

Do health programs improve health outcomes? A dive into Tanzania's 2007-2017 primary health care initiative

John Geoffrey Massito^{1*}
Khalid Twaha Shekimweli²

^{1*}john.massito@udom.ac.tz
²ktwaha@yahoo.com

¹The University of Dodoma, ²National bureau of statistics, ^{1,2}Tanzania

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ABSTRACT

The complexity of the health sector in Tanzania, characterized by underfunding and human resource shortages, necessitated the establishment of several health programs. One of the crucial programs established was the Primary Health Services Development Program (PHSDP) (2007-2017), which aimed to strengthen the accessibility of primary health services in all Tanzanian regions at the district level. Although any intervention could lead to better outcomes for the program, studies quantify its impact inadequately, and some yield inconclusive or conflicting results regarding how the programs influence the outcome variable. Employing Tanzania National Panel Surveys (wave 1 and 3) in the analysis, this study investigates the impact of the Primary Health Services Development Program (PHSDP) on maternal and child health using the Difference-in-Difference method. Results indicated that the program's implementation increased the likelihood of pregnant women delivering their children in a health facility and being attended by skilled personnel during giving birth by 43% and 53%, respectively, compared to when the program was not implemented. Moreover, using a bed net during pregnancy and after birth increases the probability of a child's health improvement by 82%. The study also finds that it takes time for the impact of the program to be realized because, at the initial stage of the program's implementation, people hesitate to attend health facilities due to misinformation in the health market and cultural beliefs about the new health information. The study recommends that it is essential to analyze the quality of care in these facilities and whether the increase is uniformly distributed across different regions and socio-economic groups. Moreover, there is a need for sustained efforts in training healthcare workers and increasing community awareness about the benefits of skilled birth attendance.

Keywords: Child Health, Impact Assessment, Maternal Health, Primary Health Services Development Program

I. INTRODUCTION

Improving maternal and child health (MCH) is a priority for global health, particularly in low- and middle-income countries where healthcare systems often struggle to provide adequate services. In sub-Saharan Africa, including Tanzania, high rates of maternal and child mortality indicate a pressing need for effective health interventions. The Government of Tanzania has made a long-term promise to provide fair, equal, and high-quality health care to protect the people's social and economic well-being (United Nations Children's Fund & World Health Organization, [UNICEF & WHO], 2020). However, according to the Ministry of Health Community

Development, Gender, Elderly, and Children (MoHCDEGEC), the health-skilled personnel requirement is high, with 46,868 qualified health professionals needed in public health facilities. The ones available are only 15,060, equivalent to 32.1 percent. This shortfall is a result of low levels of outputs from medical schools at 23,536 for all cadres, being those from certificate to postgraduate level intending to bridge the human resource gap. The existence of insufficient care creates high levels of mortality rates for both infants and females. According to the Ministry of Health, there exist high and inconsistent mortality rates between 1996, 2005, 2010, and 2015, standing at 529, 578, 454, and 556 per 100,000 live births, respectively (MoHCDEC, 2017). During the adoption of Millennium Development Goals (MDGs), the global health sector improved in terms of a decrease in maternal and infant mortality rates, where an estimated 289,000 women died during 2013, a 45% decline from 1990, as well as a decline in infant mortality from 12.7 million deaths in 1990 to 6.3 million deaths in 2013. This was considered central to the reduction of poverty globally and in Tanzania in particular, whereas stirring the Government of Tanzania (GoT) to incorporate maternal and child health issues extensively as a major component in the reduction of poverty in the National Strategy for Growth and Reduction of Poverty (NSGRP) of 2005-2010.

Achieving zero preventable maternal deaths is one of the goals Tanzania recommitted to for ICPD at the end of 2019. Various programmes were implemented in Tanzania as an effort of the government to improve the health status. The programmes include the Maternal and Child Survival Program (MCSP) and the Advanced Family Planning (AFP), both targeting ensuring quality reproductive, maternal, newborn, and child health services are effectively utilised and

accessed across all parts of the country. Such programmes had a significant role to play, including the reduction of government and individual expenditures to be allocated for the treatment of diseases, especially child health curatives, but were also linked to the reduction of the maternal mortality rate (MMR) from 578 per 100,000 in 2007 to 432 per 100,000 in 2014 (MoHCDEC, 2017). Recognising these challenges, the Tanzanian government launched the Primary Health Service Development Program (PHSDP), also known as Mpango wa Maendeleo wa Afya ya Msingi (MMAM), in 2007. The programme aimed to strengthen the primary healthcare system over a decade (2007-2017) to significantly improve health outcomes for mothers and children.

The program is also intended to ensure that pregnant women have access to skilled attendance at childbirth and availability of emergency treatment care in the event of unforeseen complications; there is a provision of a solution to the shortage of human resources in the health sector, most especially in the public health facilities. In addition, the program aimed at battling the levels of maternal mortality rate, which by then stood at 578 deaths per 100,000 live births (MoHCDEC, 2017). Finally, the program aimed also at scaling up the prevention of mother-to-child health services in regional districts, health centres, and dispensaries (TDHS, 2015/16). However, like any other program implemented in Tanzania whose primary objectives were focused on reducing deaths for both mothers and children, the PHSDP was implemented along pre-existing challenges, including insufficient funding of the sector, human resource shortages, and slow-paced or stagnant construction of health facilities, which could affect the effectiveness of such programs.

