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Original Research

The impact of national health promotion policy on stillbirth and maternal mortality in South Africa

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ABSTRACT

Objectives: In 2015, the South African government implemented the national health promotion policy (NHPP), intending to reduce stillbirth and maternal mortality. This study was designed to quantify the impact of the NHPP on stillbirth and maternal mortality in both the South African population and immigrant citizens.

Study design: This was a panel analysis using secondary data issued by Statistic South Africa-Vital Statistics.

Methods: The author exploited the changes in smoking status that the NHPP exerted between 2015 and 2017. The author then builds credible control and treatment groups based on smoking status for both groups. Women who quitted smoking post-NHPP implementation were considered as the treatment group. Women who persisted with smoking post-NHPP implementation were classified as the control group. The author then used a Two-stage Least Squared Model to quantify the impact of the NHPP on stillbirth and maternal mortality in both the South African and immigrant populations.

Results: The model shows that NHPP averts stillbirths by 8.36% in the South African population residing in the urban areas and by 2.84% in the rural segments of the country. NHPP averts South African maternal mortalities by 20.88% in urban areas and by 15.60% in the rural segments of the country.Regarding the immigrant population, the model shows that NHPP averts immigrant's stillbirths by 7.61% in the urban areas and by 2.79% in the rural segments of the country. In addition, NHPP averts immigrant maternal mortalities by 19.22% in the urban areas and by 13.04% in the rural segments of the country.

Conclusions: NHPP reduces stillbirth and maternal mortality outcomes slightly biased toward the South African population. These inequalities reflect immigrant's lack of response to the NHPP framework and inadequate access to the South African health system.

Introduction

There is an ongoing debate about the relevance of health promotion policies in averting mortalities.[1–3] Some authors argue that health promotion policies are critical to improving health outcomes[4] – a view supported by the World Health Organization.[5] These papers support the idea that health promotion policies are essential to avert maternal deaths and stillbirths. However, other authors argue that there is no significant evidence that health promotion yields significant improvement in health outcomes.[6] These inconsistencies invite more novel ideas to re-evaluate the health promotion policies' impact on public health outcomes.

In 2015–2019, responding to the World Health Organisation[5] recommendations, the South African government implemented the national health promotion policy (NHPP) to reduce maternal and child mortality rates.[7] Key to this policy strategy was the mobilization of disadvantaged communities to take ownership of their health.[7] So far, no study has assessed the impact of NHPP on maternal mortality and stillbirth in South Africa. Furthermore, international evidence shows that public health programs often impact differently on different population groups.[8–10] Currently,

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there is no comparative analysis of NHPP impacts concentrating on various population groups in South Africa. This paper is design to fill these gaps.

Previous studies on health promotion policies suggested that health promotion programs might be a good investment for the health system.[11–15] For example, in 2018, a group of authors published a review of prior research on health promotion programs and found a positive return on investment on such health promotion interventions.[16] However, as the authors noted in that review article, much of the prior literature was limited by the lack of robust samples from low- and medium-income countries (LMICs).

There is a need to advance the health promotion literature with a perspective from LMICs, considering that health promotion programs have been underfunded in LMICs, especially in Africa.[17–19] Furthermore, the current South African literature does not appear to have analyzed how health promotion policies improve immigrant's maternal mortality and stillbirth, despite immigrants being the most vulnerable groups,[20,21] which are often neglected in health services and policy coverage debates.

Currently, South Africa experiences a relatively high influx of immigrants, mainly from other African countries. The female population of immigrants is significantly growing. According to the UN statistics, there were 4.2 million immigrants in South Africa in 2017,[22] which constituted approximately 7.2% of the entire population. Of this group, more than 2 million were women immigrants from under-resourced backgrounds compared with South African women.

Given this evident socio-economic inequality between South African women and immigrant women, it was essential to quantify any possible differences between domestic and immigrant's maternal mortality and stillbirth arising from NHPP impact to assist the achievement of the universal declaration of human rights,[23,24] so that no one is left behind from government interventions. Therefore, this study is designed to quantify the impact of the NHPP on stillbirth and maternal mortality from 2015 to 2017 in the South African population. In addition, the study also quantifies the impact of NHPP on immigrant's stillbirth and immigrant's maternal mortality outcomes.

