Trends in Maternal Health in Rwanda

Further Analysis of the 2014-15 Demographic and Health Survey

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Republic of Rwanda

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Additional information about the 2014-15 RDHS may be obtained from the National Institute of Statistics of Rwanda, 6139 Kigali, Rwanda; telephone: +250 252 571035; fax: +250 252 570705; email: info@statistics.gov.rw; internet: www.statistics.gov.rw.

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ABSTRACT

This report examines levels, trends, and inequalities in maternal health in Rwanda from 2010 to 2014-15 among women age 15-49 with a recent birth. The analysis uses Demographic and Health Survey (DHS) data for 15 key indicators of maternal health: 6 for antenatal care, 3 for delivery, 1 for postnatal care, and 5 for barriers to accessing medical care. Levels and trends in these indicators were analyzed overall and by three background characteristics: women's education, household wealth quintile, and region. A further analysis of disparities by wealth quintile was also performed, using the concentration index. Overall, the results show substantial improvements for 6 of the 9 key indicators of antenatal care, delivery care, and postnatal care, as well as a decrease in reported barriers to care. However, a majority of women still receive fewer than the recommended number of at least four antenatal care visits, do not receive a postnatal check-up within 2 days following delivery, and report at least one serious problem in obtaining health care. The study also shows persistent disparities by education, wealth, and region. In both surveys, 11 of the 15 health indicators were significantly unequal by women's household wealth status. Moreover, 8 indicators were even more unequal by household wealth status in 2014-15 than in 2010. Sometimes, gains can occur faster among the wealthiest than the poorest. Nevertheless, as maternal health care improves in Rwanda, additional initiatives and outreach should be directed to disadvantaged groups and regions in order to ensure better equity in maternal health.

KEY WORDS: Rwanda, maternal health, Demographic and Health Surveys, health disparities

1 INTRODUCTION

1.1 Background

This report examines trends and disparities in 15 maternal and child health indicators in Rwanda from 2010 to 2015. Globally, substantial progress has been made in improving maternal health. The maternal mortality ratio (MMR) has fallen worldwide by nearly half since 1990. The percentage of assisted births increased from 59% in 1990 to 71% in 2014, and contraceptive prevalence increased from 55% of married women in 1990 to 64% in 2015 (United Nations 2015). According to the World Health Organization (WHO), the maternal mortality rate fell from 385 maternal deaths per 100,000 women of reproductive age in 1990 to 216 per 100,000 in 2015; the annual number of maternal deaths declined by 43%, from 532,000 in 1990 to 303,000 in 2015; and the approximate global lifetime risk of maternal death declined considerably, from 1 in 73 to 1 in 180 between 1990 and 2015 (World Health Organization et al. 2015).

Although every region of the world experienced declines in levels of maternal mortality between 1990 and 2015, challenges remain globally and particularly in low- and middle-income countries. Worldwide, it is estimated that about 830 women die every day from complications of pregnancy and childbirth (World Health Organization et al. 2015). Among the 303,000 maternal deaths estimated in 2015, virtually all were in developing countries, and about two-thirds in sub-Saharan Africa (World Health Organization et al. 2015). In 2015, the MMR was 20 times higher in developing countries than in developed countries, at 239 maternal deaths per 100,000 live births versus just 12 per 100,000. The MMR was highest in sub-Saharan Africa, at 54 maternal deaths per 100,000 live births. The lifetime risk of maternal mortality is estimated at 1 in 36 in sub-Saharan Africa compared with 1 in 4,900 in developed countries (World Health Organization et al. 2015).

1.2 Maternal Health in Rwanda

Although sub-Saharan Africa remains the region with the highest global burden of maternal mortality, Rwanda is among nine countries considered to have achieved Millennium Development Goal (MDG) 5A, by having reduced the maternal mortality ratio by three-quarters between 1990 and 2015 (World Health Organization et al. 2015). In the 2012 report of the Countdown to 2015 Collaboration, Rwanda was ranked as the country with the highest average annual rate of maternal death reduction, at 9% (World Health Organization 2014). Other maternal indicators, such as number of births occurring in a health facility, the number attended by a skilled provider, and the total fertility rate, have shown significant improvements. For instance, births assisted by a skilled provider increased from 69% in 2010 to 91% in 2015; the gap between the wanted fertility rate and the total fertility rate decreased from an average of 1.5 children per woman in 2010 to 1.1 in 2015 (National Institute of Statistics of Rwanda et al. 2015). Additionally, data from the national health management information system (HMIS) have shown a substantial increase in the percentage use of iron supplements to prevent anemia, and tetanus toxoid immunization, as well as better detection of health risks, which has led to an increase in the percentages of women detected with high-risk pregnancies and the percentages of pregnant women tested for anemia (Rwanda Ministry of Health 2014).