Despite the remarkable improvements in the reduction of death rates in younger age groups, in which infant mortality rate fell from 99 to 51 per 1,000 live births between 1999 and 2010, and under-5 mortality declined from 147 to 81 per 1,000 live births within the same year, the situation remains unsatisfactory where deaths of both mothers and children are relatively high, with maternal death at 454 per 100,000 live births and 51 per 1,000 live births, respectively, in 2010 (TDHS, 2015/16). The situation remains stubbornly high, with maternal death standing at around 321 per 100,000 and infant mortality at 36 per 1,000 live births in 2019 (TDHS, 2015/16). Moreover, considering the clustering of infancy, childhood, and up to five mortalities by gender conclusively delineated that male children experience higher mortality as compared to females. The male children's infant mortality rate stood at 51 deaths per 1,000 live births, while that of female children was 41 deaths per 1,000 live births. Such variations also exist in the urban-rural categorisation of infant mortality. As of 2018, the infant mortality rate for urban Tanzania was estimated at 48.5 deaths per 1,000 live births, and rural Tanzania was 46.0 deaths per 1,000 live births. The low number of deaths in the rural areas might have resulted from the poor records taken in the cause of the particular areas because of the giving birth at-home practice.

The situation originated from the government's inadequate provision of inputs in the health sector, mainly in terms of resources for infrastructure establishments and improvement, human resources capacitation, and health centre equipment. With such incapacity, the sector's performance remained less proactive as well, bringing about complexity in the health sector, which spooked the establishment of several programmes, including the Primary Health Services Development Program 2007-2017 (MoHCDEC, 2017).

1.1 Statement of the Problem

The existence of insufficient care creates high levels of mortality rates for both infants and females (Amponsah et al., 2020). According to the Ministry of health, the female mortality rates for the years 1996, 2005, 2010 and 2015 were 529, 578, 454 and 556 respectively per live births (TDHS, 2010). The implementation of the program brought significant change in maternal mortality especially in the years coming to the closure of the program. Meanwhile, from the (TDHS, 2015/16) infant mortality rates exemplified the downward trend accounting for the years 1999, 2010, 2012 and 2015 being at 99, 51, 46.2 and 43 deaths per 1000 live births. Despite the remarkable improvements over the years in infant care, the health provision is unsatisfactory standing at 43 deaths per 1000 live births.

Previous studies such as (Frankenberg, 2009; Onwujekwe 2019; Zhou 2020; Belo et al. 2017; Sharma 2016; Tanner et al. 2015; Mohanan 2016; Goyet et al. 2019; Gitobu et al. 2018; Shankar 2017) provide insights on the knowledge on the significance of various programs or projects implemented in various areas just like the current study. The studies also clearly delineate the existing relationships among various variables such as (clinical attendance, knowledge of nutrition affairs, socio-economic outcomes as well as the cost of delivery to mention a few) and how they are interlinked in improving maternal and child health. At this particular juncture, the study finds vivid underlying empirical proof that there exists a correlation with the improvement of maternal and child health. In light of that, this study ventures to take into account a component of advocacy projects such as advocating for the use of mosquito nets on mothers mostly given at clinics, and how that significance could be a crucial aspect/component in improving the health sector and more specifically maternal and child health. Contrary to the empirical literature, this study examined the impact of the PHSDP program on maternal and child health in Tanzania. The study used the two NPS waves that is wave 1 and 2 and with an employment of the DID method of estimation, the association between the existence of a place of delivery, skilled birth attendants, and mother-to-child advocacy projects on the improvement of maternal and child health in Tanzania was ascertained.

1.3 Research objective

- i. To determine the effect of the PHSDP program on maternal health through the place of delivery.
- ii. To determine the effect of the PHSDP program on maternal health proxied by skilled birth attendance.
- iii. To determine the effect of the PHSDP program on child health through the mothers' utilization of bed nets.

II. LITERATURE REVIEW

2.1 Theoretical Review

2.1.1 Grossman Model

The Grossman model of demand for health is a guiding model for this study. The model being one of the most highly regarded models in the modeling of health care consumption serves as exemplary in empirical studies that focus on determining how best variables influence outcomes. The healthcare consumption models investment as human capital, with the initial ideals of Grossman that individuals make several investments in themselves with the inclusion of education, training, and health being a productive good this implies that health stock results in healthier days (Mohan, 2016). The model stretches further beyond the traditional demand analysis by buying in the idea of including an individual as a producer of health rather than just a normal consumer and this is done through artificial separation of consumption and production, (Grossman, 1972).

The model also argued in Grossman (1999) that an individual's stock of knowledge normally affects the market and non-market productivity but yet still affects the determinants of health as a total amount of time that would be spent in the creation of wealth. Argued further into exemplifying health as a choice variable because it is a source of utility (satisfaction) and it determines income as well as wealth levels. Moreover, the model premised that an individual's happiness is similar to being healthy, implying that the health-happiness relationship is a function of health stock that is fundamentally built on a given period by an individual with corresponding necessary investments.