History of NHPP

The NHPP originated in 2015 from cooperative efforts among private donors, the government department of health, academia, and non-governmental organizations, which brought preventive services at the community level to support public health outcomes. The NHPP was implemented from 2015 to 2019 using various methods, such as home visits done by community health promoters to support the adoption of NHPP recommendations. Other implementation methods included education programs offered at public health facilities targeting pregnant women and various media marketing adverts to promote the ideas of preventive services to avert maternal mortality, stillbirth, and other non-communicable diseases. These methods were mainly communicated in English to mobilize the country to take ownership of their health, especially in low-income communities.

The services of NHPP included educational programs for integrated management of childhood illnesses, breastfeeding, healthy eating programs, immunization campaigns, prevention of violence against women and children, prevention of substance abuse, and tobacco consumption. So far, the NHPP has succeeded in reducing the percentage of the smoking population with an average of 67% in the low-income communities of South Africa (see Figure 1 in the Appendix).

In light of the declining smoking population driven by NHPP interventions, the present study seeks to answer the following questions: (1) What impacts does NHPP exert on the South African population's stillbirth and maternal mortality? (2) Are there regional and educational differences in the impact of NHPP on stillbirth and maternal mortality outcomes? (3) Is the NHPP having positive effects on immigrant's stillbirth and immigrant's maternal mortality outcomes? This article explores findings that demonstrate the potential of the NHPP to improve maternal health.

Methods

The author uses the Vital Statistics panel data provided by Statistic South Africa (Stats-SA) from 2015 to 2017. The Vital Statistics data were released in 2019 and are collected annually on approximately one million individuals, covering leading causes of deaths for South Africans and citizens of other nationalities residing in South Africa. The Vital Statistics database sampling procedure involves explicit stratification by province and within each province by urban and non-urban areas.

Household causes of deaths are drawn under this stratification. Individual characteristics presented in each household unit include the deceased's age, cause of death, the pregnant status of the deceased, gender, education level, job occupation, smoking status of the deceased, smoking status of the remaining next of kin, nationality status, and other general socio-economic status variables. The survey general structure questions for a binary response. For example, households are asked the smoking status of the deceased. The general reply is either yes, the deceased was smoking, or no, the deceased was not smoking. The paper used this binary variable to quantify the changes in stillbirth and maternal mortality outcomes in individuals who accepted NHPP recommendations and quitted smoking vs those who resisted NHPP efforts and persisted with smoking.

In this analysis, the author exploited the changes in smoking status that the NHPP exerted in the South African and immigrant population groups between 2015 and 2017. The author then builds credible control and treatment groups based on smoking status for both groups. Individual women who quitted smoking post-NHPP implementation were considered as the treatment group. Individual women who persisted with smoking post-NHPP implementation were classified as the control group.

The author used the strategy described by Mostert and Vall [25,26] to quantify the impact of the NHPP on stillbirth and maternal mortality in both the South African population and immigrants citizens. In addition, sine smoking is known to be associated with increased stillbirth and maternal mortality risk; the author compared the outcomes by smoking status.

Hence, the author opted to analyze these results in individuals whose smoking status was disclosed to prevent hidden biases. Furthermore, NHPP mainly covered low-income communities. Therefore, the analysis only focuses on households whose job occupations paid <900 US$ per month to prevent any confounding factors (e.g. agricultural and fishery workers, elementary occupations workers, clerical support workers, plant operators, etc.).

The author did not directly compare households who persisted in smoking to those not smoking, as these two groups of households can be different in many additional dimensions that can have direct impacts on stillbirth and maternal mortality outcomes (e.g. differences in income, proximity to health institutions, and social status of the household).

