DISCUSSION PAPER SERIES

IZA DP No. 4593

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November 2009

Forschungsinstitut
zur Zukunft der Arbeit
Institute for the Study
of Labor

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Discussion Paper No. 4593
November 2009

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IZA Discussion Paper No. 4593
November 2009

ABSTRACT

Evaluation of the Impact of the Mother and Infant Health Project in Ukraine*

This paper exploits a unique opportunity to evaluate the impact of the quality change in the labor and delivery services on maternal and infant health. Since basic medical care has been universally available in Ukraine, implementation of the Mother and Infant Health Project allows addressing quality rather than quantity effect of medical care. Employing program evaluation methods we find that the administrative units participating in the Project have exhibited greater improvements in both maternal and infant health compared to the control rayons. Among the infant health outcomes, the MIHP impact is most pronounced for infant mortality resulted from deviations in perinatal period and respiratory system failures. As for the maternal health, the MIHP is the most effective at addressing anemia, blood circulation, and urinary-genital system complications, as well as late toxicosis. The analysis suggests that the effects are due to early attendance of antenatal clinics, lower share of C-sections, and greater share of normal deliveries, and these effects are causal. Preliminary cost-effectiveness analysis shows enormous benefit per dollar spent on the project: the cost to benefit ratio is one to 122 taking into account both maternal and infant lives saved as well as cost savings due to changes in labor and delivery practices.

JEL Classification: I12, I18

Keywords: maternal health, maternal mortality, infant health, infant mortality, prenatal care

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* This research has been funded by the Global Development Network and the Bill & Melinda Gates Foundation, within the GDNs Fifth Global Research Project "Promoting Innovative Programs from the Developing World: Towards Realizing the Health MDGs in Africa and Asia." The views expressed by the authors do not necessarily reflect those of the funding bodies. The authors would like to thank Nancy Quian, Andrew Jones, Jeffrey Smith, Lyn Squire, and the GDN project management team for their valuable comments and suggestions during the January 2009 GDN Project workshop in York, United Kingdom. The authors are also thankful to Helene Lefevre-Cholay and the entire MIHP-Ukraine team for their cooperation and constructive criticism, as well as to Tatiana Nizalova for medical guidance on pregnancy related conditions and outcomes.

1 Introduction

Infant mortality/morbidity has often been a focus of health economics and medical research as a major indicator of a country's well-being, while maternal health outcomes have been much less investigated. Several reasons are to be named for such a development. One is that the rates of maternal deaths are quite low in developed countries. And the second is attributed to the difficulty of measuring maternal health outcomes, the problem that is most severe in developing countries. Nevertheless, the issue of maternal health attracts considerable attention of society due to the fact that most of maternal deaths and health deteriorations are preventable. Moreover, recent evidence demonstrates that improvements in health outcomes for mothers and infants are related not as much to the availability of care (structural quality), but to the way this care is provided (process quality) (Barber and Gertler, 2002). Furthermore, some studies find that access to low quality providers in fact contributes to higher child morbidity and mortality (Sodemann et al., 1997).

Notwithstanding the importance of the matter, studies of the impact of quality of prenatal care and labor and delivery services on maternal and infant health outcomes are quite rare: it is difficult to find a setting that allows separation of quality from quantity dimension. This paper contributes to the literature analyzing the impact of exogenous change in the quality of labor and delivery services caused by the Mother and Infant Health Project (MIHP). Ukrainian setting creates a unique opportunity for an identification of this quality impact: (i) unlike the situation in developing countries (where health initiatives come together with new facilities), participation in the Project has changed only quality dimension of services, since the basic prenatal and obstetric care is universally available; (ii) unlike the situation

in developed countries (where population health compares favorably to the rest of the world), the level of maternal and infant health outcomes is quite poor leaving enough room for improvement and allowing for identification of the impact; (iii) every maternity regularly reports information on maternal and infant health outcomes to a regional health administration resulting in a uniform data set of good quality. In addition, the study investigates the mechanisms through which reductions in infant and maternal mortality and morbidity take place via estimating the impact of the MIHP on prenatal care use, intermediate health outcomes, and mortality components.

Using difference-in-difference methodology it is found that the MIHP participating rayons observe greater improvements in maternal and infant health. The results indicate that improvements in maternal morbidity (lower prevalence of anemia, blood circulation system, veins, and urinary-genital complications) and mortality may be due to earlier attendance of prenatal clinics, increased rate of normal deliveries, and reduction in the rate of C-sections. The same channels may be leading to improvements in infant health: the MIHP participation significantly reduces total infant mortality through the reductions in infant mortality resulted from deviations in perinatal period and respiratory system failures.

The paper is structured as follows. Next section describes the system of health care in Ukraine, the Mother and Infant Health Project, and provides an overview of related literature. Section three focuses on the empirical methodology followed by the descriptive analysis in Section four. Basic estimation results are offered in Section five. Section six follows with the robustness checks and discussion. Cost-Benefit considerations are presented in Section seven. Section eight concludes.

2 Background

2.1 Health Care System and Maternal Health Services in Ukraine

The right for free health care is one of the basic Constitutional rights in Ukraine (Article 49). And, although the informal payments are widespread (Allin, Davaki, and Mossialos, 2005), certain set of basic services can be rendered by patients for free, and this is most evident with respect to maternal and infant care. Majority of the health care establishments are publicly owned and are subordinated to regional administration. By the end of 2000, Ukraine had more than 24 thousand of health care facilities, including various support units like medical statistical centers, medical treatment facilities, spas, health resorts, blood transfusion centers, etc. At the same time only about six thousand individuals and about one thousand of legal entities had been licensed to practice medicine independently (Lekhan, Rudiy, and Nolte, 2004). According to the same source, only about 2% of the population had medical insurance, although this number has been growing with the improvement of economic conditions up to year 2008. However, the trend is likely to reverse in the face of the current economic crisis. According to the Ministry of Health Report the overall health care financing in year 2007 comprised 3.9% of the GDP compared to the 3.3% in year 2006 (MHCU, 2007), which is considerably lower than in the EU and Eastern European countries (OECD average is 8.9%).[1]

The network of reproductive facilities consists of maternities (approximately one per rayon[2]) and women's clinics (about 1-3 per rayon) as well

[1] OECD Health Data 2009, www.oecd.org/health/healthdata.

[2] Administratively, Ukraine consists of 25 large units - "oblast" - (including the Autonomous Republic Crimea), and 2 cities of the country subordination (Kyiv and Sevastopol). An oblast consists of about 13-46 small administrative units - "rayons". Rural units as well as small towns are subject to rayon governance, while large towns and cities are subordinated to oblasts.

as pediatric clinics. Women's clinics specialize in antenatal care including (i) monthly patronage of pregnant women, (ii) routine tests (blood, pressure, and urine) and measurements (weight and height), (iii) prevention of complications during pregnancy, and (iv) family planning counseling. Rayon maternities address delivery and postpartum issues, while oblast maternities focus on complicated labor and delivery cases (those with severe anemia, diseases of urinary-genital, blood circulation systems, etc.). Pediatric clinics provide regular infant care including vaccination and routine monitoring in the first year of life and thereafter as need arises.

2.2 Mother and Infant Health Project Description

The Mother and Infant Health Project (MIHP)[3] is an eight-year project advocating evidence-based medical practices aimed at improvement of women's reproductive and newborns' health. With funding from the USAID and private sources, and with the support from the Ministry of Health of Ukraine, the project is being implemented by the JSI Research and Training Institute. The first phase of the project has been initiated in September 2002 in four regions of Ukraine, but first four maternities have actually joined the Project in mid-December 2003. By the end of 2006 the Project expanded to 20 maternity hospitals in twelve pilot regions. Following the Millennium Development Goals for the country (MEU, 2005), the MIHP pioneers to introduce new evidence-based medicine (EBM) standards: partner deliveries; avoidance of unnecessary C-sections, amniotomies and episiotomies; use of free position during delivery; immediate skin-to-skin contact; early breastfeeding; and the rooming-in of mothers and newborns. In addition, the Project actively supports the provision of trainings on effective perinatal

[3] `http://www.mihp.com.ua/english/Home/homepage.html`

technologies for the staff of the MIHP maternities, development of "centers of excellence" that serve as models in training/education of the medical practitioners of the corresponding oblast, and organizing health awareness campaign on healthy lifestyles.

The MIHP also aims to reinforce liaisons with local governmental institutions. The Project works on integration of EBM standards into a package of perinatal practices throughout Ukraine. It also targets revision of the current curricula for medical universities and colleges in order to increase the evidence base of educational programs for medical students and health care providers.

The MIHP in Ukraine belongs to a family of maternal and infant health improving initiatives throughout the world and builds upon their experience, JSI MotherCare[4] (1998-2000) being the largest among them. However, the MIHP in Ukraine is unique both with respect to the institutional setting and to its scope and length. Most of the earlier projects implemented by the JSI have mainly focused on specific issues (e.g. pregnancy of adolescent girls in Uganda and Zambia, anemia in Malawi) and have been short-term (the longest have been two-year projects in Egypt, Pakistan, and Zambia). Studying the MIHP impact in Ukraine has three advantages: (i) evaluation of the change in the quality of services in a setting where the access to basic services has not changed, (ii) identification of the dynamics in the effect of the MIHP participation over time, and (iii) documentation of the pathways through which the effect manifests itself by analyzing various final and intermediate outcomes.

[4] http://www.jsi.com/JSIInternet/Publications/women.cfm

2.3 Related Literature

Although it is obvious that the determinants of maternal and infant health are closely related, there are very few works where the issue of maternal and infant health is considered jointly (Winikoff, 1988; Conway and Kutinova, 2006). Moreover, most of the economic literature (both theoretical and empirical, likewise in developed and developing countries) focuses on infant health almost completely ignoring the issue of maternal health. Similar trend has been observed in the medical literature (AbouZahr, 2003). Two reasons are to be named for such a phenomena. One is that the rates of maternal death are quite low in developed countries. And the second is attributed to the difficulty of measuring maternal health outcomes, especially in developing countries. Nevertheless, even in the developed nations with their low maternal mortality ratios (which are 2-3 time lower than those in Ukraine) this issue draws considerable attention due to the fact that most of these rare deaths are preventable. Moreover, as Haas, Udvarhelyi, and Epstein (1993) claim "60 percent of women receive medical care for some complication of pregnancy and 30 percent suffer complications that result in serious morbidity" (as cited in Conway and Kutinova (2006)).

MIHP is a program that targets quality of labor and delivery services directly as well as quality of prenatal care indirectly, since most of the obstetricians in Ukraine have joint appointments in maternities and antenatal clinics. Therefore the expected impact of the MIHP can be inferred from earlier literature on impact of antenatal and obstetric care. Antenatal care can reduce maternal mortality and morbidity both directly, through detection and treatment of pregnancy-related or intercurrent illnesses, and indirectly, through detection of women at increased risk of complications of delivery and referring them to a suitably equipped facility (Oxaal and Baden, 1996).

Analysis of historical data shows that a significant fall in maternal mortality ratios in the UK and the USA can be attributed to improved obstetric care. In particular, Carroli, Rooney, and Villar (2001) emphasize that better delivery care significantly reduces maternal mortality from infections and hemorrhage. Laditka et al. (2005) in turn suggest that adequate prenatal care may reduce potentially avoidable maternity complications. However, other authors underline that the impact of prenatal care and/or certain interventions during pregnancy is more difficult to assess due to a large number of confounding factors not observed by researchers (Carroli, Rooney, and Villar, 2001). At the same time out of the socio-economic factors, only income has been identified as a significant determinant in reducing the probability of having a complication (Laditka et al., 2005).

An institutional determinant of infant health outcomes that usually receives a lot of attention from researchers is health care spending. But empirical evidence from a cross-country study of developing countries suggests that the health care spending has no significant effect on child mortality while the access to health care and the mother and infant health programs do. The reason for the lack of the impact of spending on mortality may be inexpensiveness of effective interventions so that "they do not even show up in data on ... public spending" (McGuire, 2006).