In terms of accessibility to Medicare services, the Model argued that most health-influencing behaviours such as obtaining Medicare are valued for their effect on Health rather than in and of themselves. And that the demand for Medicare and other behaviours affecting Health typically derived from the demand for Health (Frew, 2013). The model is based on several assumptions, but the study operates on the grounds of a single assumption that individuals have a high degree of control over their Health and this is because they tend to influence Health- affecting consumption patterns, healthcare utilization, and the use of environment. According to Lalazaryan and Farashband (2014), paper the inter-temporal utility function model is presented as follows: -

$$U = U[\Phi_t H_t Z_t], \quad t = 0, 1, \dots, n$$

Where: - Φ_t is the service flow per unit stock, H_t is the health stock at age "t", Z_t is the consumption of another commodity, and $h_t = \Phi_t H_t$ represents the total consumption of Health Services. This implies that the Net Investment in the stock of health was equal to the Gross investment minus the depreciation on the health stock i.e. $H_{t+1} - H_t = I_t - \delta_t H_t$ with the rate of depreciation being exogenous (Lalazaryan & Farashband, 2014). The investment model treats health as a durable capital stock and that with any increase in inputs such as health facilities, it is more likely the individual's utilization of Medicare will rise and thus result in healthy days. Investment in health has great probable payback in the future as compared to the costs that were to be endured in terms of time and wage loss.

The implications of the theory to this study is that; as a result of the direct relationship between investment done by an individual (health expenditure among women), utilization of Medicare, and investment on durable capital being health facilities stipulated by the theory we should expect to observe a greater effect on the utilization of the health care and improvement of the health status of the individual considering that the primary goal of the PHSDP program was establishment of health facilities across the country. The implications of this study have been examined by computing the effect of the PHSDP program through health facilities coverage, utilization of formal health services (Skilled birth attendance), and mother-to-child advocacy on utilization of bed nets as a proxy measure of child health and how they are correlated to the health expenditure among women.

2.2 Empirical Review

Health improvement through the implementation of interventions is complex especially on the health outcomes in the developing world despite the rise in the quality and availability, with strategies mainly focusing on improving traditional means of birth and expansion of reproductive health care services (Frankenberg, 2009).

Shankar (2017) conducted a study on the mobile health (m-health) application on improving the utilization of maternal, newborn and child health care services in the rural area of Uttar Pradesh in India. The study employed a DID estimation method to determine the effect of the intervention from the Propensity score-matched samples from the intervention and control areas in the pre and post-intervention periods. The results revealed that the coverage of iron-folic acid supplementation and three or more antenatal care visits and ambulance use-age increase in intervention areas by 10.3% and 2.06% respectively. Moreover, the resemblance in the intent and methodology of Shankar's study with the current research remains as assessing the effect of a given program on maternal and child health as well as the use

of DID method of effect estimation. But differ in the components used in the assessment of maternal and child health where the current study employed health facilities available for delivery, skilled personnel and bed net utilization respectively.

An evaluation study on maternal and neonatal child health implemented in a rural province in Zimbabwe was conducted in 2017 by Kureya (2017). The study employed a community care group approach; a concurrent multi-method research design through a cross-sectional survey, record reviews and key informant interviews. Whereby, 86% recalled having Malaria chemoprophylaxis and 85% had full-filled four antenatal visits. The study suggests that such programs in rural areas increase knowledge and utilization of health resources (Kureya, 2017). Maternal and neonatal child health assessment strikes the resemblance of the study with the current study, yet there exists a non-concurring aspect in the difference of data source. The previous employed both primary and secondary data while the latter study employed secondary but specifically panel data thus lacking enough qualitative statements from key informants.

Gitobu et al. (2018) conducted a study to determine the effect of Kenya's free maternal health care policy on the utilization of health facility delivery services and maternal and neonatal mortality in the national wide public health facilities. The study employed a time-series analysis on maternal and neonatal mortality as well as health facility delivery services utilization for two years before and after the policy intervention in 14 counties across 77 health facilities. The implementation of the policy intervention had divisive results where firstly, there was a significant increase in the number of health facility deliveries with a 29.5 percent increase but no significant change in both the ratio of maternal and neonatal mortality. These results conclusively indicated that cost is a determinant to the utilization of health facilities for delivery in Kenya, this implies that there remains a need to promote free delivery services.

Goyet et al. (2019) undertook a study on the quality improvement in maternal and newborn healthcare from the lessons obtained from programmes supported by the German Development Organization in Africa and Asia. The assessment describes that attainment of the Sustainable Development Goals and Universal Health coverage is clocked upon ensuring the mandatory improvement of maternal and child health care. The study further endeavor in the extensive and vigorous literature review of documents obtained from the implementing countries which included country health sector reports as well as project implementation reports. Results obtained from the study revealed that the Gesellschaft Fur International Zusammenarbeit (GIZ) multilevel approach being combined with good partner's coordination techniques could result in institutionalization of the quality improvement activities and also lead to sustainable results due to the proposed integrative techniques between the systems components and the performance of health systems.

An assessment of the uptake of lifesaving services in Hoima District in Uganda was conducted by Babughirana et al., (2020). The study was bodied on a perspective that accounted for the current situation of the country where: the Maternal mortality ratio was 336 maternal deaths per 100,000 live births and infant mortality at 43 per 1000 live births but also because about 42 percent of those deaths occurred during the neonatal period. The assessment employed the use of a cross-sectional quantitative design of six hundred and ninety-one women that had children with age below five years. The particular study revealed that, out of 55.1 percent of the women that attended at least four antenatal care visits only 23.4 percent had attended and antenatal care in their first trimester. This also consequently reveals that only 0.4 percent of the antenatal care services met the required standards of quality of antenatal care services. Finally, only 11.1 percent of the males participated in all maternal and newborn care requirements and that 39.9 percent of the male accompanied their women to seek healthcare.