For these reasons, the author did not opt for ordinary least squares (OLS) model estimation because of the possibility of having inflated coefficients.[25,26] Instead, the author opted for a 2SLS model presented below:

$$Y_i^a = \alpha_1 + \beta_1 \sim NHPP_i\partial + AgeFE + \psi Education - FE + \theta PlaceFE + \rho YearFE + \xi Race_i + \sigma Female_i$$
$$NHPP_i^a = \alpha_2 + \beta_2 Treat_i^a + AgeFE + \psi Education - FE + \theta PlaceFE + \rho YearFE + \xi Race_i + \sigma Female_i \quad (1)$$

In the first equation, Y is one of the outcomes for individual at age ɑ, and '~NHPP' is the predicted benefit from the national health promotion policy proxied by no smoking. The regression includes age fixed effects (which capture age differences that can influence maternal mortality and stillbirth outcomes), education fixed effects (which capture the family education dynamics which can influence mortality outcomes), place of death fixed effects (which capture the deaths recorded at home and in healthcare facilities), year fixed effects (which capture the year and seasonality effects which may influence mortality outcomes), race fixed effects (which capture for racial differences that can influence mortality outcomes), and a dummy for female (for the regressions in which the study estimate effects for both males and females).

In the second equation (which corresponds to the first stage regression), participation in the NHPP program is estimated as a function of the treatment dummy variable, which identifies the individuals who responded positively and maintained a no-smoking lifestyle. Thus, in all model estimations, the study needs two assumptions to be fulfilled: first, probability of being treated, and this will be corroborated by the F-test of the first stage equation; and second, the exclusion restriction needs to hold, that is, the instrument should not influence the primary outcome directly through any channel other than treatment.

This assumption means that differences in stillbirth and maternal mortality outcomes between the treated and control groups can only be because of NHPP's influence in reducing smoking. Thus, there is no reason to believe that the treatment group should have better stillbirth and maternal mortality outcomes than the control group observed in the same regions. Furthermore, no other South Africa event explains any difference in stillbirth and maternal mortality outcomes that would affect only the treatment group but not the control group. Thus, the paper is confident that the exclusion restriction is satisfied, meaning NHPP can explain these changes in Figure 2 of the Appendix.

Results

Descriptive analysis

Table 1 presents the exact difference between the treatment and control groups. First, individuals who persisted with smoking recorded a higher probability of stillbirth and maternal mortality than those who accepted the NHPP interventions and stopped smoking.

Table 1
Descriptive statistics.

	Treated	Control
Benefiting from NHPP	99.9%	0.0%
Female	51.1%	51.3%
In rich provinces	53.0%	53.4%
Reported stillbirth	1.3%	3.1%
Reported maternal mortality	3.4%	7.1%
Reported foreign nationals	14.2%	13.1%
Observations	125,751	120,820

NHPP, national health promotion policy.
Source: Own elaboration with data from Stats-SA vital statistics 2015–2017.

Results of two-way 2SLS model

The tables present a comparative picture of how NHPP interventions that drove down smoking also averted stillbirth and maternal mortality. When analyzing the 2SLS model estimations' results, the paper noted that the first stage regression's F-statistic is very large, pointing toward the instrument's strong validity (see Table 2). Furthermore, stillbirths were reduced by 0.13 percentage points in the urban regions. The mean of stillbirth is 1.61 in this region. Therefore, NHPP reduces the rate of stillbirth by 8.36%.

Similarly, stillbirth was reduced by 0.87 percentage points in rural settings. On the other hand, the mean for stillbirth is 2.60 for these regions; therefore, NHPP reduces the stillbirth rate by 2.84%. This estimation shows that the NHPP did not appear to have as great an impact on the rural population as on the urban one.

The study then next examines whether NHPP positively impacts the maternal mortality outcomes, considering that it positively impacts stillbirth. The paper found in Table 3 that NHPP reduces maternal mortality in both urban and rural populations. NHPP reduces maternal mortality by 0.10 percentage points, implying a 20.88% improvement in the urban population. Once again, the NHPP impact was lower in improving maternal deaths in the rural population. Indeed, living conditions are key determinants of maternal healthcare utilization,[27] which could explain these results.