Similarly, using individual level data, Bhalotra (2007) finds no effect of health care spending. However, when investigating separately the effect on poor and rural households, spending does play a role in improving infant health for those groups. Goldman and Grossman (1982) find that health care spending and public policy programs in the US do have a significant impact on infant mortality, and argue that this impact runs through improvements in health of mothers, rather than the use of prenatal care per se. The evidence

also shows that infant and child mortality and morbidity are determined by poverty and unemployment rate (Bhalotra, 2007; Currie and Grogger, 2000), parental education, urban residence, and maternal health in general (Buckley, 2003; Chou et al., 2007).

It is common in health economics research to find little or no effect of prenatal care on infant health, which may be due to two reasons - endogeneity and heterogeneity. Mothers anticipating poor birth outcomes are more likely to seek more prenatal care and seek it earlier while still having poorer than average outcomes. Authors that use exogenous variation in prenatal care, such as "natural experiment", find positive and significant impact of prenatal care use on birth outcomes (Evans and Lien, 2005). Conway and Deb (2005) in addition to addressing the issue of endogeneity explore the possible heterogeneity in the impact of prenatal care on birth outcomes. Looking at all births simultaneously may obscure the effect of prenatal care on "normal" births. Some of the births result in poor outcomes due to bad maternal behavior or poor fetus condition to begin with and cannot be remedied by any prenatal care intervention. Therefore, lack of significant impact of prenatal care on infant health may be explained by data that do not distinguish between "normal" and "problematic" pregnancies. Thus, Conway and Deb (2005) find that prenatal care has a substantial effect on "normal" pregnancies.

Despite serious shortcomings, such as misclassification of deaths and difficulties with registering severe impairments related to pregnancies and births, but not resulting into death outcomes, most common measure used in the literature relying on statistical evidence is maternal mortality. With respect to infant health outcomes, in addition to various measures of infant mortality (e.g. perinatal, early and late neonatal, infant mortality etc.), birth weight

and early onset of breastfeeding are also used, although the latter outcome measure is less common. However, for example birth weight is left beyond the scope of this study merely because the data set contains too many missing observations to allow for meaningful conclusions on that outcome.

Current study contributes to the literature in two ways: (i) by evaluating causal impact of quality of labor and delivery services, (ii) by studying a wide range of maternal and infant health outcomes simultaneously and identifying the mechanism through which the MIHP impact manifests itself, and (iii) by decomposing the impact of the MIHP over time since the start of the project. The outcomes studied include those usually used in the literature, but also a wide range of morbidity outcomes related to various complications in both mothers and infants, and intermediate outcomes, such as a rate of C-sections and an early onset of prenatal care. Concerning potential misreporting for infant health outcomes in the Soviet Union and the NIS countries documented in early studies (Brainerd, 2006; Anderson and Silver, 1986), it should not have an impact on the results as long as misreporting is unrelated to the treatment, which is very unlikely.

3 Empirical Strategy

The preliminary insider assessment of the Project shows positive trends in maternal and infant health outcomes in the participating maternities along various dimensions: neonatal mortality and morbidity, level of C-sections and episiotomies, use of individual delivery rooms, companion presence, etc. However, this insider monitoring does not allow identifying the real effect of the treatment for two reasons. One is that the Project may have a spillover effect on the neighboring community, in which case the insider assessment would

give an underestimate of the true effect. The other reason is that analyzing the data at the site of treatment does not allow separating the effect of the Project from the changes in the outcome measures due to other confounding factors, in which case it would be an overestimate or an underestimate of the true effect depending on the sign of the correlation between the confounding factors, the treatment variable, and the outcome.

Theoretically maternal and infant health (Conway and Kutinova, 2006) depends on health inputs, including such intermediate determinants as prenatal care and access to health services (McCarthy and Maine, 1992), mother and infant health endowments, and socio-economic characteristics (distant determinants). However, in the empirical specification we omit all of these variables to avoid over controlling.[5] The simplest estimator used to evaluate the effect of the MIHP participation (treatment effect) is a difference-in-difference estimator (DD) and the empirical model takes the following form:

$$H_{rt} = \beta_0 + \beta_P P_{rt} + T_t\beta_t + R_r\beta_R + T_tO\beta_{to} + \beta_X X_{rt} + u^0_{rt}, \qquad (1)$$

where health outcome H in region r at time period t depends on treatment P. Overtime changes in health outcomes are compared between the MIHP participating rayons and the control rayons netting out the common time trend T_t, rayon-specific fixed effects R_r, and oblast-specific time effect T_tO since all medical institutions are subordinated to and financed by oblast-level authorities. X_{rt} is a variable indicating whether other programs that may have an impact on maternal and infant health are being implemented in

[5]The analysis has also been performed including the full list of controls (total population morbidity, number of Chornobyl-related diseases, doctor's load, per capita number of obstetricians and midwives, share of deliveries to women aged 18-34, share of first deliveries, number of colleges and universities interacted with time, logarithm of real average wage, share of employed among working age population, per capita air pollution, ratio of divorces to marriages, population weighted number of families getting utility subsidies). However, none of these variables show statistical significance and do not alter in any meaningful way the estimates of the MIHP impact.

a rayon in a particular year [6]. It should be mentioned that these programs are rather different from the MIHP. Most of them are associated with significant financial contributions, provision of new expensive equipment, etc., while the MIHP emphasizes low cost of quality improvements. This makes it absolutely necessary to control for the effect of these other programs and attempts to compare it to the MIHP impact. In order to account for the remaining serial correlation, the standard errors are clustered at the rayon level (Kezdi, 2004; Stock and Watson, 2008).

In such a setting, the estimate of β_P for the treatment dummy (MIHP participating rayon) gives us the difference-in-difference (DD) estimate of the treatment effect of the MIHP participation. However, this estimate may be biased due to a potential contamination of the control group. This contamination is quite likely since the MIHP sites are required to provide trainings to the personnel of all maternities of the oblast where the site is located. Thus, the model is augmented by a variable MIHP-oblast that could capture the impact of these trainings:

$$H_{rt} = \beta_0 + \beta_P P_{rt} + \beta_P^{tr} P_{rt}^{tr} + T_t\beta_t + R_r\beta_R + T_t O\beta_{to} + \beta_X X_{rt} + u_{rt}^0, \qquad (2)$$

In this case β_P^{tr} picks up the effect of trainings only and represents the lower bound of the MIHP impact.

The estimates of the MIHP impact discussed above represent average treatment effects across all MIHP rayons compared to all control rayons in all periods after the Project start. However, this approach is subject to several limitations. First of all, it does not allow for heterogeneity of treatment since

[6] These programs include Swiss Neonatal Program, Hospital to Hospital Program (The Ukraine 3000 Charitable Foundation), Cradle of Hope (Viktor Pinchuk Charitable Foundation). The full list of the programs, their timing, location, and funding is available from the authors upon request.

various components of the Project may be implemented in stages. Second, it does not account for a possibility that the Project impact may depend on the duration of participation. Finally, it does not refute the possibility that the MIHP maternities are systematically different from the control group prior to the treatment and whether this difference has an impact on the validity of the Project impact estimates. To tackle these issues the MIHP indicator in Equation (1) is replaced with a set of variables reflecting the timing of the Project implementation: (T_{-3},T_{-2},T_{-1},T_1,T_2,T_3). All these variables are equal to zero for the control group outcomes and 1 for the treatment group at various stages of the Project implementation: three years before, two years before, one year before, one year after the Project start-up, two years after, three and more years after respectively.

However, there still exists a possibility that the resulting estimates may not reflect the true treatment effect, since the rayons could have experienced other health affecting initiatives implemented simultaneously with the MIHP. Thus, the estimated treatment effect of the MIHP would be upward-biased if other initiatives' influence on maternal and infant health outcomes is positive and downward-biased otherwise. Triple difference procedure is usually used in the literature to address this problem. However, it is impossible to directly apply it in the current setting since most of the outcomes used in the study are related to infants and females of fertile age only. Consequently, two alternative estimation procedures are utilized as tests for the validity of the DD strategy.

The first procedure applies the model described in Equation (1) to the pregnancy unrelated (placebo) outcomes (e.g. prevalence of diabetes, hepatitis, etc.). Lack of statistically significant health improving effect on these outcomes would confirm the validity of the DD estimates of the MIHP impact

on pregnancy related outcomes. The second procedure applies to an outcome which refers to the whole rayon population but can potentially be affected by the Project (e.g. hypertension). In this case it is possible to apply the DDD procedure with a slight modification of the suggested empirical model:

$$H_{rt} = \beta_0 + \beta_{PF} P_{rt} F_{rt} + \beta_P P_{rt} + \beta_F F_{rt} + Z_{rt}\beta_Z + \beta_{RF} R_r F_{rt} + \beta_{TF} T_t F_{rt} + \quad (3)$$

$$+\beta_{TR} T_t R_r + T_t \beta_t + R_r \beta_R + \beta_X X_{rt} + u^0_{rt},$$

where F_{rt} is the percentage of female population of fertile age. In this case the coefficient β_{PF} is the triple difference estimate of the MIHP treatment effect.

Outcome Variables. There are three groups of outcome variables to be evaluated: maternal, infant, and pregnancy-unrelated health outcomes (see Table 1). Bearing in mind difficulties that exist with the measurement of maternal mortality (Shiffman, 2000) stemming from the erroneous attribution of the cause of death, the emphasis in the current paper is put on the less arguable maternal health outcomes which can be plausibly attributed to changes in the quality of labor and delivery services. In addition, the MIHP impact on intermediate outcomes, such as early onset of antenatal care, rates of C-sections and normal deliveries is estimated.

Treatment Variables. The treatment effect is represented by (i) dummy variable that takes the value of one for MIHP-participating rayon (MIHP-rayon), (ii) dummy equal to one for all rayons of an oblast with at least one MIHP rayon, and (iii) a set of variables reflecting the time before and after the

start-up of the Project in the treatment rayons.[7]

4 Data and Descriptive Analysis

Since all of the treatment rayons are urban, the analysis is constrained to urban rayons (i.e. those that have at least one town or city) resulting into an unbalanced sample of 14 treatment[8] and 227 control rayons. The data are obtained from the oblast Centers of Medical Statistics (CMS) which collect periodic administrative reports from all health care establishments on a routine basis. Existing gaps in the data, and therefore varying number of observations, do not reflect any systematic patterns, since they are mostly due to the difficulties of locating records at the CMSs, unrelated to the willingness of maternities to report certain types of outcomes.[9] The analysis covers the period from 2000 to 2006.[10]

The restriction of the sample only to urban rayons serves several purposes. First, it allows matching the treatment rayons to more comparable control rayons, since no rural rayons have participated in the MIHP. Second, rayons are more homogeneous compared to the larger administrative/geographic areas and therefore the aggregated statistics is more reliable. Third, rayons with

[7]Some of the rayons have more than one maternity, so the whole analysis has been performed with the dummy variable substituted by the percentage of rayon maternities participating in MIHP. No qualitative difference in the results has been observed. The results are available upon request.

[8]By the end of 2006 MHIP expanded to 20 maternity hospitals. However, the number of treatment rayons in our sample is limited to 14. Six locations are excluded for the following reasons: (i) two maternities are located in the capital city of Kyiv and are excluded from the analysis since this is the largest and most developed city in Ukraine and it cannot be plausibly compared to the other cities in the regions; (ii) three maternities are in Donetsk city, which is represented by one unit since it is possible for women in the same city to use any one of these maternities; (iii) two locations are excluded since the medical data are poorly reported for them.

[9]They are also unrelated to the availability of care: neither new maternities opened nor old ones closed during the analysis period.