Mohanan (2016) conducted an impact evaluation study on the Chiranjeevi Yohana (CY) program on the institutional delivery rates, cost of delivery and other socio-economic outcomes on the rural areas of Gujarat. The study employed a DID analysis on the retrospective births histories and outcomes from both households in the Gujarat districts and the combination with the rollout dates of the CY program among districts. The results revealed that the CY program was not associated with the changes in the probability of institutional delivery, obstetric complications or reductions in the households out of pocket expenditures for deliveries. Mohanan's study concurs with the study under review in terms of components of assessment including institutional delivery as well as the use of DID method of analysis on impact estimation. The results of the assessment of the CY program reveal quite a different tale on the association of the program and the probability of change in the institutional delivery.

Tanner et al. (2015) conducted a study on improving coverage and utilization of maternal and child health services in Lao PDR. The study was an evaluation of the Community Nutrition Project and how to interlink it with the improvement of the mothers and children under two years old: antenatal care visits and institutional delivery. The results revealed that although the general effects of the said outcomes are mixed, the project showed improvements for the poorest 40 percent of the population. The study concurs with the current in evaluating the impact of the projects among others is the institutional delivery and its link to maternal and child health improvement but unlike the study under review where results indicate a significant association results from the Tanner study can only be contemplated at poorest 40 only.

Nababan et al. (2017) conducted a study on improving maternal, newborn and child health status of both Urban and Peri-urban Areas in the Gazipur district of Bangladesh in Bangladesh. The study employed a population-based

survey, health facility assessment as well as key informant interviews. The result revealed that facility delivery increased to 65 percent and skilled attendants at birth increased 63 percent while all other objectives such as an increase in knowledge, services uptake and improvement of referral mechanisms were achieved. Concurring with the study under review, health facility assessment en-tell the increase in the deliveries in institutions with a consequent increase in the skilled attendants. Despite the aligning aspects, the study induced components of knowledge measurements, services uptake and referral mechanisms which with the current study data set proves highly unlikely to comprehend.

Sharma (2016) in measuring what works: an impact evaluation of women's groups on maternal health uptake in rural Nepal. The study evaluated maternal health in a low-income country where; a five-year controlled, non-randomised, repeated cross-sectional study of a certain particular community-based maternal health promotion intervention that focused on improving maternal health uptake in women's groups. A DID estimation was undertaken to assess the effect of the intervention on outcome variables where the intervention had a significant association in increasing the likelihood of attending antenatal care at least once during pregnancy and three times increase in the intake of folic acid and iron. Regardless of the improvements but the intervention had no improvement in birthing at an institution or with a skilled birth attendant. Common ground for both studies resides on the intent and the employment of a similar method of impact estimation but despite the mutual aspects results revelation from the Sharma study pronounce a different story in terms of institutional deliveries and skilled birth attendant association to the program.

Belo et al., (2017) steered a study on Maternal and Newborn mortality as it pertains to the community's opinions on why pregnant women and newborns are dying in Naticiri, Mozambique. Insufficient numbers of qualified health professionals, equipment and difficulties in accessing healthcare are just a few challenges that could potentially lead to huge numbers in both maternal and neonatal mortality in the nation. The study was a baseline for an implementation research project that was aimed at reducing maternal and neonatal mortality in Naticiri, Nampula, Mozambique. The study employed a descriptive mixed study where analysis was done on both primary and secondary data collected. The results indicated that common reasons were identified as causative of high numbers of maternal mortality rate and neonatal mortality such as poor treatment received at health centres; long walking distances; negligence of health professionals; teenage pregnancies; giving birth at home; and limited knowledge at the community level on women and girls health.

Zhou (2020) commissioned a study on the effect of conditional cash transfer programs on maternal and child services and outcome uptake in the rural areas of western China. The study employed a Difference in Difference method of estimation on the 1522 household survey. The results revealed, a positive but rough small effect was noticeable in the uptake of the maternal and child health services but not the case for child health outcomes. The methodological approach in the study conforms to the present but diverge in variables used in defining the measures of maternal and child health outcomes.

Kruk (2016) conducted an evaluation study of a maternal health program in Uganda and Zambia that led to the obtaining of mixed results on the quality of care and satisfaction. The multi-donor program had been designed to reduce the maternal mortality rate in both Uganda and Zambia. The conducted study used a quasi-random research design in evaluating the effects on the provision of obstetric knowledge, clinical confidence, job satisfaction and perceived quality. Provider's knowledge, clinical confidence and satisfaction were significantly higher in intervention districts than in comparison for both Uganda and Zambia. However, patients in Uganda intervention facilities had a higher probability of ranking higher rates for equipment's availability, communication skills, care quality and provider's knowledge as compared to patients in comparison facilities. Unlike in Zambia where differences were fewer in both intervention and comparison facilities.

The Onwujekwe (2019) assessment study of a free maternal and child health program and the prospects for program re-activation as well as scale-up by the use of a new health fund in Nigeria. 12 states in Nigeria implemented a program that necessitated the need for identification of the enabling and constraining factors to program implementation and the opportunities for the adaptation and program scale-up. The study involved a review of various relevant literature and in-depth interviews with key informants. Generally, the assessment was constituted in themes derived from the conceptual framework of the study. The post outcome of the program was defined as pro-poor, efficient and effective which resulted in several improvements including function ability of health facilities, availability of services and the reduction of out-of-pocket expenditures. The study concurs with the later study in terms of its assessment of the link between program implementation and its effect on the health facilities and services available due to the existence of skilled personnel. Despite its credible similarities, there exists a difference in the data/information types used in Onwujekwe's study resulting in a more qualitative with no quantitative data to qualify the study.