The author examined education-based differences of NHPP's impact on maternal mortality outcomes and repeated the same regressions only for the educated individuals (Grade 12 and other tertiary qualifications) and only for the least educated individuals (Below Grade 12 completion). Table 4 shows that NHPP improves maternal mortality more for the educated population. For example, in the treatment group, maternal deaths were reduced by 21.75% for the educated population and 14.80% for the least educated population.

Table 2
2SLS estimation of the impact of NHPP on stillbirth.

2SLS	Urban	Rural
	Stillbirth	
NHPP	−0.0013[a]	−0.0087[a]
	(0.0002)	(0.0001)
Age fix effect	Yes	Yes
Year fix effect	Yes	Yes
Gender fix effect	Yes	Yes
Race fix effect	Yes	Yes
Place of death fix effect	Yes	Yes
Mean for stillbirth	0.0161	0.0260
Observations	12,049	10,594
F-stat 1st SLS	89.4101	78.2741

Note: The results are from a 2SLS model. In the first stage equation, the dependent variable is the probability of being treated with NHPP. Simultaneously, the instrument is a dummy variable equal to 1 for individuals who responded to NHPP and maintained a no-smoking lifestyle and 0 for individuals who avoided the NHPP recommendation and persisted with smoking. In the second stage regression, the dependent variable is a dummy variable of 'stillbirth'. Both regressions include age, year, gender, race, and place of death fixed effects. Source: Vital statistics provided by Statistic South Africa from 2015 to 2017. NHPP, national health promotion policy.
[a] Significant *P* value at <0.05. Coefficients in brackets represent standard errors.

Table 3
2SLS estimation of the impact of NHPP on maternal mortality.

2SLS	Urban	Rural
	Maternal mortality	
NHPP	−0.0010[a]	−0.0087[a]
	(0.0002)	(0.0001)
Age fix effect	Yes	Yes
Year fix effect	Yes	Yes
Education fix effect	Yes	Yes
Race fix effect	Yes	Yes
Place of death fix effect	Yes	Yes
Mean for maternal mortality	0.0481	0.0560
Observations	126,565	106,630
F-stat 1st SLS	119.9601	104.2201

Note: The results are from a 2SLS model. In the first stage equation, the dependent variable is the probability of being treated with NHPP. Simultaneously, the instrument is a dummy variable equal to 1 for individuals who responded to NHPP and maintained a no-smoking lifestyle and 0 for individuals who avoided the NHPP recommendation and persisted with smoking. In the second stage regression, the dependent variable is a dummy variable of 'maternal mortality'. Both regressions include age, year, education, race, and place of death fixed effects. Source: Vital statistics provided by Statistic South Africa from 2015 to 2017. NHPP, national health promotion policy.
[a] Significant *P* value at <0.05. Coefficients in brackets represent standard errors.

Table 4
2SLS estimation of the impact of NHPP on maternal mortality by education level.

2SLS	Educated	Least educated
	Maternal mortality	
NHPP	−0.0109[a]	−0.0080[a]
	(0.0005)	(0.0011)
Age fix effect	Yes	Yes
Year fix effect	Yes	Yes
Race fix effect	Yes	Yes
Place of death fix effect	Yes	Yes
Mean for maternal mortality	0.0501	0.0541
Observations	116,561	116,634
F-stat 1stSLS	117.9601	109.2201

Note: The results are from a 2SLS model. In the first stage equation, the dependent variable is the probability of being treated with NHPP. Simultaneously, the instrument is a dummy variable equal to 1 for individuals who responded to NHPP and maintained a no-smoking lifestyle and 0 for individuals who avoided the NHPP recommendation and persisted with smoking. In the second stage regression, the dependent variable is a dummy variable of 'maternal mortality'. Both regressions include age, year, race and place of death fixed effects. Source: Vital statistics provided by Statistic South Africa from 2015 to 2017. NHPP, national health promotion policy.
[a] Significant *P* value at <0.05. Coefficients in brackets represent standard errors.

Table 5 shows that the NHPP appeared to reduce stillbirth and maternal mortality rates among the immigrant population. However, the impact of NHPP is lower in reducing immigrant's stillbirth and maternal mortality compared with the South African citizens.