[10]Although the MIHP project started in September 2002, the first four maternities joined the MIHP on December 10, 2003. So, year 2003 is considered being the first year when the implementation of the Project started.

urban settlements are large enough to make it less likely that the individuals living in the area would seek care outside the rayon.[11]

Sample Description. In the pre-treatment period the MIHP rayons are in general characterized by poorer population health outcomes. Tables 2-3 provide summary statistics comparing the difference between MIHP and non-MIHP rayons in year 2000 (pre-treatment period) and year 2006. For many of the outcomes but a few there is no statistically significant difference between treatment and control rayons. Among those few outcomes that show significant difference in the pre-treatment period are C-sections, late toxicosis, as well as complications related to the thyroid gland system for maternal health, and stillbirths, perinatal, early neonatal mortality, infant mortality due to perinatal deviations, infant morbidity due to respiratory system problems and congenital anomalies for infant health. However, for all these outcomes the non-MIHP rayons compare more favorably to the treatment rayons. This confirms that the selection into the MIHP is based on poor outcomes suggesting that the estimates of the MIHP impact should be considered as a lower bound since the selection on poorer pre-treatment outcomes leads to an underestimation of the treatment effect.

Despite the pessimistic pre-project health conditions, after the implementation of the MIHP the majority of the maternal and infant health outcomes have improved. Over the period from 2000 to 2006 a sharp decrease in maternal mortality (from 24 to 4 in the MIHP rayons) and a drastic decline of the full set of maternal morbidity indicators are observed. The total infant mortality rate, which in 2000 exceeds the non-MHIP indicator by 2, has declined from about 14 to 9 cases per 1000 live births, and is no longer statistically

[11] To test the last argument, a robustness check for the whole range of outcomes is performed on a set of rayons that consist of oblast-subordinated cities (metropolitan areas). The results are discussed further.

different from the non-MIHP sites in year 2006. The only outcome that has worsened is the percent of C-sections, for both MIHP and non-MIHP rayons, which is an unexpected result. However, these are only simple comparisons of means and they do not account for other factors that could have influenced the outcomes.

5 Estimation Results

Maternal Health. Table 4 shows the impact of the MIHP and other programs on the maternal health outcomes. The treatment variable is measured as an indicator equal to one for the MIHP participating rayons in all time periods after they joined the Project. Therefore, the estimated coefficient shows average treatment effect for all MIHP-participating rayons in all periods. As could be seen from Column (1), the difference-in-difference estimate of the MIHP impact is health improving for most outcomes, including intermediate ones: women in the MIHP participating rayons are more likely to have normal deliveries and attend antenatal clinics prior to 12 weeks of gestation, and are less likely to have C-sections. With respect to the complications related to pregnancies, labor and delivery, as well as postpartum period, mothers in the MIHP-participating rayons are less likely to experience anemia, problems with the blood circulation system, and late toxicosis. In line with the explanations in Conway and Deb (2005), no effect is found on the problematic[12] and abnormal[13] deliveries. This also indicates absence of selection of healthier patients in the MIHP maternities after the start of the Project.

[12]Deliveries exhibiting ex ante deviations from the "norm" such as improper position of a fetus (face or breech presentation), abnormally small pelvis, etc.

[13]Deliveries are classified as "abnormal" if a healthy woman suddenly experiences abnormal labor activities, e.g.abrupt finish of labor pains during an active labor phase, too quick/too slow labor, uterus distortions etc.

Family Planning. The lower part of Table 4 reveals positive effect of the MIHP participation on abortion rates and on use of contraceptive pills, although the effect disappears once the MIHP oblast effect is controlled for (Columns (3)-(5) of Table 4). Nevertheless some positive impact on the abortion rates may occur for at least two reasons. First, it may be suggestive of the better and earlier diagnostics leading to abortions of defective fetus. Second, women may become aware of better services provided in the MIHP sites and therefore be attracted there for all kinds of procedures including abortions. It would be interesting to evaluate the MIHP impact on abortion measures by gestation age and types, but unfortunately such data is not available at the moment.

Infant Health. As could be seen from Table 5, the MIHP impact on infant mortality (total, stillbirths, and perinatal) is negative and statistically significant. The evidence suggests that most of this effect is contributed by the impact of the MIHP participation on infant mortality due to deviations in perinatal period and congenital anomalies. The effect of the Project on most other components of infant mortality is negative, but small in magnitude and not statistically significant.

The lower part of the table presents the estimates of the MIHP impact on infant morbidity. No significant treatment effect is found for total infant morbidity and the only component of it being affected is morbidity due to deviations in perinatal period. The effect is quite large in magnitude - average treatment effect is a 12 percent decline compared to the baseline value of the outcome (-0.43 reduction from 3.53 diseases per 100 infants in year 2000).

6 Robustness Checks and Discussion

To address various concerns related to the contamination of the control group and causality of the MIHP impact, three variations to the basic specification have been pursued: (i) accounting for the trainings provided to the medical personnel of the same oblast, (ii) exploration of the MIHP impact over time, including pre-MIHP period, and (iii) estimation of the MIHP impact on pregnancy unrelated (placebo) outcomes, including a triple difference procedure.

Effect of MIHP Trainings. Columns (3) through (5) in Tables 4-5 show the estimates from the maternal and infant health regressions including the spillover effect on the same oblast maternities which can be interpreted as the effect of the MIHP trainings, the lower bound of the overall MIHP impact. As could be seen, the MIHP impacts on most maternal health outcomes in Column (3) become stronger what is expected in the case of addressing the issue of contamination of the control group. At the same time, for infant health, most of the estimates of the direct impact become statistically insignificant, while the effect on infant mortality due to respiratory system failures and perinatal deviations becomes stronger. For some outcomes (maternal mortality, normal deliveries, and anemia) there exists a significant effect of the MIHP trainings, although it is about twice smaller in magnitude for normal deliveries and anemia, than the direct MIHP impact.

MIHP Effect Over Time. As Tables 6-7 show in most cases there is no significant difference between treatment and control rayons in the years prior to the Project implementation. This points to the causality of the MIHP impact with respect to all of the maternal health outcomes. However, with

respect to the infant health, the situation is more complicated. For example, contrary to the earlier descriptive results, the MIHP rayons have compared favorably to the control rayons in perinatal, early and late neonatal, and total infant mortality even long before the Project start. At the same time the difference almost doubles after the start of the Project for total infant mortality indicating some presence of the Project impact but substantially undermining the confidence in the causality of these effects. At the same time, there is a clear causal effect of the Project on infant mortality due to deviations in perinatal period and respiratory system failures.

Another dimension that the reported estimates uncover is the dependence of the MIHP impact on time. For example, share of normal deliveries increases in the year of the Project start-up, the increase is even more pronounced in the year after and decreases afterwards.[14] The situation is different for C-sections, late toxicosis, anemia, and blood circulation system complications - the health-improving effect seems to be almost linear over time. As to the infant health, the MIHP impact increases over time for total infant mortality and is slightly decreasing for infant mortality due to perinatal deviations and respiratory system failures.

MIHP Effect on Placebo Outcomes. Table 8 presents the estimates of the impact of the MIHP participation on placebo outcomes. As the estimates indicate, no statistically significant health improving effect is observed for such pregnancy unrelated outcomes as tuberculosis, diabetes, hepatitis, hypertension, as well as for teenage morbidity. Since the pregnancy-unrelated outcomes apply to the overall population, it is possible to test them further

[14]Statistical significance of the impact estimates three years after the start-up of the project may be impacted to a great extent by small number of cases in this category. This issue shall be addressed in the follow-up study when there will be relatively more maternities participating in the project more than three years.

using a triple difference specification in Equation (3). As Table 9 shows, there is a significant negative impact of the MIHP on two seemingly unrelated outcomes - hypertension and tuberculosis morbidity, which may be due to an earlier onset of obstetric care. Somewhat surprising impact on the tuberculosis morbidity may be related to the fact that in Ukraine husbands/partners of pregnant women are required to have an X-ray exam for tuberculosis before the delivery.

Of course, the best placebo outcomes would have been the ones which relate only to men, but they are currently not available. However, this issue will be addressed in the future work.

Other Selection Issues. Potential problem with the estimates of the MIHP effect exists in case if the MIHP participating maternities after joining the Project start selecting less complicated pregnancies, ensuring better outcomes simply by the composition of the patients. However, as the evidence suggests, many of the maternities that have joined the Project are second and third level maternities, which are specially designated to deal with high risk pregnancies and therefore are legally obliged to admit all the high risk referrals from the surrounding areas. Another issue is that the participating maternities after joining the project could have attracted more women which could have had normal deliveries in any case, leading again to a change in the pool of patients not related to the MIHP impact. This preposition is tested by looking at the impact of the MIHP participation on the number of deliveries and comparing it to the estimates of the MIHP impact on the number of C-sections, normal deliveries, and problematic deliveries. The estimate of the impact on the number of deliveries is positive and statistically significant, but very small in magnitude compared to the estimates for the normal deliveries

and C-sections. In addition, as Table 6 shows, the MIHP participating rayons have always been rayons with a greater number of deliveries than the control rayons. At the same time the impact on C-sections and normal deliveries appears only after the start of the Project and therefore could be considered as causal.

Furthermore, the estimates of the MIHP impact on problematic and abnormal deliveries are not significant in all specifications suggesting lack of selection or self-selection of patients on potential outcomes. However, to address the issue of self-selection further, a robustness check for the whole range of outcomes is performed on a set of rayons that consists of oblast-subordinated cities (metropolitan areas). Since there are much fewer oblast-subordinated cities, they are located at quite a distance from each other, reducing the possibility of massive movement of pregnant women. In addition, these are larger cities with a better developed infrastructure and are more homogeneous in the quality of prenatal and obstetric care. Qualitatively the results are similar from these regressions (Tables 11-18), but quantitatively they are much stronger than in the basic analysis.

7 Cost-Benefit Considerations

A comprehensive cost-benefit analysis of the MIHP project is limited, since the majority of maternal and infant health indicators are hard to assess in monetary terms (e.g. increase in early neonatal visits of mothers; decrease in the number of cases of late toxicosis and complicated deliveries; decrease in infant morbidity due to various reasons etc.). Therefore, we focus on the most "tangible" cost effectiveness indicators and compare (i) average annual per maternity cost of the Project and (ii) average annual per maternity "tangible"

benefits.

The average annual per maternity cost is about 60,000 USD, and it is calculated as an overall cost of the first phase of the project - 6 mln USD - distributed over 20 treatment sites during 2002-2006 when the first MHIP phase was implemented, including the first year of the Project setup. Set of "tangible" benefits includes savings due to (i) a switch from C-sections to vaginal deliveries, (ii) switch away from medicine-intensive ways of leading both C-sections and vaginal deliveries, and (iii) saved lives of mothers and infants due to the implementation of the MIHP practices. Table 10 provides a summary of the benefits calculation. The estimates of the impact are taken from the preferred specification in Tables 4-5, Column (3).

One of the major findings from the current analysis is that the number of C-sections in the MIHP participating rayons decreases by 4.71% or by 132.17 deliveries on average per year. The difference in the average cost between vaginal deliveries and C-sections is 92.35 UAH per patient[15]. Hence, the aggregated savings from a "C-section towards vaginal deliveries switch" is 12,206.09 UAH (92.35 UAH times 132.17 patients).

Switch away from medicine-intensive ways of leading both C-sections and vaginal deliveries is associated with considerable savings which are achieved through a reduction in expenditures on tests, exams, and medicines during labor and postpartum periods. According to the MIHP team's analysis, the implementation of the MIHP technologies has significantly reduced the cost of both vaginal deliveries and C-sections. If the post-treatment year of 2005 is compared to the pre-treatment 2002, per patient cost of vaginal deliveries has

[15]The average per patient cost of C-sections and vaginal deliveries has been calculated by the MIHP project team (for further details see Appendix). Per patient here combines both cost for a mother and a newborn. The cost survey has been conducted in three MIHP participating maternities in years 2002 and 2005. In the current cost-benefit calculation the average cost per delivery as estimated from these three maternities is taken as an average per delivery cost for all participating rayons.

dropped by 107.30 UAH, while per patient cost of C-sections has declined by 149.35 UAH. Since the average number of vaginal deliveries in 2005 is 2,464.69 and the average number of C-sections is 341.51, the aggregated savings total to 315,465.95 UAH. Together with the cost savings due to a switch away from C-sections this brings 327,672.03 UAH which is equivalent to 64,957.40 USD of savings per year.