III. METHODOLOGY

3.1 Data Types and Sources

The study used the National Panel Survey (NPS) data which is secondary data. The data used in this study is the first (2008) and third (2015) waves obtained from the National Bureau of Statistics. The PHSDP period of implementation ranged from 2007 to 2017 because the first wave was produced in 2008 which reveals that NPS data could not provide prior information before the start of the program. An assumption in the study is that despite the period indicated by the program of 2007 -2017, but the impact of such a program with massive initial investments to be established cannot be measured in 2007 rather in the year 2008. The study uses the first wave (2008) as the base year information and 2015 as the comparison year.

From the waves, the study focused on the information about the place of delivery, the birth by skilled personnel as well as mothers obtaining mosquito bed nets. Despite the relevant information to be collected from any of the existing waves, the two specific waves were chosen not only for compatibility reasons to cover the period under study but also considering the challenges in the accommodation of other waves for instance; wave 4 misses data for the specific variables that were tested in the study.

3.2 Methods

The study employed the Difference-in-difference (DID) method of estimation, which is an impact evaluation of before-after and treatment-control group comparisons widely used in economics, public policy, and other fields. The method is used in a quasi-experimental setting where the DID estimate of a program or policy can then be obtained in its simplest form being equivalent to calculating the after-before difference in outcomes in the treatment group and subtracting from the difference of the after-before difference in the control group. The method is a combination of before-after and treatment-control group comparisons, unlike other methods that allow for a simple comparison of treatment and control groups this particular method aims at estimating the causal effects of a program when treatment assignment is non-random.

The DID method is typically used to estimate the effect of a specific intervention in this particular case the PHSDP program. Normally relies on a less strict exchangeability assumption where in the absence of treatment, the unobserved difference between treatment and control groups is the same over time. The method's pros are that it removes biases in post-intervention period comparisons between treatment and control that could be a result of the permanent difference between those groups. Where also removes the biases from comparisons over time in the treatment group that could be the result of trends due to other causes of the outcome. The key variables in the study are the number of facilities that respond to the accessibility to the health facilities, skilled birth attendance as a response to the utilization of the health care being provided, and the mother's utilization of the bed net as a proxy. The period under study is between 2007 and 2017.

3.3 Empirical model

$$Y_{it} = \beta_0 + \beta_1 * Time + \beta_2 * Intervention + \beta_3 * [Time * Intervention] + \varepsilon_{it} \quad (1)$$

Whereby; Y_{it} represents the Outcome of interest (place of delivery, attendant at birth, and child health), $Time$ shows how the intervention affects individuals at a specified time, $Intervention$ is the immediate effect of PHSDP on maternal and child health outcomes and $Time * Intervention$ is the interaction term represents the actual impact of the intervention on the individual over a certain period.

3.4 The Panel Unit Root Test

Unit root tests are useful econometric tools in the analysis of the time-series behaviour of the panel data. It has been observed that in a panel the main source of the increase in power for testing unit root is the additional variance provided by independent cross-section observations (Panchachan, 2019). The panel unit root test in this study (LM Test) was conducted to determine whether the panels were stationary or not. The LM Test states the Null hypothesis (H_0) in which all panels are stationary whilst the alternative (H_1) states that some panels contain unit roots. The results of the test show that the p-value > 0.05 ; thus we fail to reject the Null hypothesis. The LM test results showing the stationary of the panels are presented in **Appendix 2**.

3.5 Serial Correlation Test

Serial correlation in linear-panel data models biases to the standard errors and thus affects the efficiency of the results deeming it necessary to determine or identify the serial correlation in the idiosyncratic error term in a panel data model. A highly suggested method or test is the Wooldridge test due to its relatively few assumptions and easiness in its implementation. The test uses the residuals from a regression in the first- -difference because the first- difference



normally removes the individual-level effect. The Wooldridge Test is robust to conditional heteroscedasticity. This simulation process is demonstrated from a linear one-way model as follows:

$$Y_{it} = \alpha + x_{it}\beta_1 + z_{it}\beta_2 + \varepsilon_{it} \text{ for all } (i \in 1,2, \dots N) \text{ and } (t \in 1,2, \dots M) \tag{2}$$

Where; Y_{it} is the dependent variable, x_{it} is $(1 \times K_2)$ which is a vector of time-varying covariates, z_i is $(1 \times K_2)$ which is a vector of time-invariant covariates, α , β_1 and β_2 , are parameters and ε_{it} the unobserved factors. After the first difference, the regression can be expressed as follows:

$$\Delta Y_{it} = \Delta x_{it}\beta_1 + \Delta \varepsilon_{it} \tag{3}$$

The serial correlation test was conducted to determine the existence of serial correlation and biases of the idiosyncratic error term in a panel data model. Pearson’s test of cross-sectional independence is a measure of the strength of the association between variables. The results of the test show that the p-value > 0.05; thus we fail to reject the Null hypothesis, implying there is no serial correlation in the panel data. Test results showing serial correlation are presented in **Appendix 3**.

3.6 Variable Description

Table 1 presents the description of each variable as used in the DID estimation models above. Each variable in terms of code used in the models, its description, and expected sign in describing the results of the study.