Discussion

The NHPP appears to play a positive role in advancing public health outcomes. The study also finds that the impact of NHPP is more robust for the urban population than for the rural population. These results are consistent with findings reported in Brazil.[28]

The study also analyses differences in the impact of NHPP for the educated and least educated population in South Africa. NHPP improves maternal mortality outcomes to a more considerable extent in the educated segment of the population. These results are consistent with findings from Canada,[29] Ireland,[30] and other international studies,[31] where education was found to play a significant role in advancing public health outcomes.

Table 5
2SLS estimation of the impact of NHPP on maternal mortality and stillbirth of immigrant citizens.

2SLS	Urban	Rural
	Maternal mortality	
NHPP	−0.0106[a]	−0.0077[a]
	(0.0012)	(0.0020)
Age fix effect	Yes	Yes
Year fix effect	Yes	Yes
Education fix effect	Yes	Yes
Race fix effect	Yes	Yes
Place of death fix effect	Yes	Yes
Mean for maternal mortality	0.0551	0.0590
Observations	9849	8948
F-stat 1st SLS	91.3601	87.5501
	Stillbirth	
	−0.0010[a]	−0.0008[a]
	(0.0002)	(0.0001)
Age fix effect	Yes	Yes
Year fix effect	Yes	Yes
Gender fix effect	Yes	Yes
Race fix effect	Yes	Yes
Place of death fix effect	Yes	Yes
Mean for stillbirth	0.0131	0.0290
Observations	6049	5942
F-stat 1st SLS	73.7501	69.4721

NHPP, national health promotion policy.
[a] Significant *P* value at <0.05. Coefficients in brackets represent standard errors.
Source: Vital statistics provided by Statistic South Africa from 2015 to 2017.

Health policies in South Africa tend to perpetuate skewed inequality between educated and less educated populations because the English language is preferred over other local languages. The less educated people, especially in rural areas, are less fluent in English, resulting in meek improvement in public health outcomes.

Hence, the NHPP does not improve stillbirths and maternal deaths equally for all groups, and this inequality of impact has significant implications for the further implementation of NHPP. This paper endorses the strengthening of NHPP to make its utilization practical for both rural and urban areas and educated and less educated groups. More diversification of the NHPP language programs will go a long way in reducing the current inequalities.

Finally, the paper also analyses the impact of the NHPP on the immigrant population. More specifically, the paper finds a robust improvement in stillbirth and maternal deaths in immigrants who responded to NHPP interventions. However, the slightly lower coefficient in the immigrant population group reflects the existing health disparities between the South Africans and immigrants. These results are similar to findings reported in Taiwan.[32] Health promotion programs and preventive care utilization in Taiwan were relatively low among immigrants citizens compared with the locals, resulting in lower health outcomes for the immigrants.

Limitations

The paper acknowledges that the current binary variables do not capture all epidemiological outcomes linked to these women considering that Stats-SA vital statistics is still missing maternal deaths data for 2018 and 2019. Furthermore, there is no advance information on the determinates of stillbirths and maternal deaths in the Vital Statistics panel data. Thus, the author interprets the results as evidence of substantial improvement in stillbirth and maternal mortality outcomes attributed to NHPP while not capturing other qualitative changes that may further explain these health outcomes. For example, stillbirth can also be driven by

unrecognized intrauterine growth.[33] Unfortunately, the Vital Statistics panel data do not contain such information, which should have been controlled in the analysis. Nevertheless, the paper believes such omission will not significantly influence the current estimation considering that smoking is still the primary driver of stillbirth and maternal mortality.[2]

In summary, NHPP plays a crucial role in advancing women's and children's health outcomes. For example, the policy improves stillbirth and maternal mortality for both South Africans and immigrant nationals.

Author statements

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Ethical approval

Our institution does not require ethical approval for this type of study.

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Competing interests

None declared.

Availability of data and materials

The data that support the findings of this study are available from STATSA on reasonable request.

Appendix A. Supplementary data

Supplementary data to this article can be found online at https://doi.org/10.1016/j.puhe.2021.07.009.

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