To achieve such improvements, among many other interventions, Rwanda has focused on the education of girls (Rwanda Ministry of Education 2008), as women's education has been demonstrated to

have a positive influence on maternal and child health. Attainment of education is associated with later initiation of childbearing and lower fertility, as women who attend school marry later compared with those with no education (Akmam 2002; Bongaarts et al. 1984; Lloyd, Kaufman, and Hewett 2000; Osili and Long 2008). Also, women with more education have higher levels of contraceptive use (Stephenson et al. 2007; Asiimwe et al. 2014; Larsson and Stanfors 2014). Later age at childbearing and use of contraceptives help to reduce maternal and child mortality, increasing the use of health care services for delivery, postnatal care (PNC), and immunization of children (World Health Organization 2007).

Despite these successes, Rwanda has experienced recent stagnation in some health indicators and continues to have some deficiencies in its health system. For instance, when comparing the 2010 Rwanda Demographic Health Survey (RDHS) with the 2014-15 RDHS surveys, the level of modern contraceptive use by married women remains fairly stagnant (45% in 2010 and 48% in 2014-15), and the percentage of married women with an unmet need for contraception remains relatively unchanged (21% in 2010 and 19% in 2014-15), (National Institute of Statistics of Rwanda et al. 2015; National Institute of Statistics of Rwanda et al. 2012). The 2014-15 RDHS found low levels of attending the recommended number of four or more visits for antenatal care (ANC) and receiving postnatal care (PNC), each at 40% in 2014-15 (Rwabufigiri et al. 2016).

1.3 Health Care Initiatives in Rwanda

A number of studies and reports have highlighted Rwanda's remarkable achievement in improving health in general and maternal and child health in particular (Kalipeni et al. 2017; UNFPA 2010; USAID 2012; Overseas Development Institute 2012; Farmer et al. 2013; World Health Organization 2014; National Institute of Statistics of Rwanda et al. 2015; Sayinzoga and Bijlmakers 2016). To achieve this improvement, since 2005 the Rwandan government and Rwandan health systems have put in place many innovative interventions—such as performance-based financing (PBF), Mutuelle de Santé, maternal death audit, and Rapid SMS. These have been monitored and their contributions to improving MCH have been observed (Bucagu 2016; Sekabaraga et al. 2011; Sayinzoga et al. 2016; Farmer et al. 2013). Key innovative interventions that have contributed to the improvement of maternal and child health in Rwanda over the past 2 decades include the following:

1.3.1 Community health workers

In response to the shortage of health workers during the post-genocide period, between 2005 and 2008 the Rwandan Ministry of Health opted for strengthening existing community-based interventions by using community health workers (CHWs) to balance the limited competence of the health workforce (Bucagu et al. 2012). In 2007, Rwanda initiated a reform of the national community health system, previously implemented in 1995 (Condo et al. 2014). In 2014, Rwanda had around 60,000 CHWs and each village had four CHWs. Among those four CHWs, there was one pair of general CHWs, called a binome, responsible for community health, nutrition, and HIV/AIDS prevention; another CHW in charge of social affairs contributed to addressing the well-being of individuals; and a female CHW in charge of maternal health was responsible for community-based intervention during and after pregnancy and for child care (Rwanda Ministry of Heath 2015a). Rwanda has understood that women have an important role to play in achieving better heath in general and maternal and child health in particular. It is in this regard that CHWs in charge of MCH in the villages are women. The strong involvement of women in health measures within local communities, particularly safe delivery and reproductive health, has shown significant results in

improving maternal health (Condo et al. 2014; Ngabo et al. 2012; Farmer et al. 2013; Overseas Development Institute 2012; Bucagu 2016).