Table 1
Variables Description, Measurements, and Definitions

Variable Name	Description	Variable Code in the Model	Expected sign
Maternal health	The dummy variable takes the value 1 if the mother's child was delivered in a hospital or clinic and 0 otherwise	Y_{1it}	+
	The dummy variable which takes the value 1 if the skilled personnel is a doctor or nurse and equals 0 midwives, traditional birth attendants, friends, or other	Y_{1it}	+
Child health	The dummy variable which takes value one if a mother had slept under a bed net yesterday	Y_{20-it}	+
Intervention	Control variable for all other factors that can affect both mother and child health	PHSDP	+
Interaction term	The actual impact of the program	Time*PHSDP	+

Maternal health variable captures the conditions surrounding the delivery of a mother's child, specifically whether the child was delivered in a healthcare facility and the type of skilled personnel present during delivery. It is a dummy variable that takes the value 1 if the mother's child was delivered in a hospital or clinic and 0 otherwise. We expect it to have a positive sign (+) indicates that delivering in a hospital or clinic is associated with better maternal health outcomes. On the other hand, it is also a dummy variable that takes the value 1 if the skilled personnel attending the delivery is a doctor or nurse, and 0 if the delivery is attended by midwives, traditional birth attendants, friends, or others. The child Health variable assesses the protective measures taken to safeguard child health, specifically whether a mother slept under a bed net the previous night. This is also a dummy variable that takes the value 1 if a mother had slept under a bed net the previous night and 0 otherwise. The expected positive sign (+) suggests that sleeping under a bed net is associated with better child health outcomes by reducing the risk of vector-borne diseases like malaria. Intervention is a control variable that accounts for all other factors that might influence both maternal and child health. This variable is included to control for potential confounding variables that could affect the outcomes of interest. The interaction term represents the actual impact of the intervention program over time. This variable captures the temporal effect of the intervention on health outcomes for which the program's impact is anticipated to improve maternal and child health outcomes as time progresses.

IV. FINDING & DISCUSSION

4.1 Descriptive Statistics

Table 2 presents descriptive statistics for four variables related to maternal and child health outcomes. These variables include the average age of respondents, the place of delivery, skilled birth attendance, and the use of bed nets for child health. The statistical measures provided are the mean, standard deviation, skewness, kurtosis, minimum, and maximum values for each variable.



Table 2

Descriptive Statistics of the Variables Used

Variable	Mean	Std Dev	Skewness	Kurtosis	Min	Max
The average age of the respondent	27.5	7.09	0.52	2.51	12	49
Place of delivery (1=Public)	0.64	0.48	-0.59	1.35	0	1
Skilled birth (1=Attended by professional)	0.59	0.49	-0.35	1.12	0	1
Child health (1=Use bed net)	0.73	0.44	-1.06	2.12	0	1

Source: Author’s Construction, using NPS 2008/2015

A total of 2,953 women appeared in the two NPS Waves used as a sample of the study. The data indicated that the respondents’ age ranged from 12 to 49 years old with an average age found to be 27 years. This average age reflects a young demographic, which is typical in many developing countries where early childbearing is common. On average, 64% of women had given birth in hospitals and clinics or maternity with an average of 59% of the women being attended by doctors and nurses. This is an important indicator of maternal health service utilization. The mean value of 0.73 indicates that 73% of children use bed nets, which is a positive indicator for malaria prevention. This descriptive analysis provides insights into the demographic characteristics and key health indicators among the respondents. The data show moderate variations in respondent age, a significant proportion of deliveries in public facilities, considerable skilled birth attendance, and high bed net usage among children. The skewness and kurtosis values indicate the shape and distribution characteristics of these variables.

4.2 Regression Results

Table 3 outlines the relationships between several variables and their impacts on three critical maternal and child health outcomes: place of delivery, attendant at birth, and child health. Each variable’s influence is measured through estimates, standard deviations (SD), and p-values (P), offering insights into the significance and strength of these relationships.

Table 3

The Likelihood of PHSDP to Influence Maternal and Child Health Outcomes

	LR Chi2(3) = 411.65			LR Chi2(3) = 411.65			LR Chi2(3) = 411.65		
	Prob>Chi2 = 0.000			Prob>Chi2 = 0.000			Prob>Chi2 = 0.000		
	pseudo R2 = 0.1028			pseudo R2 = 0.1028			pseudo R2 = 0.1028		
	Place of delivery			Attendant at birth			Child health		
Variables	Estimate	SD	P	Estimate	SD	P	Estimate	SD	P
Constant	2.32***	0.198	0.000	1.68***	0.156	0.000	1.784***	0.161	0.000
Time	-0.063	0.246	0.798	0.069	0.197	0.722	0.259	0.209	0.217
PHSDP	-2.77***	0.262	0.000	-2.09***	0.171	0.000	-1.67***	0.176	0.000
Time*PHSDP	0.533**	0.198	0.042	0.432**	0.217	0.046	0.827***	0.231	0.000

Source: Author’s Construction, using NPS 2008/2015

The regression results presented in Table 3 show that the interaction term (Time*PHSDP) which explains the actual effect of the program on maternal health through the place of delivery has a P-value equal to 0.042 which is less than 0.05 level of significance. This result implies that the coefficient is statistically significant indicating that the program’s implementation increased the likelihood of pregnant women delivering their children in public/private health facilities by about 53% unlike if the program was not implemented. This indicates that the program's primary priority of maternal health improvement through the strengthening of the 2555 health centers and 62 District hospitals as well as the construction of emergency obstetric care with all necessary equipment was effective. The regression results for the relationship between maternal health and the place of delivery align with the results achieved by (Nababan et al., 2017) in the end-line evaluation where the program affected the increase in the facility delivery in Bangladesh. This is contrary to what was examined by (Mohanani, 2016), where the program had no significant changes in the increase in the probability of institutional delivery in rural areas of Gujarat.

