children	No. of Female Children	1.03	0.94	1.13	0.514

- Comparison Group Hosmer and Lemeshow Test: p =0.139

3.5 Screening for Hypertension

3.5.1 Sample Description

Table 3.5.1 shows that data for hypertension screening was collected from all the 89 health centers in both the pretest and posttest.

Aside from very few records with missing data on age, sex and years of schooling during the posttest phase, all main variables had completely valid values.

Table 3.5.1: Distribution of Valid and Missing Cases For Main Variables

Variable	Pretest		Posttest	
	Valid	Missing	Valid	Missing
Number of Sampled Health Centers	89	0	89	0
Age	884	0	917	4
Sex	884	0	918	3
Years of Schooling	884	0	917	4
BP Checking During the Survey Day	884	0	921	0
BP Recording During the Survey Day*	884	0	276	0
Total Number of Visits Over the Last Year	884	0	921	0
Number of Times BP Was Recorded Last Year	884	0	921	0
Final Screening for Hypertension	884	0	921	0

* Only for those reporting their blood pressure checked

Table 3.5.2 shows that over 48% of the sample came from the central region, 36% from the north and 16% from the south. About 32% of the respondents came from the CHCs.

The male female ratio was 0.72:1 reflecting the expected sex differential of users of MoH health centers. The mean age during the pretest and posttest phases was almost identical at 52.69 and 52.64 years respectively ($p = 0.92$). While the majority of respondents (44%) were belonging to the youngest age group 40-49 years, less than 8% were in age group above 70 years of age. There were some significant differences in the proportion of age categories of respondents between the pre and posttest data.

The mean number of years of schooling was identical at 5 years for the pre and posttest. The low education is probably related to the age structure of the sample. About 41% of the sample had zero years of schooling compared to 10.3% with higher education.

Table 3.5.2: Overall Sample Characteristics

Variable	Pretest		Posttest		Pooled	
	N	%	N	%	N	%
Total	884	100	921	100	1805	100
Region*						
North	338	38.2	314	34.1	652	36.1
Central	398	45.0	470	51.0	868	48.1
South	148	16.7	137	14.9	285	15.8
HC Type						
CHCs	270	30.5	306	33.2	576	31.9
PHCs	614	69.5	615	66.8	1229	68.1
Sex						
Male	351	39.7	403	43.9	754	41.8
Female	533	60.3	515	56.1	1048	58.2
Age Groups in Years*						
40-49	412	46.7	384	41.9	796	44.2
50-59	234	26.5	293	32.0	527	29.3
60-69	147	16.6	188	20.5	335	18.6
=>70	90	10.2	52	5.7	142	7.9
Education						
Illiterate	385	43.5	362	39.4	747	41.4
1-6	174	19.7	238	25.9	412	22.9
7-12	229	25.9	229	24.9	458	25.4
Higher Education	97	11.0	89	9.7	186	10.3

* Statistically significant difference between the pre and posttest

3.5.2 Screening for Hypertension

Table 3.5.3 shows that 30% of respondents in the posttest compared to 26.4% in the pretest reported having their blood pressure checked. The 14% of the observed improvement in the posttest was not shown to be significant. For those reporting their BP was checked, medical files showed that BP readings were recorded only in 63% in the posttest compared to 57.5% in the pretest. Again the 10% observed improvement in the posttest did not show statistical significance.

Screening for hypertension among respondents on the survey day was noted to be 18.9% in the posttest compared to 15.2% in the pretest. The 24% increase between pre and posttest was significant. Finally, the overall screening that takes into consideration BP recordings in the medical file over the last year including the survey day did not change significantly over more than 4 years. Screening increased by only 4% from 37% in the pretest to reach 38.5% in the posttest.

Table 3.5.3: Distribution of Main Variables by Study Phase

Variable	Phase				
	Pretest		Posttest		p value
	n	%	n	%	
BP Checking During the Survey Day	233	**26.4**	276	**30.0**	0.088
BP Recording During the Survey Day*	134	**57.5**	174	**63.0**	0.203
Screening During the Survey Day**	134	**15.2**	174	**18.9**	0.035
Final Screening Over the Last Year	327	**37.0**	355	**38.5**	0.496

*Among those reporting their BP was checked
** Among the overall sample

Examining screening for hypertension on the survey day across the focal and non-focal health centers showed some significant changes in favor of focal health centers Focal health centers improved by about 36% in the posttest. Unfortunately this change did not hold true for the year around screening for hypertension where there were no significant changes between the pre and posttest (Table 3.5.4).

Table 3.5.4: Distribution of Main Variables by Study Phase and Intervention Group

Variable	Focal %		Non-Focal %	
	Pretest	Posttest	Pretest	Posttest
BP Checking During the Survey Day	28.6	32.2	21.1	23.9
BP Recording During the Survey Day	56.7*	68.2	58.2	44.1
Screening During the Survey Day	16.2*	22.0	12.3	10.5
Final Screening Over the Last Year	38.5	40.5	33.3	33.2

* Statistically significant

One can conclude that the efforts exercised through PHCI activities such as clinical training and quality assurance did not materialize into improvement in screening for hypertension irrespective of the procedure simplicity. Absence of active supervision is thought to be the major player of absence of improvement for this indicator.

3.5.3 Prediction of Screening for Hypertension

Table 3.5.6 shows prediction of the screening for hypertension for the available variables. As expected the phase of the study did not show any prediction for the appropriateness of screening for hypertension. Age and sex showed significant prediction for the screening variable. A male patient aged 40 years and above was 1.37 times less likely to have his blood pressure checked than a female patient.

For each one year increase in age there is 1.2% more likelihood that the patient was screened for hypertension.