The reduction in maternal and infant mortality can be taken as a final measure of the effectiveness of the Project. The estimates suggest that the MIHP participation on average translates into 1.69 fewer maternal deaths per maternity per year and 7.51 fewer infant deaths resulted from deviations in perinatal period and respiratory system failures.[16] The estimates of the value of statistical life (VSL) do not exist in Ukraine. However, evaluated at the conservative estimate of a VSL from the literature (Giergiczny (2008) reports 0.79 mln USD for Poland, country most similar to Ukraine, with existing estimates of the VSL), this would result in a tremendous benefits of 7.3 mln USD for the country, well surpassing the cost of the Project.

So overall, the project costs to benefits ratio is 1 to 122 (60 to 7,332 thousand USD) if one takes into account value of lives saved and it is 1 to 1.08 (60 to 65 thousand USD) if one considers only costs savings due to change in C-section and vaginal delivery practices and switch away from C-sections to vaginal deliveries. The latter represents the lowest bound of the Project's benefits, since it does not take into account any health-improving impact of the MIHP. Although the range is quite wide and this preliminary calculation suffers from several limitations, it seems unlikely that given the

[16] According to estimates from the preferred specification from Table 4, the estimated MIHP impact on maternal mortality is 63 per 100,000 live births. Evaluated at the average number of live births in a participating maternity in year 2005 - 2681,4 live births - this translates into 1.69 fewer maternal deaths. Similarly, 28 newborns saved per 10,000 live births translates into 7.51 fewer infant deaths per maternity per year.

estimated impact the true costs would exceed the true benefits.

8 Conclusion

Exploiting a unique opportunity provided by the Mother and Infant Health Project in Ukraine this paper evaluates the impact of the improvement in the quality of labor and delivery services on maternal and infant mortality and morbidity. This has become possible for two reasons. First is that the maternal and infant health outcomes are lagging behind those in Europe, thus allowing the identification of the effect of health-related interventions. Second, and the most important, is that the labor delivery services and prenatal care are universally available in Ukraine. So, the estimation of the effect of the MIHP can be interpreted as an impact of the improvement in the quality of services, which is a rare opportunity in the research.

Employing program evaluation methods it is found that the urban administrative units (rayons) participating in the Project have exhibited greater improvement in both maternal and infant health compared to the control rayons. At the same time no effect has been found on the pregnancy unrelated outcomes, such as diabetes, hepatitis, and teenage morbidity, indicating the causality of the MIHP impact. The MIHP impact is most pronounced for infant mortality resulting from deviations in perinatal period and respiratory system failures and maternal mortality and morbidity related to late toxicosis, anemia, urinary-genital and blood circulation system complications. The analysis suggests that the effect stems from the early attendance of antenatal clinics, lower share of C-sections, and greater share of normal deliveries.

Decomposition of the MIHP impact over time supports the causality of the main findings, since no effect has been found in the pre-Project period.

At the same time, among infant health outcomes only evidence on infant mortality due to perinatal deviations and respiratory system failures can be interpreted as causal.

Interestingly, the MIHP implied very little monetary intervention - all of the provided equipment has been low cost, but most of the change has occurred through trainings of the personnel and changes in their attitudes and practices. The maternities participating in the Project have become more mothers' and family friendly, practicing active partner participation in the process of labor and delivery, less involvement of medicines, and joint mother-baby accommodation. As a result, even after controlling for the overall trend in the country and oblast-specific time trend, the rayons with the MIHP-participating maternities do observe better maternal and infant health outcomes. And the impact is more significant statistically and economically for the outcomes directly related to the quality of labor and delivery services: decrease in infant morbidity and mortality due to deviations in the perinatal period and respiratory system failures, maternal mortality and various complications experienced by mothers during pregnancy, labor and delivery, and in postpartum period. It can also be attributed to the indirect impact of the MIHP on the quality of prenatal care since most of the doctors employed by maternities have dual appointments at the antenatal clinics.

As the preliminary cost-benefit calculation shows, the Mother and Infant Health Project seems to be associated with a tremendous return to the country. The project costs to benefits ratio is 1 to 122 if one takes into account value of lives saved and it is 1 to 1.08 if one considers only costs savings due to changes in C-section and vaginal delivery practices and a switch away from C-sections to vaginal deliveries. Even though these cost-benefit considerations are quite rough, they indicate that the benefits of the MIHP are

much higher than the costs.

This study provides evidence on the effectiveness of a low-cost change in the quality of the provision of labor and delivery services. Although this evaluation is not without a fault, especially with respect to its ability to separate the impact of various components of the Project, it provides some guidelines to be used in the development of future interventions. At the same time one should be cautious when considering the institutional setting in which the MIHP has worked. First of all, Ukraine has a well-qualified health care labor force: well trained doctors and nurses in all parts of the country have regularly scheduled courses to upgrade their knowledge and exams that follow them. Second, Ukraine has a well educated population with 24% of women and 17% of men having high education (Ganguli and Terrell, 2006). These two factors alone may be a sufficient explanation of why an inexpensive change in the quality of services has been so successful in Ukraine, and may prevent policy makers from direct implementation of the Project in less developed countries. However, successful adoption of some of the components, such as warm chain practices and presence of a partner in the delivery room, may not require high skills of the personnel and well educated mothers to be successfully adopted.

References

AbouZahr, Carla. 2003. "Global Burden of Maternal Death and Disability." *British Medical Bulletin* 77:1–11.

Allin, Sara, Konstantina Davaki, and Elias Mossialos. 2005. "Paying for "Free" Health Care: the Conundrum of Informal Payments in Post-Communist Europe." `http://www.transparency.org/content/download/4847/28622/file/Part\%201_4_informal_payments.pdf`.

Anderson, Barbara A and Brian S Silver. 1986. "Infant Mortality in the Soviet Union: Regional Differences and Measurement Issues." *Population and Development Review* 12 (4):705–738.

Barber, Sarah L and Paul J Gertler. 2002. "Child Health And The Quality of Medical Care." *University of California-Berkeley Working Paper* `http://faculty.haas.berkeley.edu/gertler/working_papers/02.28.02_childheight.pdf`.

Bhalotra, Sonia. 2007. "Spending to Save? State Health Expenditure and Infant Mortality in India." *University of Bristol Working Paper* No. 07/169. `http://www.bristol.ac.uk/cmpo/publications/papers/2007/wp169.pdf`.

Brainerd, Elizabeth. 2006. "Reassessing the Standard of Living in the Soviet Union: An Analysis Using Archival and Anthropometric Data." *IZA Discussion Paper* No. 1958.

Buckley, Cynthia. 2003. "Children at Risk: Infant and Child Health in Central Asia." *William Davidson Working Paper* No. 523.

Carroli, Guillermo, Cleone Rooney, and Jose Villar. 2001. "How Effective is Antenatal Care in Preventing Maternal Mortality and Serious Morbidity? An Overview of the Evidence." *Paediatric and Perinatal Epidemiology* 15 (1):1–42.

Chou, Shin-Yi, Jin-Tan Liu, Michael Grossman, and Theodore J. Joyce. 2007. "Parental Education and Child Health: Evidence from a Natural Experiment in Taiwan." *NBER Working Paper* No. 13466.

Conway, Karen and Partha Deb. 2005. "Is Prenatal Care Really Ineffective? Or, Is the Devil in the Distribution?" *Journal of Health Economics* 3 (24):489–513.

Conway, Karen and Andrea Kutinova. 2006. "Maternal Health: Does Perinatal Care Make a Difference?" *Health Economics* 15:461–88.

Currie, Janet and Jeffrey Grogger. 2000. "Medicaid Expansions and Welfare Contractions: Offsetting Effects on Prenatal Care and Infant Health?" *NBER Working Paper* No. 7667.

Evans, William N. and Diana S. Lien. 2005. "The Benefits of Prenatal Care: Evidence From the PAT Bus Strike." *Journal of Econometrics* 125:207–239.

Ganguli, Ina and Katherine Terrell. 2006. "Institutions, Markets and Men's and Women's Wage Inequality: Evidence from Ukraine." *Journal of Comparative Economics* 34 (2):200–227.

Giergiczny, Marek. 2008. "Value of a Statistical Lifethe Case of Poland." *Environmental and Resource Economics* 41 (2).

Goldman, Fred and Michael Grossman. 1982. "The Impact of Public Health Policy: The Case of Community Health Centers." *NBER Working Paper* No. 1020.

Haas, Jennifer S., Steven Udvarhelyi, and Arnold M. Epstein. 1993. "The Effect of Health Coverage for Uninsured Pregnant Women on Maternal Health And the Use of Cesarean Section." *Journal of American Medical Association* 270 (1):61–64.

Kezdi, Gabor. 2004. "Robust Standard Error Estimation in Fixed-Effects Panel Models." *Hungarian Statistical Review, Special English Volume* 9:95–116.

Laditka, Sarah B., James N. Laditka, Melanie P. Mastanduno, Michele R. Lauria, and Tina C. Foster. 2005. "Potentially Avoidable Maternity Complications: An Indicator of Access to Prenatal and Primary Care During Pregnancy." *Women and Health* 3 (41):1–26.

Lefevre-Cholay, Helene, Idriss Alaoui, Sasch Lamstein, and Viktor Galayda. 2006. "Exploring the Cost Impact of MIHP Intervention." Mimeo.

Lekhan, Valeria, Volodomyr Rudiy, and Ellen Nolte. 2004. "Health care systems in transition: Ukraine." *European Observatory on Health Systems and Policies* 6 (7). `http://www.euro.who.int/Document/E84927.pdf`.

McCarthy, James and Deborah Maine. 1992. "A Framework for Analyzing the Determinants of Maternal Mortality." *Studies in Family Planning* 1 (23):23–33.

McGuire, James M. 2006. "Basic Health Care Provision and Under-5 Mortality: A Cross-National Study of Developing Countries." *World Development* 3 (34):405–425.

MEU. 2005. "Millennium Development Goals. Ukraine." *Ministry of Economy of Ukraine* http://www.undp.org.ua/download.php?id=1139.

MHCU. 2007. "Informational and Analytical Materials as to the Results Achieved by the Health Care System in Ukraine in January-June 2007." *Ministry of Health Care of Ukraine* http://www.moz.gov.ua/ua/main/docs/?docID=8252.

Oxaal, Zoe and Sally Baden. 1996. "Challenges to Women's Reproductive Health: Maternal Mortality." Tech. Rep. 38, BRIDGE Report. http://www.bridge.ids.ac.uk/reports/re38c.pdf.

Shiffman, Jeremy. 2000. "Can Poor Countries Surmount High Maternal Mortality?" *Studies in Family Planning* 4 (31):274–289.

Sodemann, M., M.S. Jakobson, I.C. Molbak, I.C. Alvarenga, and P. Aaby. 1997. "High Mortality Despite Good Care-Seeking Behavior: a Community Study of Childhood Deaths in Guinea-Bissau." *Bulletin of the World Health Organization* 3 (75):205–12.

Stock, James H. and Mark W. Watson. 2008. "Heteroskedasticity-Robust Standard Errors for Fixed Effects Panel Data Regression." *Econometrica* 76 (1):155–174.

Winikoff, Beverly. 1988. "Women's Health: An Alternative Perspective for Choosing Interventions." *Studies in Family Planning* 4 (19):197–214.