1.3.2 Community-based health insurance scheme

Piloted in 1999, extended countrywide in 2000, and made mandatory for all Rwandans in 2006, the community-based health insurance (CBHI) scheme, known as Mutuelle de Santé, is another Rwandan heath strategy to increase access to and use of basic health services. In 2012, 91% of the population was enrolled in Mutuelle de Santé, and another 7% was registered with other health insurance programs (Logie et al. 2008). The community-based health insurance scheme has contributed to the improvement of maternal and child health in Rwanda by increasing both socioeconomic and geographic accessibility, which are known to be barriers to reproductive, maternal, newborn, and child health (RMNCH) (Bucagu et al. 2012; Lu et al. 2012; Priedeman et al. 2013). For instance, the community based-health insurance scheme covers 90% of ambulance transfers; this consequently makes possible timely transfers to high-level health facilities for emergency intervention (Overseas Development Institute 2012; Priedeman et al. 2013).

1.3.3 Strong political will and government commitment

The determination of the central and local Rwandan governments to build a better society has been identified as a contributing factor to the improvements of health sector performance in general and to maternal and child health in particular (Sayinzoga and Bijlmakers 2016). In response to high rates of maternal mortality, the government of Rwanda prioritized RMNCH throughout its policies and main health sector reforms within a context of strong national ownership and heath sector decentralization (World Health Organization 2014). In addition, the central government has put in place mechanisms of close supervision and control of the performance of health institutions and individual health workers, through performance contracts that include financial incentives and punitive measures (Rwanda Governance Board 2014). This political will has helped Rwanda achieve a remarkable performance compared with other countries that are in the same condition as Rwanda and have received similar funding from international donors (Overseas Development Institute 2012)

1.3.4 Performance-based financing

The government of Rwanda adopted performance-based financing (PBF) as a heath financing strategy in 2005, after piloting it in 2001. Its aim is to motivate health providers to increase service output and improve quality of care (Rusa et al. 2009). This tool has also proved effective in improving RMNCH in Rwanda, since the health facilities and CHW cooperatives are rewarded financially based on a number of indicators that are largely related to RMNCH (Basinga et al. 2011; Rwanda Ministry of Health 2012a).

1.3.5 Decision-making based on evidence

Since 2008, Rwanda has closely monitored trends in key indicators at all levels, followed by corrective measures if targets are not attained. To monitor these trends, in 2008 Rwanda started to develop the Annual Health Statistical Booklet, using data from the Rwanda health management information system (R-HMIS), the PBF database for clinical services, the CHW information system, and several surveys. The booklet summarizes key statistics within the health sector and enables all stakeholders, policymakers, and planners to track the health sector, to develop interventions based on the actual status of health sectors, and ensure that interventions are responsive to the needs of Rwanda's people.

1.3.6 Institutionalization of maternal death audits

Rwanda is the first developing country to implement a maternal death audit (MDA) on a routine basis countrywide. This is also a proof of the country's political will in improving maternal and newborn health. Political will is the key element in bringing change (Van Lerberghe et al. 2014). The facility-based maternal death audit approach has provided hospitals with evidence on causes of death and their contributing factors, and enabled them to make recommendations for reducing the occurrence of deaths from these causes. Introduced in Rwanda in 2008, the implementation of MDA recommendations has likely contributed to the reduction of maternal deaths, as shown in a study by Sayinzoga and colleagues (2016). Other studies have also demonstrated the effectiveness of MDA in improving obstetric care (Hofman and Mohammed 2014; Dumont et al. 2006).

1.3.7 Rapid SMS and mUbuzima systems

In 2009, Rwanda developed the Rapid SMS, a short message-based system to improve maternal and child health, and in 2012 scaled up the system after it had been piloted in Musanze, North region. This free open-source framework allows maternal health CHWs at the community level to connect interactively with a national centralized database as well as with health facilities, and in case of emergency provides a quick way to alert an ambulance driver (Ngabo et al. 2012). This initiative has proven its effectiveness in improving emergency obstetric and neonatal care and increasing facility-based childbirth (Ngabo et al. 2012).

Additionally, in 2012 CHWs registered in the mUbuzima system started to report using that server. This system allows CHWs to enter and transmit data into the community health information system using a mobile phone. These data are used to assess the individual performance of CHWs and overall progress toward maternal and child health program indicators (Marsch et al. 2015).