Table 3.5.6: Logistic Regression of Screening for Hypertension

Variable		Odds Ratio	OR 95% CI		Sig.
			Upper	Lower	
Study Phase	Posttest	1.07	0.88	1.29	0.507
	Pretest	-	-	-	-
HC Type	CHCs	0.99	0.80	1.23	0.914
	PHCs	-	-	-	-
Region	North	0.79	0.58	1.06	0.118
	Central	0.92	0.70	1.21	0.559
	South	-	-	-	-
Sex	Male	0.73	0.58	0.90	0.004
	Female	-	-	-	-
Age	Age	1.01	1.00	1.03	0.012
Years of Schooling	Years of Schooling	1.01	0.99	1.03	0.324

- Comparison Group Hosmer and Lemeshow Test: p =0.002

3.6 Status of Control of Diabetes

3.6.1 Sample Description

Data was collected from all of the 89 selected health centers during both phases of the study. All blood samples were delivered in good shape to the Central Lab where HbA1c was performed with no single missing value (Table 3.6.1). The same table shows few missing values for age, years of schooling and disease duration. The highest missing values were reported for employment during the pretest at about 2.4%.

Table 3.6.1: Distribution of Valid and Missing Cases For Main Variables

Variable	Pretest		Posttest	
	Valid	**Missing**	**Valid**	**Missing**
Number of Sampled Health Centers	89	0	89	0
Region	1190	0	1150	0
Health Center Type	1190	0	1150	0
Age	1188	2	1150	0
Sex	1190	0	1150	0
Years of Schooling	1188	2	1146	4
Employment	1161	29	1140	10
Duration of the Disease in Years	1181	9	1146	5
HbA1c	1190	0	1150	0
BMI	1174	16	1142	9

The pooled sample was 2340 respondents with 1190 from the pretest and 1150 from the posttest (Table 3.6.2). About 44% of the sample came from the central region followed by about 39% from the north and 17.3% from the south. More respondents from the south and less from the central region were noted during the posttest as compared to the pretest mainly due to higher responses from the south. Over 70% of the respondents were users of PHCs.

The male female ratio was 1:1.4 which reflects the gender structure of clients in the targeted age groups. The mean age of respondents was statistically younger in the pretest at 55.1 years compared to 57.7 years in the posttest ($p<0.005$). The age difference is clearly reflected in the age groups shown in table 3.6.2. The shift in age is partly explained by follow up of the same respondents in about 38% of cases making them more than 4 years older.

Overall, about 23% of the respondents were employed, 13% retired and 64% unemployed. There were more retired in the posttest as compared to the pretest, which might be partly due to follow up issue.

The differences in the educational level of respondents for the two study phases were statistically insignificant. The mean years of schooling was 4.4 and 4.8 years at the pretest and posttest respectively (p=0.036). The mean disease duration increased significantly from 5.7 in the pretest to 6.3 years in the posttest. The disease duration categories show similar changes with more respondents in the higher categories. Again this can be explained by following up about 38% of the same participants.

Table 3.6.2: Overall Sample Characteristics

Variable	Pretest		Posttest		Pooled	
	N	%	N	%	N	%
Total	1190	100	1150	100	2340	100
Region*						
North	455	38.2	454	39.5	909	38.8
Central	555	46.6	472	41.0	1027	43.9
South	180	15.1	224	19.5	404	17.3
HC Type						
CHCs	351	29.5	338	29.4	689	29.4
PHCs	839	70.5	812	70.6	1651	70.6
Sex						
Male	480	40.3	472	41.0	952	40.7
Female	710	59.7	679	59.0	1389	59.3
Age Groups in Years*						
<30	30	2.5	17	1.5	47	2.0
30-49	299	25.2	217	18.9	516	22.1
50-59	394	33.2	350	30.4	744	31.8
60-69	315	26.5	387	33.7	702	30.0
=>70	149	12.6	179	15.6	328	14.0
Employment*						
Employed	374	32.2	145	12.7	519	22.6
Retired	90	7.8	218	19.1	308	13.4
Not Employed	697	60.0	777	68.2	1474	64.1
Education						
Illiterate	567	47.7	510	44.5	1077	46.1
1-6	255	21.5	252	22.0	507	21.7
7-12	273	23.0	284	24.8	557	23.9
Higher Education	93	7.8	101	8.8	194	8.3
Disease Duration in Years						
0-3	361	30.6	205	17.9	566	24.3
4-6	279	23.6	296	25.8	575	24.7
7-10	277	23.5	287	25.0	564	24.2
>10	264	22.4	358	31.2	622	26.7

* Statistically significant difference between the pre and posttest

3.6.2 Status of Control of Diabetes and Obesity

The diabetes control figures are different from those reported in the pretest report as far as more stringent criteria of the American Diabetes Association were applied. Readings of HbA_{1c} less than 7% were considered controlled diabetes.

The mean HbA1c increased significantly from 7.55% during the pretest to reach 7.98% during the posttest. This difference is mainly due to the presence of high values in the upper 5% of the distribution during the posttest. Nevertheless, the controlled - uncontrolled categories of diabetic patients were statistically similar during both phases of the study despite the observed mild increase of uncontrolled from about 61% to about 63%.

The mean of the body mass index (BMI) decreased insignificantly from 30.1 Kg/m2 in the pretest to 29.7 Kg/m2 (p=0.06). Examining the BMI categories further supports the no change between the two study phases.

Table 3.6.3: Distribution of the Status of Control of Diabetes and BMI by Study Phase

Variable		Phase				
		Pretest		Posttest		p value
		n	%	n	%	
Status of Control of Diabetes	Controlled	459	38.6	421	36.6	0.327
	Uncontrolled	731	**61.4**	729	**63.4**	
Body Mass Index	Normal	210	17.9	231	20.2	0.123
	Overweight	402	34.2	411	36.0	
	Obese	562	**47.9**	501	**43.8**	

Table 3.6.4 looks at the main variables taking into account the intervention dimension in addition to study phase. The change in the status of control of diabetes over the project lifetime was insignificant for both focal and non-focal health centers with a p value of 0.9 and 0.14 respectively.