Table 1: List of Analyzed Health Outcomes

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Maternal Health Outcomes	**Infant Health Outcomes**
Normal Deliveries per 100 deliveries	Stillbirths per 1,000 Newborns
C-sections per 100 deliveries	Perinatal Mortality per 1,000 Newborns
Deliveries	Early Neonatal Mortality per 1,000 Livebirths
Maternal Mortality per 100,000 livebirths	Late Neonatal Mortality per 1,000 Livebirths
Per Cent of Pregnant Visited Antenatal Clinics before 12 weeks	Postneonatal Mortality per 1,000 Livebirths
Late Toxicosis per 100 Pregnancies	
Deliveries Complications per 100 deliveries	Infant Mortality per 1,000 Livebirths
includig those related to:	including those related to:
Urinary-Genital System	Infection
Anemia	Nervous System
Blood Circulation	RespiratorySystem
Veins Complications	Congenital Anomalies
Thyroid Gland Complications	Perinatal Deviations
Problematic Deliveries	
Abnormal Deliveries	Total Infant Morbidity per 100 Infants
	including those related to:
	Infection
	Nervous System
	RespiratorySystem
	Congenital Anomalies
	Perinatal Deviations

Family Planning Indicators	**Pregnancy and MIHP -unrelated Health Outcomes**
Abortions per 1,000 Women of Fertile Age	Tuberculosis Diagnosed per year per 1,000 Population
Use of Contrac. Pills among 1,000 Women of Fertile Age	Diabetis Diagnosed per 1,000 Population
	Hypertension per 100,000 adults
	Teenage Morbidity per 1,000 teenagers

Notes: (1) "Problematic" deliveries are those exhibiting ex-ante deviations from the "norm". For instance, improper presentation/position of a fetus (face or breech presentation), abnormally small pelvis of a mother etc. (2) Deliveries are classified as "abnormal" if a healthy woman suddenly experiences abnormal labor activities, e.g. abrupt finish of labor pains during an active labor phase, too quick/too slow labor, uterus distortions etc.

Table 2: Descriptive Statistics: Maternal Health and Family Planning Outcomes

	2000		2006	
	MIHP	Non-MIHP	MIHP	Non-MIHP
Maternal Health				
Maternal Mortality	22.34	34.5	4.49	13.12
	(26.06)	(95.27)	(10.37)	(55.24)
Normal Deliveries	29.63	36.64	60.75	55.70
	(13.41)	(15.93)	(15.29)	(14.69)
C-sections	11.95***	7.65***	13.86**	10.97**
	(6.02)	(4.00)	(3.81)	(4.44)
Early Neonatal Visits	80.58	80.76	90.16	89.13
	(10.23)	(9.08)	(8.09)	(6.45)
Late Toxicosis	12.17**	8.55**	7.22	7.00
	(5.01)	(5.43)	(3.08)	(4.33)
Complicated Deliveries by Cause:				
Urinary-Genital System	7.92	7.16	8.03	7.34
	(4.57)	(8.12)	(5.67)	(6.91)
Anemia	23.94	28.48	11.84**	24.24**
	(14.83)	(18.83)	(5.33)	(21.13)
Blood Circulation	4.19	5.28	2.80	3.76
	(4.20)	(8.62)	(2.94)	(5.00)
Veins	2.86	2.04	2.04	2.00
	(1.90)	(2.28)	(1.43)	(1.92)
Thyroid Gland	18.79**	8.86**	10.85	8.84
	(24.83)	(12.46)	(9.48)	(11.85)
Per cent Problematic Deliveries	5.89	11.76	4.06	7.50
	(4.89)	(16.10)	(2.03)	(8.74)
Per cent Abnormal Deliveries	8.80*	13.93*	5.19*	8.01*
	(3.91)	(9.32)	(2.85)	(5.35)
Family Planning				
Abortions per 1,000 Fertile Age Females	29.59	27.86	22.47***	15.57***
	(14.71)	(13.25)	(12.28)	(9.07)
Contracept Pills per 1,000 females	104.11***	54.45***	190.85*	147.45*
	(64.89)	(52.19)	(112.76)	(84.44)
Observations	13	194	14	227

Notes: Standard errors in parentheses.

Table 3: Descriptive Statistics: Infant Health Outcomes

	2000		2006	
	MIHP	Non-MIHP	MIHP	Non-MIHP
Infant Mortality Total	13.85*	11.14*	9.34	10.45
	(4.30)	(5.76)	(3.66)	(5.49)
Stillbirths	6.75***	4.16***	5.11	4.84
	(3.94)	(3.30)	(2.72)	(3.59)
Perinatal	12.97***	7.58***	8.66	8.28
	(5.99)	(4.93)	(5.04)	(5.22)
Early Neonatal	6.24***	3.48***	3.65	3.36
	(3.91)	(3.06)	(3.05)	(3.32)
Late Neonatal	3.69	2.40	2.31	2.48
	(4.52)	(3.47)	(2.32)	(2.66)
Postneonatal	4.50	5.79	3.71	4.40
	(2.67)	(5.16)	(2.20)	(3.20)
Mortality by cause:				
Infection	6.18	5.34	6.76	4.43
	(6.21)	(11.22)	(8.53)	(9.47)
Nervous system	1.73	2.98	2.06	2.12
	(3.17)	(8.05)	(3.57)	(5.98)
Respiratory system	4.86	8.58	5.52	4.77
	(9.43)	(14.14)	(5.68)	(10.93)
Congenital Anomalies	41.45	31.57	25.65	25.09
	(13.42)	(34.65)	(13.42)	(25.58)
Perinatal Deviations	50.38**	28.91**	38.87	37.95
	(38.30)	(32.70)	(26.61)	(33.68)
Infant Morbidity Total	232.42	200.60	217.57**	174.93**
	(91.53)	(69.41)	(104.69)	(63.62)
Morbidity by cause:				
Infection	6.50	5.43	4.61	4.33
	(6.95)	(3.72)	(3.01)	(2.89)
Nervous system	6.59	4.09	13.05**	6.65**
	(7.24)	(6.72)	(10.76)	(9.54)
Respiratory system	121.65*	100.09*	119.67***	85.19***
	(52.71)	(39.68)	(86.96)	(36.14)
Congenital Anomalies	0.67*	0.47*	0.51	0.39
	(0.52)	(0.40)	(0.31)	(0.27)
Perinatal Deviations	3.53	3.23	1.69	2.30
	(1.72)	(2.06)	(1.52)	(1.37)
Observations	13	194	14	227

Note: Standard errors in parentheses.

Table 4: Estimated Impact of the MIHP on Maternal Health Outcomes

	MIHP	Other Programs	MIHP rayon	MIHP oblast	Other Programs	N	Rayons
	(1)	(2)	(3)	(4)	(5)		
Maternal Mortality	-7.15	-0.57	-63.22*	-58.33*	-1.94	1619	245
	(9.47)	(17.02)	(34.03)	(33.74)	(17.16)		
Normal Deliveries	10.48***	-0.18	19.02***	8.88**	0.03	1619	245
	(1.96)	(3.74)	(4.71)	(4.13)	(3.70)		
Deliveries/1,000 Population	1.21***	0.26	1.19***	-0.02	0.26	1609	245
	(0.32)	(0.78)	(0.43)	(0.41)	(0.78)		
C-sections	-2.22***	0.60	-4.71***	-2.59	0.54	1619	245
	(0.65)	(1.03)	(1.75)	(1.57)	(1.01)		
Early Neonatal Visits	2.50***	-0.35	3.12**	0.65	-0.34	1619	245
	(0.89)	(1.12)	(1.57)	(1.54)	(1.13)		
Late Toxicosis	-1.77**	-1.82	-2.79**	-1.07	-1.85	1619	245
	(0.76)	(1.35)	(1.18)	(1.10)	(1.35)		
Complicated Deliveries by cause							
Urinary-Genital System	-1.66	-0.54	-4.30**	-2.74	-0.61	1619	245
	(1.84)	(1.33)	(1.96)	(1.90)	(1.35)		
Anemia	-4.41**	-5.42**	-10.94***	-6.79*	-5.58**	1619	245
	(1.82)	(2.52)	(3.65)	(3.60)	(2.52)		
Blood Circulation	-1.33**	-0.48	-2.16*	-0.86	-0.51	1619	245
	(0.53)	(0.70)	(1.17)	(1.04)	(0.70)		
Veins	-0.41	-0.34	-0.52	-0.12	-0.34	1619	245
	(0.26)	(0.34)	(0.75)	(0.75)	(0.34)		
Thyroid Gland	-1.62	-0.20	-4.72	-3.23	-0.28	1619	245
	(1.43)	(1.69)	(4.84)	(4.81)	(1.68)		
Problematic Deliveries	-1.32	1.88	1.05	2.47	1.94	1619	245
	(0.98)	(1.92)	(1.92)	(1.87)	(1.93)		
Abnormal Deliveries	0.87	1.23	-0.04	-0.94	1.20	1611	244
	(0.70)	(1.08)	(0.86)	(0.78)	(1.09)		
Family Planning Indicators per 1,000 Women of Fertile Age							
Abortions	2.08**	-1.32	2.43	0.36	-1.32	1550	244
	(0.85)	(1.35)	(1.54)	(1.45)	(1.36)		
Use of Contrac. Pills	23.40**	-25.64	6.73	-17.36	-26.05	1567	245
	(10.93)	(16.70)	(15.53)	(15.84)	(16.80)		

Notes: (1) The sample for each regression contains 1612 observations for 244 rayons, including 13 treated rayons. (2) The estimation results are from rayon fixed effect regressions with time dummies and oblast-time interactions as additional control variables.

Table 5: Estimated Impact of the MIHP on Infant Health Outcomes

	MIHP	Other Programs	MIHP	MIHP oblast	Other Programs	N	Rayons
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Infant Mortality Total	-2.46***	-2.53	-2.61	-0.15	-2.53	1619	245
	(0.91)	(1.60)	(2.49)	(2.55)	(1.60)		
Stillbirths	-1.47***	-0.26	-0.95	0.54	-0.25	1619	245
	(0.53)	(0.67)	(1.61)	(1.60)	(0.67)		
Perinatal	-2.09***	-2.54**	-0.71	1.43	-2.51**	1619	245
	(0.70)	(1.00)	(1.40)	(1.43)	(1.01)		
Early Neonatal	-0.60	-2.15***	0.23	0.87	-2.13***	1619	245
	(0.46)	(0.76)	(0.97)	(0.94)	(0.76)		
Late Neonatal	-0.50	-1.13**	-0.57	-0.08	-1.13**	1611	245
	(0.33)	(0.46)	(0.78)	(0.80)	(0.46)		
Postneonatal	-0.39	-0.02	-1.74	-1.40	-0.05	1618	245
	(0.64)	(0.89)	(1.57)	(1.61)	(0.90)		
Mortality by cause							
Infection	0.16	2.12	5.84	5.91	2.26	1618	245
	(2.08)	(2.57)	(4.86)	(5.01)	(2.57)		
Nervous system	-1.41	3.68*	5.22	6.90	3.84*	1619	245
	(1.22)	(2.21)	(6.53)	(6.70)	(2.21)		
Respiratory system	0.87	-1.21	-9.05*	-10.33**	-1.45	1619	245
	(1.83)	(2.35)	(5.08)	(5.10)	(2.36)		
Congenital Anomalies	-7.75*	-0.69	-20.96	-13.75	-1.01	1619	245
	(4.22)	(6.12)	(19.90)	(20.04)	(6.11)		
Perinatal Deviations	-10.96**	-11.53	-18.88**	-8.24	-11.72	1619	245
	(4.99)	(8.54)	(9.47)	(9.45)	(8.56)		
Infant Morbidity Total	-1.93	-0.32	-35.77	-35.20	-1.15	1619	245
	(7.85)	(11.55)	(43.50)	(43.44)	(11.57)		
Morbidity by cause							
Infection	-0.15	0.53	2.03	2.27*	0.58	1619	245
	(0.55)	(0.63)	(1.52)	(1.33)	(0.63)		
Nervous system	-0.32	0.94	-0.27	0.05	0.94	1619	245
	(1.14)	(2.16)	(2.86)	(2.68)	(2.16)		
Respiratory system	5.99	-16.65	-43.37	-51.36	-17.86	1619	245
	(6.45)	(12.07)	(44.46)	(44.41)	(12.16)		
Congenital Anomalies	0.01	-0.12	-0.08	-0.09	-0.12	1619	245
	(0.05)	(0.11)	(0.09)	(0.08)	(0.11)		
Perinatal Deviations	-0.43**	0.47	0.12	0.57	0.48	1619	245
	(0.19)	(0.42)	(0.46)	(0.45)	(0.42)		