1.3.8 Investment in adolescent health

Levels of maternal mortality and morbidity are high among pregnant adolescents (World Health Organization 2007), and the risk of dying extends to their infants (Mathur et al. 2004). Rwanda has invested in the health of adolescents regarding their sexual and reproductive health and rights, and prevention of gender-based violence. In 2012, following WHO guidelines on preventing early pregnancy and poor reproductive outcomes among adolescents in developing countries (World Health Organization 2011), the Rwanda Ministry of Health, in collaboration with all stakeholders involved with adolescents and young adults, developed the adolescent sexual reproductive health and rights policy. The general objective of the policy is to ensure that all adolescents and young adults in Rwanda have access to and can use good-quality, comprehensive sexual and reproductive health information, education, and services in a youth-friendly environment (Rwanda Ministry of Health 2012b).

1.3.9 Improved service quality

Compared with other developing countries, Rwanda has improved the quality of its health services in general and its maternal and child health services in particular (Rwanda Ministry of Health 2006; Overseas Development Institute 2012). This has been possible through better training of health providers in Emergency Management of Obstetric Neonatal Care (EmONC) and Kangaroo Mother Care of health centers / district hospitals in antenatal, postnatal, and post abortion care. All CHWs in charge of maternal

and child health are trained on the management of pregnant women and how to support them at the community level. They have been trained extensively and are provided with incentives to reach maternal and child health targets (Overseas Development Institute 2012; Rwanda Ministry of Health 2015b). Also, services are provided 24 hours a day. Monitoring and supervision visits are taking place. All these factors could be associated with the improvement of RMNCH (UNFPA 2010).

1.3.10 Local initiatives

Local initiatives, such as the Ubudehe, Girinka program, umuganda, and Imihigo, have contributed substantially to the improvement of MCH in Rwanda. Ubudehe, defined as the traditional Rwandan practice and cultural value of working together to solve problems (Mupenzi 2014), has contributed to increase access to health services through enrolling people in the community-based health insurance scheme (Mutuelle de Santé). In 2011, based on criticism of the flat premium structure of Mutuelle de Santé—aggravating inequality, benefiting the rich more than the poor—(Schmidt et al. 2006), the annual subscription was changed from a flat-fee structure to stratified contribution whereby the contribution for the poorest category of participants is paid by government and its partners (Binagwaho et al. 2012).

The Girinka program was initiated in 2006 by Rwandan President Paul Kagame (Larson 2007). It offers a local solution to improve nutrition and economic stability. In this program a family is given a cow, and when the cow has a calf the family gives it to another family—the neediest one. This program has shown its effectiveness in reducing malnutrition and poverty, which in turn are drivers of better maternal and child health (Larson 2007).

Umuganda refers to the community work done on the last Saturday of the month; all Rwandans age 18 and older are expected to volunteer to improve the community by cleaning and promoting good health practices. During umuganda, local government leaders or health providers based in the village sometimes take the opportunity to convey messages promoting RMNCH, such as childhood immunization, ANC, PNC, delivery in a health facility, and use of contraceptives.

Imihogo (performance contracts) originates from a Rwandan cultural practice whereby two parties commit themselves publicly to achieve particular goals. Failing to attain the goals leads to dishonor, while attaining them leads to becoming role models in the community (African Development Bank 2012). IMIHIGO is one of the key tools for planning and implementing development policies introduced by the government of Rwanda in 2006, and it is changing the face of the country (Rwanda Governance Board 2014). The performance contracts are signed between the President of the Republic and the district mayors on behalf of their constituencies. At the same time, all civil servants sign the performance contracts with their superiors at their place of work. The goals set by the district mayors include promoting maternal and child health, mutual health insurance participation, family planning use, better nutrition, and women's empowerment, including stopping gender-based violence, achieving gender equity, and creating jobs and access to information and communication technology for women (Rwanda Governance Board 2014).

1.4 Objective of the Report

Against the backdrop of substantial health investments and recent initiatives in Rwanda, this report aims to document levels and trends of key maternal health indicators from 2010 to 2015, both overall and by women's education, household wealth status, and region. The report examines the extent to which differences in maternal health exist by these characteristics among Rwandan women age 15-49 with a recent birth, and if so, whether these disparities have diminished since 2010 or are getting worse.

2 DATA AND METHODS

2.1 Data

This analysis uses data from the Rwanda 2010 and 2014-15 Demographic and Health Surveys (DHS). Table 1 summarizes the sample size for each of these surveys. A map of the five regions of Rwanda is shown in Figure 1.