The body mass index figures were somewhat better in focal health centers than non-focal with more respondents falling in the normal group and less in the obesity group. The change in BMI for the focal centers between the two phases of the study was significant.

The above findings indicate that training of health workers, introduction of standards and protocols and presence of performance improvement review teams in the health centers were insufficient to lead to significant improvement in diabetes control. This

might have happened due to a combined effect of short maturation of interventions and absence of an effective supervision and follow up system.

Table 3.6.4: Distribution of the Status of Control of Diabetes and BMI by Study Phase and Intervention

Variable		Focal %		Non-Focal %	
		Pretest	**Posttest**	**Pretest**	**Posttest**
Status of Control of Diabetes	Controlled	39.7	39.4	39.5	36.5
	Uncontrolled	60.3	60.6	60.5	63.5
Body Mass Index	Normal	15.4*	17.8	16.6	22.6
	Overweight	34.0	37.6	35.7	34.6
	Obese	50.6	44.7	47.7	42.8

*Statistically significant at p = 0.07

3.6.3 Prediction of the Status of Control of Diabetes

As expected table 3.6.5 shows that the study phase had no role in predicting the state of control of diabetes. Similarly, type of health center did not seem to play any role in the prediction of the status of control of diabetes despite the fact that CHCs had internists offering a supposedly better management of diabetics. Region wise, the north was not different from the south while respondents from the central region were 29% more likely to have their diabetes controlled compared to respondents from the south.

The sex of the patient behaved indifferently to predicting disease control status. The age was a significant predictor of control for diabetes where with each year of age increase the diabetes was 2.2% more likely to be brought under control. Educational level showed that with the increase of one year of schooling, the control of diabetes becomes 6% significantly more likely to happen. Conversely, employment did not show significant prediction of diabetes control. Disease duration showed a somewhat negative relationship with control of diabetes. With each year of increase in disease duration the possibility that a diabetic patient becomes controlled is about 6% less.

As expected, obesity also proved to be a significant predicator for the control of diabetes. Non-obese subjects were 1.34 times more likely to be controlled than obese subjects. Finally, one should note that this study did not aim at looking at a detailed list of factors affecting diabetes control but rather reporting the indicators as is.

Table 3.6.5: Logistic Regression of Status of Control of Diabetes

Variable		Odds Ratio	OR 95% CI		Sig.
			Upper	Lower	
Study Phase	Posttest	0.98	0.82	1.17	0.834
	Pretest	-	-	-	-
HC Type	CHCs	0.97	0.79	1.19	0.759
	PHCs	-	-	-	-
Region	North	0.95	0.73	1.24	0.703
	Central	1.29	1.01	1.66	0.044
	South	-	-	-	-
Sex	Male	1.07	0.86	1.32	0.556
	Female	-	-	-	-
Age	Age	1.02	1.01	1.03	<0.005
Years of Schooling	Years of Schooling	1.06	1.04	1.08	<0.005
Employment	Employed	0.82	0.65	1.33	0.678
	Not Employed	-	-	-	-
Disease Duration	Disease Duration	0.94	0.93	0.96	<0.005
Obesity	Not Obese	1.34	1.12	1.60	0.002
	Obese	-	-	-	-

- Comparison Group Hosmer and Lemeshow Test: p =0.46

3.6.4 Analysis of Paired Observations for Diabetes Control

Overall, only 446 participants out of the 1190 recruited in the pretest (37.5%) were followed in the posttest. The paired observations constituted about 39% of the posttest respondents. The highest response was from the north at 47.9% followed by the south region at 37.6% and the central region at 30.5%. Paired observations were obtained from all health centers but one. Almost 54% of the respondents came from the focal centers while the remaining 46% from non-focal health centers.

As far as the sample was designed to get data at the stratum level (region and health center type), one can proceed with the analysis of the 446 paired observations at the national level without going to lower levels of stratifications.

Analysis of co-variance (ANCOVA) was used to test the effect of PHCI interventions as judged by focal versus non-focal health centers on the status of control of diabetes. One should keep in mind that non-focal health centers were not a perfect comparison

due to unavoidable contamination especially regarding training component. Testing the homogeneity of regression slopes revealed an F value of 1.35 corresponding to a p value of 0.245. This finding indicates that the main assumption for ANCOVA of having the same regression slopes for the first and second readings of HbA1c for respondents coming from focal and non-focal centers was met.

Table 3.6.6 shows that the intervention as judged by focal-non-focal health centers had a statistically significant effect on the level of posttest HbA1c with an F value of 13.4 and a p value of less than <0.0055.

Table 3.6.6 Tests of Between Subjects Effects for the Posttest HbA_{1c} As Dependent Variable and Focal-Non-Focal as Intervention

Source	Type III Sum of Squares	df	Mean Square	F	Sig.	Observed Power*
Corrected Model	394.5**	2	197.3	32.3	<<0.0055	1.000
Intercept	253.1	1	253.1	41.5	<<0.0055	1.000
Pretest HbA_{1c}	304.33	1	3.4.3	49.9	<<0.0055	1.000
Intervention	81.6	1	81.6	13.4	<<0.0055	0.954
Error	2782.7	456	6.1			
Total	35337.8	459				
Corrected Total	3177.2	458				

*Computed using alpha = .05

**R Squared = 0.124 (adjusted R squared = 0.120)

Table 3.6.7 shows parameter estimates of the regression of posttest HbA1c on pretest HbA1c. The B coefficients of the regression are used to construct the estimated marginal means shown in table 3.3.8 according to the formula: Estimated marginal mean = intercept coefficient + coefficient corresponding to the level of intervention + (intercept for the pretest HbA1c × mean of pretest HbA1c)

Table 3.6.7: Parameter Estimates for the Posttest Readings of HbA_{1c} as Dependent Variable for Focal and Non-Focal Health Centers

Parameter	B	Std. Error	t	p value	95% CI		Observed Power*
					Lower	Upper	
Intercept	3.616	0.634	5.707	<0.005	2.371	4.862	1.000
Pretest HbA_{1c}	0.566	0.080	7.062	<0.005	0.408	0.724	1.000
Non-Focal Health Centers	0.844	0.231	3.657	<0.005	0.391	1.298	0.954
Focal Health Centers	0**	-	-	-	-	-	-

*Computed using alpha = .05

**This parameter is set to zero because it is redundant (comparison parameter).

Table 3.6.8 summarizes the estimated marginal means with 95% confidence interval while keeping the value of pretest HbA1c at its mean level. The HbA1c mean value for diabetics using focal health centers was significantly less at 7.97% as compared to non-focal health centers at 8.81% irrespective of the differences in the pretest readings.