See Notes to Table 4

Table 6: Estimated Impact of the MIHP on Maternal Health Outcomes: Time Dimension

	Before			After			MIHP	Other
	3 years	2 years	1 year	1st year	2nd year	3d year	oblast	Programs
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Maternal Mortality	-7.59	9.63	17.45	-35.94	-56.81	-48.14	-43.76	-0.24
	(19.63)	(15.23)	(15.15)	(38.28)	(40.15)	(41.96)	(35.85)	(16.95)
Normal Deliveries	-0.32	-2.23	0.73	19.46***	21.98***	14.50**	9.63**	0.09
	(2.53)	(2.31)	(3.08)	(6.38)	(5.51)	(5.82)	(4.74)	(3.65)
Deliveries/1,000 Population	0.68	1.11**	1.13**	2.21***	2.59***	3.85***	0.79	0.18
	(0.44)	(0.45)	(0.49)	(0.79)	(0.83)	(0.91)	(0.62)	(0.77)
C-sections	0.62	0.79	-0.85	-5.51**	-6.04***	-5.45**	-3.73**	0.52
	(1.01)	(0.82)	(0.71)	(2.18)	(1.97)	(2.31)	(1.67)	(1.02)
Early Neonatal Visits	-0.90	-0.20	0.44	4.12*	2.99	2.34	1.13	-0.20
	(0.99)	(1.18)	(1.20)	(2.11)	(2.20)	(2.66)	(1.83)	(1.13)
Late Toxicosis	-1.26	-1.43	-2.05*	-4.96**	-5.28***	-5.51**	-2.40*	-1.80
	(1.17)	(1.26)	(1.14)	(2.01)	(2.03)	(2.68)	(1.32)	(1.37)
Complicated Deliveries by cause								
Urinary-Genital System	2.15	1.28	1.10	-2.20	-4.22	-5.06	-2.89	-0.48
	(2.52)	(1.50)	(1.59)	(2.61)	(3.39)	(5.38)	(2.30)	(1.47)
Anemia	-7.38	-6.90	-9.95*	-21.42***	-23.23***	-23.55***	-12.89**	-5.31**
	(4.48)	(4.34)	(5.35)	(7.55)	(7.12)	(7.85)	(5.29)	(2.52)
Blood Circulation	-0.02	0.78	-1.59**	-3.78**	-4.24***	-4.19**	-2.60**	-0.51
	(0.89)	(1.03)	(0.69)	(1.57)	(1.46)	(1.64)	(1.23)	(0.70)
Veins	0.12	-0.06	0.24	0.03	-0.64	-0.87	-0.01	-0.28
	(0.41)	(0.35)	(0.47)	(0.94)	(0.96)	(1.02)	(0.85)	(0.32)
Thyroid Gland	-3.87*	-1.56	-2.55	-6.13	-10.17*	-8.56	-4.57	0.07
	(2.26)	(1.84)	(1.88)	(4.81)	(5.65)	(5.42)	(4.77)	(1.85)
Problematic Deliveries (1)	3.29	-0.43	-0.12	1.37	0.24	-0.02	1.49	1.97
	(2.60)	(1.53)	(1.50)	(2.53)	(2.63)	(3.00)	(2.17)	(1.88)
Abnormal Deliveries (2)	0.32	-0.36	0.07	-0.17	0.00	1.90	-0.62	1.14
	(0.93)	(1.01)	(1.24)	(1.68)	(1.77)	(2.02)	(1.28)	(1.11)
Family Planning Indicators per 1,000 Women of Fertile Age								
Abortions	-0.45	0.04	-0.23	1.24	3.44	4.16	0.59	-1.51
	(1.21)	(1.35)	(1.17)	(2.11)	(2.33)	(2.56)	(1.55)	(1.20)
Use of Contrac. Pills	-5.17	11.72	4.98	4.06	20.48	39.75	-9.98	-27.81*
	(16.16)	(12.71)	(12.27)	(21.90)	(23.26)	(36.16)	(17.47)	(15.37)

See Notes to Table 4

Table 7: Estimated Impact of the MIHP on Infant Health Outcomes: Time Dimension

	Before			After			MIHP	Other
	3 years	2 years	1 year	1st year	2nd year	3d year	oblast	Programs
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Infant Mortality total	-0.13	-2.41**	-2.68**	-5.02*	-7.15**	-4.39	-1.98	-2.43
	(1.25)	(1.07)	(1.27)	(2.91)	(3.06)	(3.40)	(2.76)	(1.61)
Stillbirths	-0.29	-0.28	-0.40	-1.33	-1.56	-1.28	0.31	-0.23
	(0.79)	(0.86)	(0.81)	(1.87)	(1.90)	(2.06)	(1.72)	(0.67)
Perinatal	-1.58*	-2.13**	-1.68*	-2.40	-3.14	-2.00	0.81	-2.43**
	(0.91)	(0.93)	(0.96)	(1.78)	(1.97)	(2.39)	(1.68)	(0.96)
Early Neonatal	-1.28**	-1.90***	-1.35**	-1.18	-1.66	-0.73	0.43	-2.07***
	(0.58)	(0.56)	(0.61)	(1.25)	(1.30)	(1.54)	(1.07)	(0.74)
Late Neonatal	-0.23	-0.52	-1.18**	-1.81*	-2.06**	-2.07*	-1.04	-1.12**
	(0.55)	(0.50)	(0.49)	(0.99)	(1.05)	(1.15)	(0.87)	(0.46)
Postneonatal	1.28	-0.15	-0.80	-2.69	-2.89	-1.39	-2.29	-0.11
	(0.89)	(0.90)	(1.03)	(1.92)	(2.03)	(2.15)	(1.80)	(0.89)
Mortality by cause								
Infection	2.07	-1.88	-5.93*	-0.65	-2.30	2.98	0.67	2.14
	(2.61)	(2.83)	(3.03)	(5.87)	(6.14)	(7.45)	(5.62)	(2.31)
Nervous system	-0.83	1.81	-2.83	1.47	2.55	4.06	4.28	3.65*
	(1.30)	(1.82)	(1.82)	(6.71)	(7.16)	(7.36)	(7.01)	(2.06)
Respiratory system	1.09	-1.74	-3.08	-13.16**	-12.46*	-8.20	-12.50**	-1.66
	(2.63)	(2.73)	(2.79)	(6.26)	(6.53)	(6.86)	(5.52)	(2.30)
Congenital Anomalies	1.47	-5.15	-5.12	-26.11	-29.45	-21.13	-17.11	-0.98
	(7.44)	(6.09)	(6.45)	(21.35)	(21.43)	(22.34)	(20.64)	(5.69)
Perinatal Deviations	-2.04	-8.23	-11.41**	-31.58***	-33.56**	-26.27*	-15.86	-11.74
	(6.13)	(5.55)	(5.64)	(11.84)	(13.40)	(15.27)	(10.72)	(8.00)
Morbidity Total	-5.00	5.38	-4.51	-37.37	-44.67	-52.33	-41.29	-0.47
	(12.21)	(9.95)	(9.38)	(45.94)	(45.56)	(45.94)	(43.96)	(11.77)
Morbidity by cause								
Infection	-0.90	-0.84	-0.20	1.83	1.62	2.33	2.57*	0.62
	(1.07)	(0.85)	(0.86)	(2.01)	(2.03)	(2.09)	(1.45)	(0.64)
Nervous system	2.98*	3.87**	2.14	2.28	0.92	5.62	0.75	0.82
	(1.74)	(1.86)	(1.94)	(3.67)	(3.56)	(3.80)	(2.79)	(2.26)
Respiratory system	-1.25	12.85	4.91	-36.18	-35.44	-59.47	-52.28	-17.45*
	(10.30)	(8.53)	(7.78)	(45.97)	(45.06)	(46.06)	(44.48)	(10.05)
Congenital Anomalies	0.01	0.05	0.05	-0.02	-0.03	-0.02	-0.06	-0.12
	(0.09)	(0.09)	(0.10)	(0.15)	(0.15)	(0.16)	(0.11)	(0.11)
Perinatal Deviations	-0.08	-0.33	-0.55**	-0.59	-0.38	-0.38	0.17	0.47
	(0.26)	(0.25)	(0.25)	(0.56)	(0.57)	(0.63)	(0.48)	(0.41)

See Notes to Table 4

Table 8: Estimated Impact of the MIHP on Placebo Outcomes

	DD			Summary Statistics					
				2000		2006			
	MIHP rayon	MIHP oblast	Other Programs	MIHP	Non-MIHP	MIHP	Non-MIHP	N	Rayons
	(1)	(2)	(3)						
Tuberculosis Morbidity	-4.10	-0.39	1.37	59.11	60.73	78.36	81.40	1619	245
	(4.37)	(4.19)	(4.33)	(12.49)	(19.39)	(23.83)	(28.54)		
Diabetis Morbidity	2.78	0.80	-11.85	108.47	121.17	200.78	215.62	1619	245
	(18.77)	(18.47)	(14.31)	(31.64)	(60.88)	(36.53)	(65.90)		
Hepatitis	111.64*	113.40*	-9.79	85.72	60.14	36.07	26.14	1170	184
	(62.85)	(64.20)	(14.66)	(69.04)	(80.35)	(31.91)	(35.39)		
Hypertension	-0.26	-0.69	-0.19	2.35	2.68	2.39	2.41	1597	245
	(0.56)	(0.63)	(0.29)	(1.28)	(1.79)	(1.02)	(1.04)		
Teenage Morbidity	0.23***	0.22***	-0.02	0.94	0.85	0.92	0.95	1587	245
	(0.08)	(0.08)	(0.04)	(0.44)	(0.28)	(0.25)	(0.35)		

See Notes to Table 4

Table 9: Triple Difference Estimates of the MIHP Impact on Placebo Outcomes

	DDD				
	MIHP rayon	MIHP oblast	Other Programs	N	Rayons
	(1)	(2)	(3)		
Tuberculosis Morbidity	-1.29*	-0.33	2.89	1504	244
	(0.66)	(0.33)	(3.81)		
Diabetis Morbidity	-0.08	-1.42*	-11.45	1504	244
	(1.49)	(0.76)	(18.46)		
Hepatitis	-2.87	1.05	-9.64	1129	184
	(3.11)	(1.15)	(14.00)		
Hypertension	-0.08*	0.05***	-0.13	1504	244
	(0.05)	(0.02)	(0.29)		

See Notes to Table 4

Table 10: Per Mother and Child Cost Savings Calculation

	C-section (CS)	Vaginal delivery (VD)	CS-VD	
Post-MIHP cost 2005, UAH	118.40	26.05	92.35	
Average number of deliveries in 2005				2,806.20
Estimated impact on CS, percent				-4.71
Number of VD that would have been CS without the MIHP				132.17
Cost Savings Due to a Switch from CS to VD				**12,206.09**
Pre-MIHP cost 2002, UAH	267.75	133.35	134.40	
Post-MIHP cost 2005, UAH	118.40	26.05	92.35	
2002 to 2005 change in cost, UAH	149.35	107.30		
Average number of deliveries in 2005	341.51	2,464.69		
Cost savings due to a change in technology	**51,005.20**	**264,460.75**		**315,465.95**
Total, UAH				**327,672.03**
Total, USD				**64,885.55**
Average number of live births in 2005, MIHP sites				**2,681.40**
Mothers' lives saved per year (63 per 100,000 livebirths)				1.69
Newborns' lives saved per year (28 per 10,000 livebirths)				7.51
Total value of saved lives (VSL=0.79 mln USD)				**7,267,432.78**
Total Benefits (including saved lives)				**7,332,318.33**

Notes: (1) The cost includes the cost of the procedure for both mother and newborn. (2) The cost is given in 2005 prices. (3) Exchange rate for year 2005 is 5.05 UAH/USD. (4) Average number of deliveries and live births per rayon is calculated for all participating rayons in year 2005.