Results from the regression analysis shown in Table 3 also show that the program's implementation increases the probability of a woman's chances to be attended by skilled personnel during giving birth by about 43% and increases the probability of a child's health's chances of improvement by about 82%. In particular, the time variable in the



regression indicates that maternal health is improving over time and the PHSDP variable controls for all other factors that can affect maternal health in the program. The regression result with the P-value = 0.046 being less than 0.05 means the coefficient of the interaction term best explains the actual effect of the program on maternal health through skilled birth. The results obtained for the relationship between maternal health and the birth attended by skilled personnel, suggest that the implementation of the PHSDP program significantly increased the likelihood of a woman's chances to be attended by skilled personnel during giving birth by about 43%. Among the programs, the major objective as a necessary tool in improving women's health was primarily rehabilitation, construction, and upgrading of the 128 training institutions to bridge the qualified health professionals in public health facilities which stood at 15,060 equivalents to a 32.1% requirement. The regression results are in line with both (Nababan et al., 2017) and Singh (2013), where both showed a significant association between program implementation with maternal health through skilled delivery. Thus, the program has bridged the staff level gap and that could explain the increase in the likelihood of a woman being attended by skilled personnel unlike if the program was not implemented.

The results obtained for the relationship between child health and mother's use of bed net, suggest that over time, the implementation of the PHSDP program significantly increased the likelihood of a child's health improvement by about 82% unlike if the program was not implemented. This outcome concurs with (Sharma, 2016), where a significant association between program implementation with child health through mother-to-child services. Thus, the program initiatives have in one way played a significant role in improving children's health even though data on other aspects of a child's health could help explain more. This also could help explain the increase in the likelihood of children's health as it combats the reduction of malaria-related deaths for children less than five years through bed net provision unlike if the program was not implemented.

4.3 The Impact of PHSDP on Maternal and Child Health Outcomes

Table 4 offers a snapshot of maternal and child health outcomes over ten years, focusing on three specific metrics: place of delivery, skilled birth attendance, and child health as indicated by bed net usage. The values represent changes over time of a health-related program, denoted by "Time*PHSDP. To determine the real impact of the Public Health Service Delivery Program (PHSDP) on the three outcomes (place of delivery, attendant at birth, and child health), given the regression results we calculate the impact as follows; -

$$Impact_t = coefficient\ of\ PHSDP + [coefficient\ of\ (Time * PHSDP) * t] \quad (4)$$

Table 4
The Impact of PHSDP Over Time

Maternal and child health outcomes	Years	Time*PHSDP
Place of delivery(1=Public/private facility, 0= Otherwise)	Initial year	-2.77
	After 5 years	-0.11
	After 10 years	2.56
Skilled birth (1=Attended by professional, 0=Otherwise)	Initial year	-2.09
	After 5 years	0.07
	After 10 years	2.23
Child health(1=Use bed net, 0=Otherwise)	Initial year	-1.67
	After 5 years	2.47
	After 10 years	6.60

Source: Author's Construction, using NPS 2008/2015

Results from Table 4 show that the initial effect of PHSDP is negative for all three outcomes (place of delivery, attendant at birth, and child health). This indicates that at the very initial stage of the implementation of the program, people hesitate to attend hospitals and other delivery facilities due to misinformation in the health market which might be a result of their cultural beliefs on the new health information. In the Trans-theoretical model of health behavior change at the initial stage of implementation of the program, people may be in the pre-contemplating or contemplating stage where they have no intention of changing their behavior or are even unaware of the program or are aware that a program exists and seriously contemplates changing the behaviour, but takes no action yet (Lalazaryan & Farashband, 2014). However, the positive interaction term suggests that the negative impact diminishes over time, and for child health and skilled birth, the effect turns positive within five years of implementation of the program, indicating substantial improvement. The results reveal that the real impact of the PHSDP on place of delivery, attendant at birth, and child health shows an initial negative effect, which becomes positive over time due to the significant interaction

between time and PHSDP. This highlights the importance of sustained implementation and monitoring of the program to achieve long-term positive outcomes.

4.4 Discussion

These results make several important contributions to the existing literature on the evaluation of health programs, as the findings indeed show that the PHSDP has a statistically significant positive effect on maternal and child health outcomes over time. The results partly confirm and partly contradict previous studies, underlining the role of context, program design, and implementation commitment.

The initial negative impact of the PHSDP across all three outcome variables resonates with the behavioral theories highlighted in the conceptual framework, such as the Trans-theoretical model. This early-stage resistance can be attributed to deeply imbedded cultural practices and initial misinformation—a challenge similarly documented in other settings. For example, Belo et al. (2017) estimated "giving birth at home" and "limited knowledge at the community level" as some of the main drivers of poor health outcomes in Mozambique; thus, similar barriers that the PHSDP may have faced in Tanzania. That suggests that a period of low uptake following a new intervention may be a common phenomenon in contexts where traditional practices are strong, and it does underline the necessity of robust, sustained community engagement from the very outset.

Nonetheless, the successive positive and statistically significant long-term outcomes for facility-based deliveries present good evidence that these initial setbacks were overcome by PHSDP. This result is congruent with those obtained by Nababan et al. (2017) in Bangladesh, where the same program resulted in a phenomenal increase in the rate of facility deliveries. The finding also corroborates that by Gitobu et al. (2018), who reported that eliminating financial barriers through Kenya's free maternal care policy increased health facility deliveries significantly. Our results thus indicate that improving physical access—which is the necessary first step toward improving maternal health outcomes—was indeed achieved through the PHSDP strategy of constructing and rehabilitating health infrastructure.