Table 3.6.8: Estimated Marginal Means of Posttest HbA_{1c}

Intervention	Mean	Std. Error	95% Confidence Interval	
			Lower	Upper
Non-Focal Health Centers	8.81	0.17	8.48	9.14
Focal Health Centers	7.97	0.16	7.65	8.28

Evaluated at pretest HbA_{1c} = 7.688.

3.7 Status of Control of Hypertension

3.7.1 Sample Description

Data was collected from all the 89 sampled health centers during both phases of the study (Table 3.7.1). The same table shows very few missing values for age, years of schooling and disease duration.

Table 3.7.1: Distribution of Valid and Missing Cases For Main Variables

Variable	Pretest		Posttest	
	Valid	Missing	Valid	Missing
Number of Sampled Health Centers	89	0	89	0
Region	1148	0	1089	0
Health Center Type	1148	0	1089	0
Age	1144	4	1087	2
Sex	1148	0	1088	1
Years of Schooling	1148	0	1085	4
Employment	1148	0	1087	2
Duration of the Disease in Years	1145	3	1085	4
Systolic and Diastolic BP variables	1148	0	1089	0
BMI	1147	1	1089	0

The pooled sample consisted of 2237 respondents with 1148 from the pretest and 1089 from the posttest (Table 3.7.2). About 46% of the sample came from the central region followed by about 37% from the north and 17% from the south. More respondents from the south and less from the central region were noted during the posttest as compared to the pretest. Sixty nine percent of the respondents were users of PHCs while the rest were users of CHCs.

The male female ratio was 1:1.7 which reflects the gender structure of clients in the targeted age groups. The mean age of respondents was statistically younger in the pretest at 57.3 years compared to 59.5 years in the posttest ($p<0.005$). The age difference is clearly reflected in the age groups shown in table 3.7.2. The shift in age is partly explained by follow up of the same respondents in about 32.3% of cases making them more than 4 years older.

Overall, about 23% of the respondents were employed, 11% retired and 66% unemployed. There were less employed in the posttest compared to the pretest. The mean years of schooling was 3.7 and 4.3 years at the pretest and posttest respectively ($p=0.004$). The significant differences were reflected in the educational categories of

respondents for the two phases of the study. Overall, 52% of the sample had zero years of schooling, while less than 8% had higher education than school.

The mean disease duration increased significantly from 6.4 in the pretest to 7.7 years in the posttest. The disease duration categories show similar changes with more respondents in the higher categories. Again, this is mainly explained by following up about over 32% of the same participants.

Table 3.7.2: Overall Sample Characteristics

Variable	Pretest		Posttest		Pooled	
	N	%	N	%	N	%
Total	1148	100	1189	100	2237	100
Region*						
North	421	36.7	399	36.6	820	36.7
Central	565	49.2	471	43.3	1036	46.3
South	162	14.1	219	20.1	381	17.0
HC Type						
CHCs	344	30.0	350	32.1	694	31.0
PHCs	804	70.0	739	67.9	1543	69.0
Sex*						
Male	398	34.7	424	39.0	822	36.8
Female	750	65.3	664	61.0	1414	63.2
Age Groups in Years*						
<50	245	21.4	165	15.2	410	18.4
50-59	372	32.5	325	29.9	697	31.2
60-69	348	30.4	398	36.6	746	33.4
=>70	180	15.7	199	18.3	379	17.0
Employment*						
Employed	319	27.8	190	17.5	509	22.8
Retired	132	11.5	115	10.6	247	11.0
Not Employed	697	60.7	783	72.0	1480	66.2
Education *						
Illiterate	630	54.9	533	49.2	1163	52.1
1-6	234	20.4	222	20.5	456	20.4
7-12	209	18.2	233	21.5	442	19.8
Higher Education	75	6.5	96	8.9	171	7.7
Disease Duration in Years*						
0-3	424	37.0	276	25.4	700	31.4
4-6	320	27.9	313	28.8	633	28.4
7-10	234	20.4	248	22.9	482	21.6
>10	168	14.7	248	22.9	416	18.6

* Statistically significant difference between the pre and posttest

3.7.2 Status of Control of Hypertension and Obesity

Table 3.7.3 shows that over 100% improvement in the status of control of hypertension was noted during the posttest at 22.3% compared to the pretest at 11%. The improvement was consistent across the six categories of the level of control of hypertension. There was an increase in the percentage of the first three categories of controlled blood pressure in the posttest compared to pretest. As for the uncontrolled categories there was a drastic decrease in grade III hypertension and mild decrease in grade II in favor of grade I disease. The observed differences were statistically significant.

Table 3.7.3: Distribution of the Status of Control of Hypertension by Study Phase

Status of Control of Hypertension	Pretest		Posttest	
	N	%	N	%
Optimal	25	2.2	47	4.3
Normal	42	3.7	86	7.9
High Normal	59	5.1	110	10.1
Controlled	**126**	**11.0**	**243**	**22.3**
Grade I Hypertension	327	28.5	429	39.4
Grade II Hypertension	380	33.1	310	28.5
Grade III Hypertension	314	27.4	107	9.8
Uncontrolled	**1021**	**89.0**	**846**	**77.7**

The mean BMI changed from 31.6 Kg/m^2 during the pretest to 31.2 Kg/m^2 during the posttest with a p value of 0.048. Table 3.7.4 shows the distribution of BMI categories by study phase. During the posttest, only less than 14% were enjoying normal BMI while about 31% were overweight and the majority (55.6%) was obese. The results of the pretest were not statistically different from the posttest (p=0.312).