Table 1 Sample sizes for the 2010 and the 2014-15 Rwanda Demographic and Health Surveys

Survey	Number of households interviewed	Number of eligible women 15-49 interviewed
2010	12,540	13,671
2014-15	12,699	13,497

Figure 1 Map of Rwanda

2.2 Methods

2.2.1 Indicators

Fifteen maternal health indicators are examined. These indicators focus on antenatal and postnatal care, delivery, and problems accessing health care. The specific definitions of these indicators are described below:

Four or more visits for antenatal care (ANC):

Among women age 15-49 who had a birth in the past 2 years, the proportion who had at least four ANC visits for the most recent birth.

First ANC visit before 4 months of pregnancy:

Among women age 15-49 who had a birth in the past 2 years, the proportion who had their first ANC visit for their most recent birth before 4 months of pregnancy.

ANC components (four indicators):

> ***Iron intake:*** Among women age 15-49 who had a birth in the past 2 years, the proportion who took iron tablets or syrup during the pregnancy of their last birth.
>
> ***At least two tetanus toxoid injections:*** Among women age 15-49 who had a birth in the past 2 years, the proportion who received at least two tetanus toxoid injections during the pregnancy of their last birth.
>
> ***Informed of the signs of pregnancy complications:*** Among women age 15-49 who received ANC for their most recent birth in the past 2 years, the proportion who were informed of the signs of pregnancy complications.
>
> ***Blood pressure:*** Among women age 15-49 who received ANC for their most recent birth in the past 2 years, the proportion whose blood pressure was measured.

Delivery by a skilled birth attendant (SBA):

Among women age 15-49 who had a birth in the past 2 years, the proportion whose most recent birth was delivered by a skilled birth attendant. If more than one person assisted the delivery, the most qualified person is described. In Rwanda, a skilled birth attendant includes doctor, nurse, medical assistant, and midwife.

Delivery in a health facility (DHF):

Among women age 15-49 who had a birth in the past 2 years, the proportion whose most recent birth was delivered in a health facility. This indicator distinguishes between home deliveries and facility deliveries. Health facilities could be government, private, or another type of facility, such as a polyclinic or dispensary.

Caesarean section delivery (C-section):

Among women age 15-49 who had a birth in the past 2 years, the proportion whose most recent birth was delivered by Caesarean section (C-section). While C-section delivery can save lives of the mother and child when complications arise during delivery, the overuse of C-section delivery when it is not necessary should be avoided. WHO indicates that C-section rates higher than 10% are not associated with reductions in maternal and newborn mortality rates (World Health Organization 2015) and therefore may be considered excess or unnecessary use of C-section delivery.

Postnatal care (PNC) for mother:

Among women age 15-49 who had a birth in the past 2 years, the proportion who received a postnatal check-up within 2 days of delivering their most recent birth.

Problems accessing health care (five indicators):

Among all women age 15-49 who reported that they had serious problems in getting health care for themselves when they were sick for any of the following four reasons—getting permission to go; getting money for treatment; distance to health facility; not wanting to go alone—and the proportion reporting at least one reason.

2.2.2 Analysis

Tests of association were performed between the above indicators and the background characteristics of women's education level, household wealth quintile, and region. These tests identify disparities in the indicators across subpopulations within each survey. Education has three categories: no education, primary, and secondary or more. The wealth quintile categories are: lowest, second, middle, fourth, and highest. The regions for Rwanda are defined as Kigali city, South, West, North, and East.

In addition, tests of differences in proportions determined whether the differences between surveys (both nationally and within subgroups) were statistically significant. These results are shown in plots with a solid line that indicates a significant change and a dotted line for a non-significant change. The values of the differences overall and by subgroups are found in the Appendix tables. Statistical testing was adjusted for the sample design and weights. Stata 15 was used to make all calculations. The national estimates and the estimates used to produce the figures are provided in the tables.

The concentration index was also used as a further study of the inequalities of the indicators by household wealth quintile. The concentration index has values that range from -1 to 1, which gives a measure of both the magnitude and direction of inequality by wealth (Barros and Victora 2012; World Health Organization 2013). A value of zero indicates that there are identical proportions of the indicator in all of the wealth quintiles, therefore representing equality by household wealth status. A positive concentration index indicates that the indicator is more concentrated in wealthier quintiles; a negative value indicates that it is more concentrated in the lower wealth quintiles.