On the contrary, our positive results are in sharp contrast to the findings from the evaluation done by Mohanan (2016) for the Chiranjeevi Yojana program in India, which reported no significant association with the probability of institutional delivery. The divergence underlines that having a program is not enough; its success is likely to depend on specific elements in the design, quality of built facilities, and effectiveness of parallel demand side interventions such as community awareness creation that might have been stronger in PHSDP.

In terms of skilled birth attendance, our 43% increase in likelihood reinforces the imperative of tackling human resource shortages, which is at the core of PHSDP goals. We find this result strongly supported by Nababan et al. (2017) and Singh (2013), who have both found significant improvements in skilled delivery following health interventions. This suggests that efforts in the program to rehabilitate training institutions and bridge the gap in staff did indeed pay off. This success story points towards a critical avenue for future research and policy: while there was an increase in numbers, the reminder by Kruk (2016) in Uganda and Zambia stresses that increased skilled attendance does not imply high-quality care. Their mixed results on patient satisfaction and perceived quality point to the fact that future efforts in Tanzania need to be placed not only on the number of health workers but also on the competencies, attitudes, and enabling environment in which they work.

For instance, the greatest effect is seen in child health proxied by bed net use, with an increase of 82% in the likelihood of improvement. This strong influence is again a finding in support of Sharma (2016), where community-based women's groups in Nepal significantly raised the prevalence of preventive behaviors such as iron and folic acid supplementation. This shows the effectiveness of the mother-to-child advocacy component of PHSDP in encouraging a specific, low-cost, high-impact preventive behavior. This success in driving the adoption of a key commodity suggests that well-designed information, education, and communication campaigns within broader health programs can yield remarkable returns in child survival, particularly against malaria.

Finally, the fact that it takes time for the benefits of this program to be gradually realized—as indicated by negative coefficients turning positive over 5 to 10 years—challenges expectations of immediate impacts. This temporal dimension is echoed in Tanner et al. (2015) in Lao PDR, where the overall impact of a nutrition project was mixed, although its benefits became clearly visible over time among the poorest 40%. It thus indicates that the real value of complex health system investments, such as PHSDP, may be underestimated in short-term evaluations. Patience and long-term funding are core requirements, given the intrinsically slow pace at which behavioral change and health system strengthening can occur.

V. CONCLUSIONS & RECOMMENDATIONS

5.1 Conclusions

It was revealed that the implementation of the PHSDP program based on its 17 components of implementation in this case the health facilities availability, skilled birth attendants as well as the mother's advocacy programs had a significant effect on the mother and child health respectively. The findings revealed that the mother's likelihood of

giving birth in hospitals increased by 53%, with a 43% likelihood increase in skilled birth attendance and an 82% increase in the likelihood of child health improvement due to the mother's advocacy program unlike if the program was not at all implemented. The analysis demonstrates complex dynamics between the variables affecting maternal and child health outcomes. In terms of the real impact of the program, the results show that time alone has no significant impact, and PHSDP initially correlates with adverse maternal and child health outcomes (place of delivery, attendant at birth, and child health). However, over time, PHSDP's influence turns positive, suggesting that its benefits materialize gradually, underscoring the importance of sustained health interventions and possibly highlighting initial challenges in program implementation.

5.2 Recommendations

Based on the results obtained from the study, the following policy recommendations seem essential for the improvement of the health sector but in particular maternal and child health; Firstly, the Government as the main actor responsible for the improvement of the health sector should in a cooperated and most robust way improve budget allocation and disbursement of funds to the Ministry of Health for satisfactory improvement of health infrastructures in the country as well as scaling up the coverage of National Health Insurance schemes. This would enable more women to access the use of hospitals and clinics during pregnancy as well as giving birth.

Secondly, the study raises the necessity of engaging in active and most continued information dissemination in terms of health promotion programs on the necessities of the utilization of health care services provided by the health facilities. Services like a mother to child provided by the PHSDP program need more advocacy through media outlets, political arenas and Government outlets to Local authorities, this way more rural residing women can utilize such opportunities offered by these programs. Provision of knowledge on the importance of such services could be a key to the improvement of women and child's health as well as a potential tool in reducing maternal and child death most especially in rural areas.

Thirdly, the issue of skilled birth attendance is complex and more likely reliant on many factors including the existence of health facilities as well as trained health personnel but because there exists a significant shortage of health's staff across all main cadres with an inclusion of the technical staff in the social welfare services, could be confronted through the provision of internships of such cadres to areas of shortages as a temporary solution while responsible organs find a more prominent solution to the problem. This could be accomplished through improving and establishment of more training institutions pertaining to diseases that were less attended to as well as research institutes for pandemics.

Furthermore, programs like PHSDP should be designed in a dynamic mechanism to allow community involvement with outside partners in the implementation of such health programs. This avenue should provide the most sophisticated, efficient and more integrated coordination system; such organizations in the health sector have been implemented in other countries like Hungary whereby it is known as Hungarian Care Coordination Organization (CCO). Such organizations normally assume responsibility for virtually the entire spectrum of services (from primary to tertiary care) for a population signed up with primary care (family doctors) in a given geographical area and against an adjusted capitation payment.

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