Table 3.7.4: Distribution of Obesity Status by Study Phase

Obesity Status	Pretest		Posttest	
	N	%	N	%
Normal	132	11.5	147	13.5
Overweight	350	30.5	336	30.9
Obese	665	58.0	606	55.6

Table 3.7.5 shows that improvement in hypertension control occurred among users of both focal and non-focal health centers. The figures of controlled blood pressure among hypertensive patients was 1.9 times better in the posttest as compared to the pretest in the focal health centers, while the improvement was 2.3 times in the non-

focal. The changes were highly significant for both focal and non-focal health centers with p value less than 0.005. It is worth mentioning that clinical training was carried out at both focal and non-focal health centers. Furthermore, some external factors other than PHCI interventions might have affected the better control of hypertensive patients such as the availability of more effective drugs. Table 3.7.5 also shows that the status of BMI did not change for both focal and non-focal over the period of 4.5 years. The p value was 0.223 for focal and 0.373 for non-focal health centers.

Table 3.7.5: Distribution of the Status of Control of Hypertension and by Study Phase and Intervention

Variable		Focal %		Non-Focal %	
		Pretest	**Posttest**	**Pretest**	**Posttest**
Status of Control of Hypertension	Controlled	12.0*	23.2	9.2*	20.9
	Uncontrolled	88.0	76.8	90.8	79.1
Body Mass Index	Normal	9.8	11.5	14.4	16.7
	Overweight	27.5	30.2	36.0	31.8
	Obese	62.7	58.3	49.6	51.5

*Statistically significant

3.7.3 Prediction of the Status of Control of Hypertension

Table 3.7.6 shows that the study phase was a significant predictor of hypertension control. The odds of hypertension control during the posttest were 2.22 that of the odds of the pretest indicating that hypertensive patients were over two times more likely to be controlled in the posttest than in the pretest.

The level of education was shown to be another significant predicator for hypertension control, as with each year of increase in schooling, a hypertensive patient was 5% more likely to be controlled. Finally, there is some association between the control of hypertension and obesity. Normal weight hypertensive patients were significantly about 1.5 times more likely to be controlled than obese counterparts. Overweight hypertensives were 1.24 times more likely to be controlled than obese, yet the figure was not statistically significant. Type of health center, region, sex, age, employment and disease duration did not show significant prediction of the controlled status of hypertension.

Table 3.7.6: Logistic Regression of Status of Control of Hypertension

Variable		Odds Ratio	OR 95% CI		Sig.
			Upper	Lower	
Study Phase	Posttest	2.22	1.73	2.85	<0.005
	Pretest	-	-	-	-
HC Type	CHCs	1.25	0.97	1.62	0.088
	PHCs	-	-	-	-
Region	North	0.75	0.52	1.08	0.123
	Central	1.29	0.94	1.78	0.116
	South	-	-	-	-
Sex	Male	0.85	0.63	1.16	0.311
	Female	-	-	-	-
Age in Years	<50	0.65	0.41	1.03	0.066
	50-59	1.09	0.76	1.58	0.635
	60-69	0.77	0.54	1.10	0.153
	=>70	-	-	-	-
Years of Schooling	Years of Schooling	1.05	1.02	1.08	0.001
Employment	Employed	0.94	0.67	1.32	0.723
	Not Employed	-	-	-	-
Disease Duration	Disease Duration	1.01	0.99	1.03	0.188
Obesity	Normal	1.49	1.06	2.11	0.023
	Overweight	1.24	0.95	1.62	0.113
	Obese	-	-	-	-

- Comparison Group Hosmer and Lemeshow Test: p =0.682

3.7.4 Analysis of Paired Observations for Hypertension Control

Overall, only 371 participants out of the 1148 recruited in the pretest (32.3%) could be followed in the posttest. The paired observations constituted about 34% of the posttest respondents. The highest response was from the north at 49.2 % followed by the south region at 33.9% and the central region at only 17.3%. The distribution is explained by the more population movement in the central region and the more difficult identification of study subjects in urban areas. Paired observations were obtained from 82 health centers out the sampled 89 centers. Almost 55.6% of the respondents came from the focal centers while the remaining 44.4% from non-focal health centers.

The original sample was designed to get data at the stratum level (region and health center type); so that one can proceed with the analysis of the 371-paired observations at the national level without going to lower levels of stratifications.

Analysis of co-variance (ANCOVA) was used to test the effect of PHCI interventions as judged by focal versus non-focal health centers on systolic and diastolic BP readings. One should keep in mind that non-focal health centers were not a perfect comparison due to unavoidable contamination especially regarding training and mass media campaigns of the health communication and marketing components.

Testing the homogeneity of regression slopes for systolic blood pressure revealed an F value of 6.36 corresponding to a p value of 0.01. This finding indicates that the main assumption for ANCOVA of having the same regression slopes for the first and second readings of systolic blood pressure for respondents coming from focal and non-focal centers was violated. Accordingly, nested ANCOVA was used to estimate a model having separate slopes.

Table 3.7.7 shows the parameter estimates of the regression of posttest on pretest BP readings. The B coefficients of the regression are used to construct the estimated prediction formula for both focal and non-focal health centers:

Predicted posttest reading of BP for non-focal = coefficient for non-focal health centers + (coefficient corresponding to interaction between non-focal and the pretest reading of BP × pretest reading of the BP). The formula for the focal health centers is similar with substitution of non-focal for focal.

The formula shows that predicted posttest systolic BP readings when pretest readings were above 140 mm of mercury were lower in the focal health centers compared to non-focal.