Table 11: Descriptive Statistics: Maternal Health and Family Planning Outcomes, Metropolitan Areas

	2000		2006	
	MIHP	Non-MIHP	MIHP	Non-MIHP
Maternal Health				
Maternal Mortality	29.05	23.18	5.72	10.37
	(26.26)	(73.76)	(11.49)	(30.00)
Normal Deliveries	25.31*	35.00*	56.48	51.88
	(11.75)	(15.46)	(14.48)	(14.34)
C-sections	13.77***	9.57***	15.14	12.94
	(5.69)	(4.41)	(3.20)	(4.35)
Early Neonatal Visits	80.77	81.63	89.54	88.62
	(10.52)	(8.34)	(8.90)	(5.65)
Late Toxicosis	12.66	9.43	7.92	7.70
	(5.35)	(6.13)	(3.02)	(5.00)
Complicated Deliveries by Cause:				
Urinary-Genital System	8.40	8.68	9.32	9.63
	(4.78)	(7.35)	(5.76)	(8.60)
Anemia	26.52	28.46	12.92**	23.47**
	(14.96)	(18.02)	(5.25)	(13.53)
Blood Circulation	4.44	4.34	3.11	3.47
	(4.67)	(7.04)	(3.24)	(3.84)
Veins	2.96	2.09	1.81	1.92
	(2.14)	(1.83)	(1.37)	(1.47)
Thyroid Gland	11.51*	5.83*	8.31	7.33
	(13.08)	(9.02)	(6.89)	(12.32)
Per cent Problematic Deliveries	5.25	8.79	4.33	7.24
	(4.26)	(12.69)	(2.05)	(7.63)
Per cent Abnormal Deliveries	7.95**	14.04**	5.10*	8.03*
	(3.76)	(9.20)	(2.58)	(5.03)
Family Planning				
Abortions per 1,000 Fertile Age Females	31.98	33.38	24.84	20.03
	(15.63)	(13.97)	(12.17)	(8.95)
Contracept Pills per 1,000 females	119.69*	79.10*	213.07**	149.24**
	(64.94)	(64.60)	(116.70)	(90.56)
Observations	10	64	11	80

Notes: Standard errors in parentheses.

Table 12: Descriptive Statistics: Infant Health Outcomes, Metropolitan Areas

	2000		2006	
	MIHP	Non-MIHP	MIHP	Non-MIHP
Infant Mortality Total	15.05*	11.83*	9.47	10.35
	(3.63)	(5.77)	(3.83)	(5.70)
By time:				
Stillbirths	7.33**	4.73**	5.49	4.79
	(4.19)	(3.24)	(2.96)	(3.20)
Perinatal	14.60***	9.04***	9.67	8.61
	(5.86)	(4.79)	(5.26)	(4.83)
Early Neonatal	7.28***	4.34***	4.28	3.74
	(3.85)	(2.78)	(3.13)	(3.06)
Late Neonatal	4.17	2.80	2.44	2.48
	(4.96)	(4.83)	(2.40)	(2.74)
Postneonatal	4.08	5.03	3.43	4.06
	(1.97)	(3.51)	(1.98)	(2.85)
By cause:				
Infection	6.36	3.63	5.77	4.23
	(5.53)	(7.56)	(4.94)	(8.13)
Nervous system	1.21	3.45	2.62	2.44
	(2.02)	(7.59)	(3.87)	(5.83)
Respiratory system	6.32	6.84	3.84	4.30
	(10.41)	(12.16)	(5.06)	(8.80)
Congenital Anomalies	40.56	31.28	28.66	26.63
	(13.19)	(27.55)	(13.45)	(23.80)
Perinatal Deviations	63.21*	38.10*	46.72	43.29
	(33.97)	(38.52)	(24.13)	(36.45)
Infant Morbidity Total	250.81	217.23	221.03	182.49
	(95.06)	(78.14)	(93.20)	(74.31)
By cause:				
Infection	7.07	5.52	5.11	4.38
	(7.17)	(3.52)	(3.05)	(2.63)
Nervous system	7.84	5.70	16.01	12.05
	(7.74)	(8.54)	(10.24)	(13.09)
Respiratory system	132.52	113.46	112.11*	86.15*
	(55.19)	(41.54)	(68.78)	(40.20)
Congenital Anomalies	0.76	0.64	0.55	0.46
	(0.56)	(0.53)	(0.32)	(0.25)
Perinatal Deviations	3.61	3.38	1.81	2.30
	(1.88)	(2.58)	(1.65)	(1.62)
Observations	10	64	11	80

Note: Standard errors in parentheses.

Table 13: Estimated Impact of the MIHP on Maternal Health Outcomes: Metropolitan Areas

	MIHP	Other Programs	MIHP rayon	MIHP oblast	Other Programs	N	Rayons
	(1)	(2)	(3)	(4)	(5)		
Maternal Mortality	-2.83	-1.12	-21.58*	-19.87	-1.83	602	93
	(10.76)	(15.43)	(11.53)	(16.18)	(15.70)		
Normal Deliveries	7.74***	0.24	37.34***	31.37***	1.36	602	93
	(2.40)	(3.96)	(2.90)	(3.62)	(3.78)		
Deliveries/1,000 Population	0.72	-0.08	2.15**	1.51	-0.02	601	93
	(0.44)	(0.77)	(0.92)	(1.03)	(0.77)		
C-sections	-2.05***	0.15	-11.22***	-9.71***	-0.2	602	93
	(0.76)	(1.19)	(2.64)	(2.72)	(1.12)		
Early Neonatal Visits	3.54***	-1.15	4.16***	0.66	-1.12	602	93
	(1.30)	(1.39)	(1.33)	(1.92)	(1.42)		
Late Toxicosis	-1.31	-2.93*	-5.76**	-4.72*	-3.10*	602	93
	(1.23)	(1.72)	(2.45)	(2.76)	(1.74)		
Complicated Deliveries by cause							
Urinary-Genital System	-2.98	0.59	-1.30	1.78	0.65	602	93
	(3.58)	(2.49)	(2.08)	(4.33)	(2.62)		
Anemia	-5.15*	-3.14	-12.25***	-7.53	-3.41	602	93
	(2.77)	(3.64)	(4.24)	(5.14)	(3.68)		
Blood Circulation	-0.96	-1.56	-6.55***	-5.93**	-1.78	602	93
	(0.80)	(1.35)	(2.48)	(2.60)	(1.34)		
Veins	-0.52**	-0.36	-0.89	-0.39	-0.37	602	93
	(0.26)	(0.48)	(1.25)	(1.28)	(0.48)		
Thyroid Gland	-0.36	0.10	-1.90	-1.63	0.04	602	93
	(1.33)	(2.06)	(2.81)	(3.14)	(2.08)		
Problematic Deliveries	0.75	2.19	6.59***	6.19**	2.41	602	93
	(1.40)	(2.07)	(1.95)	(2.43)	(2.09)		
Abnormal Deliveries	1.64	1.35	-0.70	-2.49	1.26	595	92
	(1.01)	(1.71)	(1.17)	(1.58)	(1.74)		
Family Planning Indicators per 1,000 Women of Fertile Age							
Abortions	4.87***	-3.23*	1.56	-3.51*	-3.35*	571	92
	(1.34)	(1.81)	(1.24)	(1.88)	(1.84)		
Use of Contrac. Pills	32.35*	-33.76	-12.98	-48.07*	-35.48	580	93
	(17.58)	(21.33)	(16.18)	(24.57)	(21.76)		

See Notes to Table 4

Table 14: Estimated Impact of the MIHP on Infant Health Outcomes: Metropolitan Areas

	MIHP	Other Programs	MIHP	MIHP Effect	Other Programs	N	Rayons
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Infant Mortality Total	-2.68**	-1.77	-5.92***	-3.44**	-1.90	602	93
	(1.18)	(1.58)	(0.65)	(1.41)	(1.61)		
Stillbirths	-0.75	-0.46	3.81**	4.83**	-0.29	602	93
	(0.76)	(0.78)	(1.70)	(1.87)	(0.78)		
Perinatal	-0.56	-2.68**	1.51	2.19	-2.60*	602	93
	(1.01)	(1.31)	(2.22)	(2.46)	(1.33)		
Early Neonatal	0.13	-1.81*	-2.33**	-2.61**	-1.91**	602	93
	(0.65)	(0.96)	(1.00)	(1.21)	(0.97)		
Late Neonatal	-0.51	-0.96*	-0.79*	-0.29	-0.97*	602	93
	(0.38)	(0.56)	(0.44)	(0.59)	(0.57)		
Postneonatal	-0.43	-0.58	-2.81**	-2.52*	-0.67	601	93
	(0.76)	(0.82)	(1.18)	(1.43)	(0.84)		
Mortality by cause							
Infection	-0.89	0.48	-2.35	-1.55	0.43	602	93
	(2.66)	(2.75)	(3.95)	(4.85)	(2.82)		
Nervous system	0.02	0.62	-1.51*	-1.62	0.56	602	93
	(1.54)	(2.92)	(0.78)	(1.81)	(2.94)		
Respiratory system	-1.36	-0.20	2.35	3.93	-0.06	602	93
	(2.35)	(2.25)	(2.80)	(3.75)	(2.31)		
Congenital Anomalies	1.05	-4.75	-54.51***	-58.86***	-6.85	602	93
	(5.93)	(6.09)	(8.12)	(9.95)	(5.92)		
Perinatal Deviations	-9.08	-15.55	-21.22**	-12.86	-16.01	602	93
	(5.91)	(9.81)	(9.22)	(11.13)	(9.89)		
Infant Morbidity Total	-11.32*	8.09	7.35	19.78	8.80	602	93
	(5.89)	(11.76)	(18.89)	(19.84)	(11.89)		
Morbidity by cause							
Infection	-0.22	0.61	-3.13	-3.08	0.50	602	93
	(0.46)	(0.74)	(2.15)	(2.20)	(0.74)		
Nervous system	1.61	-4.88	-11.71***	-14.11***	-5.38	602	93
	(1.70)	(3.76)	(3.75)	(4.12)	(3.75)		
Respiratory system	-3.46	-7.04	20.54	25.43*	-6.13	602	93
	(3.97)	(9.65)	(13.77)	(14.33)	(9.65)		
Congenital Anomalies	-0.01	0.01	-0.22***	-0.22**	0.00	602	93
	(0.05)	(0.11)	(0.07)	(0.09)	(0.11)		
Perinatal Deviations	-0.52*	0.77	0.27	0.84**	0.80*	602	93
	(0.29)	(0.47)	(0.21)	(0.37)	(0.48)		

See Notes to Table 4

Table 15: Estimated Impact of the MIHP on Maternal Health Outcomes: Time Dimension, Metropolitan Areas