Table 3.7.7: Parameter Estimates for the Posttest Readings of HbA_{1c} as Dependent Variable for Focal and Non-Focal Health Centers

Parameter	B	Std. Error	t	p value	95% CI		Observed Power[1]
					Lower	Upper	
Non-Focal Health Centers	81.95	12.35	6.64	<0.005	57.66	106.23	1.00
Focal Health Centers	120.27	11.48	10.47	<0.005	97.68	142.86	1.00
Non-Focal*Pretest Reading	0.46	0.08	5.97	<0.005	0.31	0.61	1.00
Focal*Pretest Reading	0.19	0.07	2.52	0.012	0.04	0.33	0.71

1-Computed using alpha = .05

Using the above formula, Table 3.7.8 shows the estimated marginal means while keeping the value of pretest systolic BP readings at it mean level of about 156 mm/Hg. The mean posttest systolic BP was shown to be slightly lower for users of focal health centers at 149.2 compared to non-focal health centers at 153.8 mm of mercury.

Table 3.7.8: Estimated Marginal Means of Posttest Systolic BP

Intervention	Mean	Std. Error	95% Confidence Interval	
			Lower	Upper
Non-Focal Health Centers	153.82	1.75	150.38	157.27
Focal Health Centers	149.23	1.52	146.25	152.21

Evaluated at pretest systolic BP = 156.03

Testing homogeneity of regression slopes for diastolic BP readings revealed an F value of 0.164 corresponding to a p value of 0.686. This finding indicates that the main assumption for ANCOVA of having the same regression slopes for the pretest and posttest readings of diastolic BP for respondents coming from focal and non-focal centers was met.

Table 3.7.9 shows that PHCI interventions as judged by focal and non-focal health centers have a statistically insignificant effect on the level of posttest HbA1c with an F value of 0.32 and a p value of less than 0.57.

Table 3.7.9 Tests of Between Subjects Effects for the Posttest HbA1c As Dependent Variable and Focal-Non-Focal as Intervention

Source	Type III Sum of Squares	df	Mean Square	F	Sig.	Observed Power*
Corrected Model	5950.57	2	2975.29	27.51	<0.005	1.00
Intercept	13193.73	1	13193.73	121.97	<0.005	1.00
Pretest Diastolic BP	5716.76	1	5716.76	52.85	<0.005	1.00
Intervention	34.98	1	34.98	0.32	0.570	0.09
Error	36777.25	340	108.17			
Total	2815091.00	343				
Corrected Total	42727.83	342				

*Computed using alpha = .05

**R Squared = 0.139 (adjusted R squared = 0.134)

Table 3.7.10 shows parameter estimates of the regression of posttest on pretest diastolic BP values. The B coefficients of the regression are used to construct the estimated marginal means shown in table 3.7.11 according to the formula:

Estimated marginal mean equals intercept coefficient + coefficient corresponding to the level of intervention + (intercept for the pretest diastolic BP × mean of pretest diastolic BP)

Table 3.7.10: Parameter Estimates for the Posttest Readings of Diastolic BP as Dependent Variable for Focal and Non-Focal Health Centers

Parameter	B	Std. Error	t	p value	95% CI		Observed Power*
					Lower	Upper	
Intercept	54.11	4.88	11.08	<0.005	44.50	63.71	1.00
Pretest HbA_{1c}	0.38	0.05	7.27	<0.005	0.28	0.48	1.00
Non-Focal Health Centers	0.65	1.14	0.57	0.570	-1.60	2.90	0.09
Focal Health Centers	0**	-	-	-	-	-	-

*Computed using alpha = .05

**This parameter is set to zero because it is redundant (comparison parameter).

Table 3.7.11 summarizes the estimated marginal means with 95% confidence interval while keeping the value of pretest diastolic BP at its mean level of about 94 mm/Hg. The very close figures of 90.3 and 89.6 mm/Hg for non-focal and focal respectively reflect the no effect as judged by the significance level in table 3.7.10.

Table 3.7.11: Estimated Marginal Means of Posttest Diastolic BP Readings

Intervention	Mean	Std. Error	95% Confidence Interval	
			Lower	Upper
Non-Focal Health Centers	90.28	0.86	88.58	91.97
Focal Health Centers	89.63	0.75	88.16	91.09

Evaluated at pretest diastolic BP = 94.04.

4. Conclusions and Recommendations

1. PHCI, as a large project with multiple diverse components reflecting a mixture of software and hardware activities, had a relatively prolonged preparatory phase. During the first quarter of 2003 only five health centers had all the six PHCI components completed. Over the last two years of the project most of the PHC related activities at health centers were accomplished with different periods of maturation. Even activities in some health centers did not start yet when this study was implemented. With such short period of interventions it was expected that PHCI activities would not affect most of the indicators that were set back in early 2000.

2. PHCI activities started its technical and non-technical components without the availability of satisfactory systems to sustain these activities. Of outmost importance was the absence of effective supervisory system that helps at early stages enforce application of the new activities and maintain them over a long period of time. Standards and protocols of care at the health centers were developed, care providers were trained and PHCI developed some tools to help observe the adherence to those standards. The absence of effective supervisory system at the MoH and engrossment of PHCI with completion of the planned activities have negatively affected the adherence to standards and protocols during the last two years. Furthermore, PHCI project was more output oriented without clear measurable outcome indicators related to various activities. The PHCI vague monitoring and evaluation plan had contributed to weak impact of project interventions

3. Evaluation of interventions that are expected to affect the primary health care services should be done after at least 4-5 years of effective implementation. Monitoring all indicators related to implementation is essential before proceeding to evaluating impacts. Strengthening systems and policies should precede efforts aiming at improving service utilization. Trying to improve service utilization without well established systems and policies to support the expected positive change would undermine sustainability.

4. Ways to improve the postnatal care at MCH facilities should be considered including outreach programs. Furthermore, missed opportunities for family planning during postnatal visits have to be considered seriously.

5. Improve the quality of maternal and child health care services in order to ensure high quality care delivery. Performed at regular intervals, evaluation of maternal and child health services should be considered as part of assuring high quality care. Defining criteria and developing methods for assessing the quality of maternal and child health services are necessary. Developing follow up mechanisms is a necessary step for modifying maternal and child health services.

6. Improve the utilization of growth and development monitoring visits for children during second and third year of life. This can be achieved by improving health awareness of the community towards growth monitoring needs and benefits. Developing the outreach program at the MOH can add considerable value to this particular intent.

7. Review and institute policies and procedures necessary for early detection of anemia both during pregnancy and early childhood. Developing procedures and protocols to be used for correct diagnosis and treatment of anemia and its underlying causes is recommended. Anemia control and prevention programs should focus on high-risk groups. Maternal and child health programs should include a management component that can ensure monitoring of procedures and protocols pertaining to anemia control. Further efforts should be exercised to improve screening procedures for anemia among children and pregnant women. Screening of children at one year of age and pregnant women for the presence of anemia has to be enforced and closely monitored. Increasing awareness of both professionals and parents of children toward the importance of screening is essential.

8. Record keeping systems should have clear evaluation schemes in order to facilitate correct monitoring of health problems. Monitoring recording systems can assist in producing accurate prevalence figures of health problems. Accuracy in reporting is essential for revealing changes and patterns of health problems. Training health workers in data management and in effective use of information is essential. Documentation of procedures and findings in patient's medical records has to be improved. Failure of recording BP in 43% of cases screened for hypertension shows the negligence of physicians that might be occurring with other procedures. Again failure to record background information such as income and education for women and children with multiple visits to the MCH clinic is another example of poor documentation.

9. Create a management system whereby a set of standards is provided and ensured. Standards that cover all areas of primary health care service delivery should be reviewed and updated as needed. These standards should be made available to all health care providers and used in monitoring service provision.

10. The national strategy for chronic non-communicable diseases urgently needs revision to improve awareness, counseling, treatment, and control levels among the hypertensive and diabetic populations. The status of control of diabetes which is considered very common disease in Jordan showed alarming figures. Both diseases are associated with significant morbidity and mortality related to complications. Improved control of the two diseases can prevent or delay complications. The strategy must establish a comprehensive network of public, private, professional, and voluntary groups involved in blood pressure and diabetes control activities, including screening and follow-up services, as well as public, patient, and professional education.

11. Screening mechanisms for hypertension among those aged 25 years and above have to be established with no delay. Screening is a simple procedure that can be applied to a prevalent disease in order to enable the prevention of serious complications. Effective treatment schedules can be made readily available once the disease is discovered.

12. Assist the MOH in developing a health education scheme that targets common health problems. When working on this recommendation, it is suggested to allocate considerable attention to the problem of anemia, diabetes and hypertension. Furthermore, the low use of contraceptive pills in face of almost 100% availability at health centers should prompt a wider and more comprehensive marketing of such pills.

5. Annexes

Timely Vaccination

Section I. Identification Variables

1. Name of Health Center | 2. Code of Health Center

3. Type of Health Center ☐ Comprehensive ☐ Primary | 4. Governorate

5. Health Directorate | 6. Location ☐ Urban ☐ Rural

7. Region ☐ North ☐ Middle ☐ South

8. Subject ID for Health Center | **9. Subject ID for Sample**

This cell is for office use only

Section II- Control Variables

10. Date of Birth | 11. Gender ☐ Male ☐ Female | 12. Family Monthly Income in JDs

13. Mother's Education ☐ Illiterate ☐ Elementary ☐ Preparatory ☐ Secondary ☐ College ☐ University

14. Father's Education ☐ Illiterate ☐ Elementary ☐ Preparatory ☐ Secondary ☐ College ☐ University

Section III- Dates of Vaccination

Total Number of Children

15. Dates of Vaccination

Vaccination Dose	Hepatitis B	DTP	Poliomyelitis	Measles	MMR
1st					
2ed					
3rd					
4th					
Booster					

Date | Name of Data Collector | Signature

Name Field Supervisor | Signature

Name Office Supervisor | Date | Signature

Growth and Development Monitoring and Anemia

Section I. Identification Variables

1. Name of Health Center | 2. Code of Health Center

3. Type of Health Center ☐ Comprehensive ☐ Primary | 4. Governorate

5. Health Directorate | 6. Location ☐ Urban ☐ Rural

7. Region ☐ North ☐ Middle ☐ South

8. Subject ID for Health Center | **9. Subject ID for Sample**

This cell is for office use only

Section II- Control Variables

10. Date of Birth		11. Gender ☐ Male ☐ Female	12. Family Monthly Income in JDs	

13. Mother's Education ☐ Illiterate ☐ Elementary ☐ Preparatory ☐ Secondary ☐ College ☐ University

14. Father's Education ☐ Illiterate ☐ Elementary ☐ Preparatory ☐ Secondary ☐ College ☐ University

Section III- Growth Visits | **Total Number of Children**

15. Number of Growth and Monitoring Visits

First Year of Life | Second Year of Life | Third Year of Life

16. Hemoglobin at the age of one year		17. PCV		18. Date	

Date | Name of Data Collector | Signature

Name Field Supervisor | Signature

Name Office Supervisor | Date | Signature

Antenatal, Postnatal Visits and Anemia of Pregnancy

Section I. Identification Variables

1. Name of Health Center | 2. Code of Health Center

3. Type of Health Center ☐ Comprehensive ☐ Primary | 4. Governorate

5. Health Directorate | 6. Location ☐ Urban ☐ Rural

7. Region ☐ North ☐ Middle ☐ South

8. Subject ID for Health Center | **9. Subject ID for Sample**

This cell is for office use only

Section II- Control Variables

10. Age | 11. Family Income in JDs

12. Women's Education ☐ Illiterate ☐ Elementary ☐ Preparatory ☐ Secondary ☐ College ☐ University

13. Husband's Education ☐ Illiterate ☐ Elementary ☐ Preparatory ☐ Secondary ☐ College ☐ University

Section III- Antenatal Care

Total Number of Women

14. Total Number of Antenatal Visits

Section IV- Postnatal Care

15. Postnatal Care ☐ Yes ☐ No | 16. Family Planning Yes ☐ No ☐ | 17. Decision Made ☐ Yes ☐ No

Section V- Anemia of Pregnancy

18. Last Hemoglobin Reading | 19. Last reading of PCV

Date | Name of Data Collector | Signature

Name Field Supervisor | Signature

Name Office Supervisor | Date | Signature

Use of Contraceptive Methods

NOTE: Please do not forget that your first question to the selected subject is about her marital and pregnancy status.