	Before			After			MIHP	Other
	3 years	2 years	1 year	1st year	2nd year	3d year	oblast	Programs
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Maternal Mortality	-1.20	6.52	6.09	-14.74	-23.68	-16.28	-18.86	-2.19
	(15.78)	(15.04)	(17.20)	(24.08)	(29.42)	(31.55)	(23.94)	(15.99)
Normal Deliveries	2.28	3.01	6.96***	44.65***	46.19***	39.75***	35.18***	1.31
	(2.84)	(2.67)	(2.44)	(3.78)	(5.24)	(5.56)	(3.99)	(3.72)
Deliveries/1,000 Population	0.20	0.48	0.28	2.72**	3.33**	4.17***	2.35**	-0.06
	(0.59)	(0.57)	(0.58)	(1.12)	(1.43)	(1.52)	(1.12)	(0.83)
C-sections	0.59	0.89	-0.95	-12.53***	-14.09***	-13.74***	-11.89***	-0.21
	(1.04)	(0.99)	(0.88)	(2.68)	(3.06)	(3.16)	(2.74)	(1.10)
Early Neonatal Visits	0.01	0.48	0.73	4.43**	3.51	0.89	-0.41	-1.08
	(1.29)	(1.54)	(1.33)	(1.97)	(2.90)	(3.48)	(2.66)	(1.46)
Late Toxicosis	-1.33	-1.83	-3.11	-9.45***	-10.22**	-9.83**	-7.23**	-3.00*
	(1.92)	(2.03)	(1.95)	(3.55)	(4.02)	(4.39)	(2.92)	(1.71)
Complicated Deliveries by cause								
Urinary-Genital System	3.98	2.27	1.04	-0.38	-1.34	-2.18	0.27	0.54
	(4.17)	(2.46)	(2.48)	(3.81)	(5.95)	(10.01)	(3.36)	(2.67)
Anemia	-1.95	-2.90	-3.70	-16.58**	-18.35**	-16.63*	-10.37	-3.30
	(3.89)	(4.28)	(4.19)	(6.79)	(8.30)	(9.57)	(6.56)	(3.60)
Blood Circulation	0.20	1.45	-0.90	-7.69***	-8.75***	-8.15**	-7.67***	-1.80
	(1.49)	(1.44)	(1.19)	(2.83)	(3.01)	(3.32)	(2.55)	(1.34)
Veins	0.31	0.40	-0.21	-1.35	-2.28	-2.66*	-1.54	-0.37
	(0.48)	(0.40)	(0.44)	(1.32)	(1.42)	(1.36)	(1.24)	(0.47)
Thyroid Gland	-0.93	-0.38	0.52	-1.38	-4.13	-1.90	-1.89	0.01
	(2.08)	(2.11)	(2.18)	(3.70)	(3.95)	(4.85)	(2.81)	(2.14)
Problematic Deliveries (1)	0.25	-5.47*	-3.40	2.52	3.42	1.92	4.33	2.60
	(3.07)	(2.79)	(2.57)	(3.34)	(3.99)	(4.23)	(3.02)	(2.13)
Abnormal Deliveries (2)	0.03	-0.36	0.06	-0.21	0.45	2.35	-1.18	1.22
	(1.44)	(1.60)	(1.72)	(2.45)	(3.06)	(3.31)	(2.43)	(1.73)
Family Planning Indicators per 1,000 Women of Fertile Age								
Abortions	1.14	2.04	2.48	5.10*	7.37**	8.94**	0.21	-3.48**
	(1.88)	(2.22)	(2.03)	(2.66)	(3.33)	(3.93)	(1.79)	(1.69)
Use of Contrac. Pills	7.15	34.65*	18.00	17.84	39.45	76.75	-11.61	-37.35*
	(21.35)	(17.96)	(15.70)	(26.44)	(34.15)	(52.02)	(16.22)	(19.19)

See Notes to Table 4

Table 16: Estimated Impact of the MIHP on Infant Health Outcomes: Time Dimension, Metropolitan Areas

	Before			After			MIHP	Other
	3 years	2 years	1 year	1st year	2nd year	3d year	oblast	Programs
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Infant total	1.56	-1.11	-1.43	-7.64***	-10.30***	-7.92***	-5.81***	-1.94
	(1.14)	(1.20)	(1.53)	(1.96)	(2.46)	(2.98)	(2.00)	(1.57)
Stillbirths	-0.11	-0.14	0.01	3.98*	4.37*	4.93*	5.38**	-0.30
	(1.03)	(1.07)	(1.08)	(2.29)	(2.65)	(2.89)	(2.24)	(0.77)
Perinatal	-0.41	-1.79*	-1.06	0.40	-0.24	1.22	1.85	-2.58**
	(0.93)	(0.97)	(1.20)	(2.98)	(3.73)	(3.89)	(3.04)	(1.26)
Early Neonatal	-0.48	-1.78**	-1.22	-3.76**	-4.77**	-3.78*	-3.52**	-1.87**
	(0.69)	(0.71)	(0.79)	(1.58)	(1.98)	(2.17)	(1.54)	(0.95)
Late Neonatal	-0.11	-0.05	-0.52	-1.48*	-2.01**	-2.03*	-1.11	-0.96*
	(0.58)	(0.56)	(0.55)	(0.77)	(0.98)	(1.11)	(0.72)	(0.57)
Postneonatal	2.37**	0.80	-0.39	-3.17*	-3.45*	-2.63	-3.53**	-0.74
	(0.94)	(0.91)	(1.20)	(1.75)	(2.00)	(2.17)	(1.74)	(0.83)
Mortality by cause								
Infection	5.12*	1.19	-2.47	-5.65	-8.60	-8.12	-7.21	0.35
	(2.71)	(2.90)	(3.31)	(5.57)	(7.29)	(8.07)	(6.78)	(2.79)
Nervous system	1.65	3.36*	0.79	-0.07	0.67	3.05	-0.68	0.39
	(1.42)	(1.81)	(1.91)	(2.46)	(3.79)	(4.43)	(3.19)	(2.73)
Respiratory system	-2.09	-2.60	-4.53	-2.73	-4.94	-1.55	0.62	0.02
	(3.61)	(3.69)	(3.78)	(5.02)	(5.80)	(7.42)	(3.80)	(2.20)
Congenital Anomalies	6.80	-1.44	-1.94	-56.61***	-61.90***	-55.65***	-63.23***	-7.06
	(8.04)	(6.90)	(6.56)	(11.79)	(14.00)	(16.75)	(12.11)	(5.82)
Perinatal Deviations	-2.67	-9.30	-9.43	-31.72**	-42.39**	-28.75	-20.92	-15.96*
	(7.87)	(6.79)	(7.78)	(14.28)	(19.12)	(19.94)	(15.03)	(9.13)
Morbidity Total	2.53	-3.57	-3.50	1.11	-5.64	-11.80	9.78	9.05
	(8.34)	(8.82)	(7.38)	(21.90)	(22.62)	(23.85)	(20.25)	(12.28)
Morbidity by cause								
Infection	0.88	0.13	1.01	-2.15	-3.37	-3.30	-3.21	0.47
	(0.78)	(0.75)	(0.71)	(2.62)	(2.91)	(3.12)	(2.65)	(0.70)
Nervous system	3.60	4.21	1.21	-9.77**	-11.95**	-6.63	-14.35***	-5.68
	(2.31)	(2.95)	(2.59)	(3.84)	(4.69)	(4.53)	(3.26)	(3.74)
Respiratory system	-2.96	-1.95	-0.73	16.41	14.45	-3.23	17.86	-5.58
	(5.62)	(6.81)	(6.80)	(15.38)	(16.15)	(21.37)	(13.76)	(8.03)
Congenital Anomalies	0.15*	0.20**	0.14	-0.07	-0.13	-0.18	-0.23	-0.01
	(0.09)	(0.08)	(0.14)	(0.17)	(0.19)	(0.21)	(0.15)	(0.10)
Perinatal Deviations	-0.01	-0.46	-0.53	-0.35	-0.19	-0.36	0.50	0.82*
	(0.37)	(0.37)	(0.38)	(0.48)	(0.63)	(0.71)	(0.42)	(0.48)

See Notes to Table 4

Table 17: Estimated Impact of the MIHP on Placebo Outcomes: Metropolitan Areas

	DD			Summary Statistics					
	MIHP	MIHP	Other	2000		2006			
	rayon	oblast	Programs	MIHP	Non-MIHP	MIHP	Non-MIHP	N	Rayons
	(1)	(3)	(5)						
Tuberculosis Morbidity	-3.20	-1.14	6.41	59.11	60.73	78.36	81.40	602	93
	(2.22)	(4.81)	(4.67)	(12.49)	(19.39)	(23.83)	(28.54)		
Diabetis Morbidity	-4.19	5.30	9.75	108.47	121.17	200.78	215.62	481	88
	(7.53)	(5.72)	(12.01)	(31.64)	(60.88)	(36.53)	(65.90)		
Hepatitis	19.80	-17.47	-15.05	85.72	60.14	36.07	26.14	257	49
	(30.82)	(14.86)	(23.11)	(69.04)	(80.35)	(31.91)	(35.39)		
Hypertension	0.08	0.24**	0.11	2.35	2.68	2.39	2.41	476	88
	(0.19)	(0.12)	(0.30)	(1.28)	(1.79)	(1.02)	(1.04)		
Teenage Morbidity	0.18*	0.17	0.04	0.94	0.85	0.92	0.95	594	93
	(0.09)	(0.12)	(0.07)	(0.44)	(0.28)	(0.25)	(0.35)		

See Notes to Table 4

Table 18: Triple Difference Estimates of the MIHP Impact on Placebo Outcomes: Metropolitan Areas

	DDD				
	MIHP rayon	MIHP oblast	Other Programs	N	Rayons
	(4)	(5)	(6)		
Tuberculosis Morbidity	-0.98	-0.51	3.62	561	92
	(0.93)	(0.96)	(4.02)		
Diabetis Morbidity	0.30	1.12	-8.53	561	92
	(1.67)	(1.96)	(16.75)		
Hepatitis	1.75	2.84	-15.46	322	53
	(3.28)	(2.61)	(14.20)		
Hypertension	-0.11**	0.04	-0.12	561	92
	(0.05)	(0.03)	(0.29)		

See Notes to Table 4

A Description of the Cost Impact Study implemented by the MIHP (Lefevre-Cholay et al., 2006)

The Cost Impact Study (CIS) was designed to evaluate the financial impact of the MIHP interventions in the Project pilot maternities and to provide health facilities and policy makers with information for replication of MIHP practices.

The Project management team has selected three MIHP facilities: Lutsk, Kovel, and Donetsk No.3. There were two criteria for selection. First, the annual number of deliveries is to exceed 1,000 cases. Second, the maternities are to be involved with the project since 2003.

For the purpose of CIS, the project management team has collected the data using the following tools: the Patient Record Review Form, the Prices and Supply Costs Form, and the Interview Guide.

The Patient Record Review Form was randomly offered to patients who gave birth in the target facilities. A total of 200 records were reviewed in each facility - 100 from 2002 and other 100 selected in 2005. The Form covered topics such as admission and discharge time, type of delivery, types of lab tests performed and medicines used, as well as other information helpful for comparing delivery-related practices before and after MIHP interventions.

The Prices and Supply Costs Form was aimed at quantifying the resources used for MIHP practices, which were revealed via the Patient Record Review Form. The types of resources included drugs, injection supplies, lab tests and diagnostic procedures, and infant formula. Initially, the study design involved collecting prices of each resource from the facility pharmacies and local pharmacies, and calculating an average price. However, this data was extremely sensitive to local market imbalances. Thus, eventually it was de-

cided to use the "standard prices" based on the lowest wholesale offers found in the national electronic trading system (www.apteka.com.ua). Unit prices were collected solely from 2005. This allows the analysis to isolate the changes in costs due to changes in practices and resources used as opposed to changes in prices.

The Interview of the facility staff was conducted to corroborate the use of practices, drugs and supplies listed in the Patient Record Review Forms. It was also aimed to reveal under-reporting, over-reporting, miss-reporting, and unexpected practices that arose during the record review process. A total of 3 senior obstetrics-gynecologists, 3 midwives, and 3 neonatologists at the three MIHP pilot facilities were interviewed.