Section I. Identification Variables

1. Name of Health Center ____ 2. Code of Health Center ____

3. Type of Health Center ☐ Comprehensive ☐ Primary 4. Governorate ____

5. Health Directorate ____ 6. Location ☐ Urban ☐ Rural

7. Region ☐ North ☐ Middle ☐ South

8. Subject ID for Health Center ____ **9. Subject ID for Sample** ____

This cell is for office use only

Section II- Control Variables

Estimated Daily Load of MWRA ____

10. Age		11. Number of Male Children		12. Number of Female Children		

13. Employment Status ☐ Employed ☐ Unemployed ☐ Retired ☐ Housewife

15. Women's Years of Schooling ____ 16. Husband's Years of Schooling ____

Section III- Contraceptive Use

17. Do You Currently Use Any Contraceptive Method? Yes ☐ No ☐ If yes,

18. What Method Of The Following Do You Currently Use

☐ Pills ☐ Norplant ☐ Abstinence
☐ IUD ☐ Diaphragm, foam, ☐ Withdrawal
☐ Condom ☐ ♀ Sterilization ☐ Breastfeeding
☐ Injectables ☐ ♂ Sterilization ☐ Others:

19. What is the source of your contraceptive? ☐ This HC ☐ Other MoH HC ☐ Non-MoH HC

20. Do you have problems getting contraceptives? ☐ Yes ☐ No ☐ Not Sure

21. If Yes, specify the problem

☐ Non-availability ☐ Adverse Reactions
☐ Male Provider ☐ Others Specify: ____
☐ No Daily Provision

Date ____ Name of Data Collector ____ Signature

Name Field Supervisor ____ Signature

Name Office Supervisor ____ Date ____ Signature

Screening for Hypertension

NOTE: You can proceed filling the questionnaire only if the patient is not known to be hypertensive and he/she is over the age of 40

Section I. Identification Variables

1. Name of Health Center | 2. Code of Health Center

3. Type of Health Center ☐ Comprehensive ☐ Primary | 4. Governorate

5. Health Directorate | 6. Location ☐ Urban ☐ Rural

7. Region ☐ North ☐ Middle ☐ South

8. Subject ID for Health Center | **9. Subject ID for Sample**

This cell is for office use only

Section II- Control Variables

10. Age | 11Gender: ☐ Male ☐ Female | 12. Years of Schooling

Section II- Hypertension Screening | **Estimated Load of >40 Years of Age**

13. Has your BP been checked during today's visit? ☐ Yes ☐ No

14. Today's BP reading in patient's medical record ☐ Yes ☐ No

15. Number of visits documented over the last year

16. Number of times the BP was checked over the same period of time

Date | Name of Data Collector | Signature

Name Field Supervisor | Signature

Name Office Supervisor | Date | Signature

Status of Control of Diabetes

Section I. Identification Variables

1. Name of Health Center | 2. Code of Health Center

3. Type of Health Center ☐ Comprehensive ☐ Primary | 4. Governorate

5. Health Directorate | 6. Location ☐ Urban ☐ Rural

7. Region ☐ North ☐ Middle ☐ South

8. Subject ID for Health Center | 9. Subject ID for Sample (office use only)

10. Name of the Patient | 11. Phone Number

12. Address

Section II- Control Variables

Expected Number of Diabetics During the Data Collection Period

13. Age | 14Gender: Male ☐ Female ☐ | 15. Years of Schooling

16. Weight in Kg | 17. Height in cm | 18. Duration of Diabetes in Years

19. Employment Status ☐ Employed ☐ Unemployed ☐ Retired

Section III- Glycosylated Hemoglobin

21. HbA_{1c} Reading

Date | Name of Data Collector | Signature

Name Field Supervisor | Signature

Name Office Supervisor | Date | Signature

Blood Collection and Lab Form for Diabetes

Health Center Name | **Code of Health Center**

Governorate | **Directorate of Health**

Serial Number	Name	Date of Blood Collection	Name of & Signature of Physician	HBA1c Reading	Date of the Test	Name & signature of lab technician

Status of Control of Hypertension

Section I. Identification Variables

1. Name of Health Center | 2. Code of Health Center

3. Type of Health Center ☐ Comprehensive ☐ Primary | 4. Governorate

5. Health Directorate | 6. Location ☐ Urban ☐ Rural

7. Region ☐ North ☐ Middle ☐ South

8. Subject ID for Health Center | 9. Subject ID for Sample (office use only)

10. Name of the Patient | 11. Phone Number

12. Address

Section II- Control Variables

Expected Number of Hypertensives During the Period of Data Collection

13. Age | 14. Gender: Male ☐ Female ☐ | 15. Years of Schooling

16. Weight in Kg | 17. Height in cm | 18. Duration of Hypertension in Years

19. Employment Status ☐ Employed ☐ Unemployed ☐ Retired

Section III- Blood Pressure Readings

20. Systolic BP | 21. Diastolic BP

Date | Name of Data Collector | Signature

Name Field Supervisor | Signature

Name Office Supervisor | Date | Signature