The indicators used for the analysis in this report are all bounded between zero and one, which means that the amount of dispersion is related to the overall mean. Therefore, a correction is required to take this into consideration in order to allow for comparisons between different indicators that may have

very different means. The Erreygers (2009) correction was used as in other studies of health inequalities (Binnendijk, Koren, and Dror 2012; Monteiro et al. 2010; Van Malderen et al. 2013). The concentration indices were produced using the *conindex* command in Stata 15 (O'Donnell et al. 2016). The sample weight and survey cluster was considered; however, the *conindex* command does not allow for use of survey stratification design.

Three different tests were performed on the concentration indices. The first is a two-tailed test, to test if the concentration index in each survey and for each indicator is significantly different from zero. To reach equality we would like to see a concentration index that is not statistically different from zero. The second is a one-tailed test, to test if the concentration index decreased significantly. The third test is also one-tailed, to test whether the concentration index increased between the 2010 DHS survey and the 2014-5 survey. Ideally, we would like to see a concentration index moving toward zero. Therefore, if the indicators have positive concentration indices, we would like to see a significant decrease in the concentration indices from 2010 to 2014-15. And if the indicators have negative concentration indices, we would like to see a significant increase.

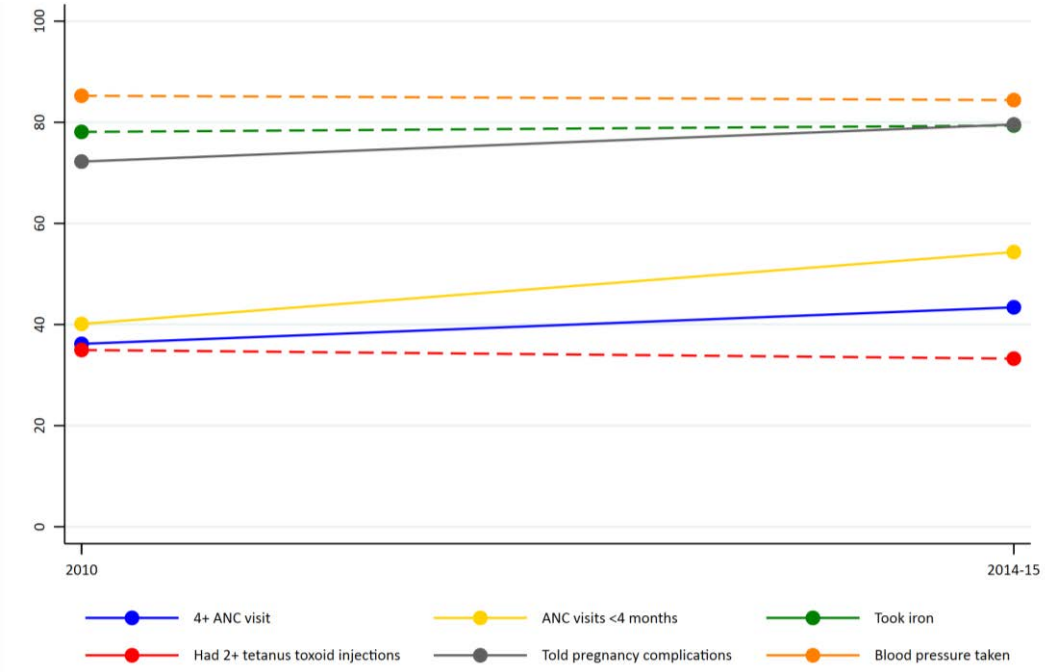
In addition, a one-sided test was performed to determine whether the concentration index significantly improved from the first survey to the second. For indicators that are usually concentrated among the wealthier households, as for all of the MCH indicators in this report apart from stunting and wasting, the concentration index is expected to be positive. For those indicators, improved equity will be implied if a positive concentration index in the first survey becomes less positive and closer to zero in the second survey. For stunting and wasting, the concentration index is expected to be negative, since they are concentrated among the poorer households; thus equity is improved if the concentration index becomes less negative and closer to zero from the first survey to the second.

3 RESULTS

3.1 Antenatal Care

Figure 2 shows the six indicators related to antenatal care (ANC) that were examined among women age 15-49 with a birth in the past 2 years: attending at least four ANC visits for their most recent birth; attending an ANC visit before 4 months of pregnancy; and four indicators related to the ANC components: took iron; received at least two injections of tetanus toxoid vaccine; told of the signs of pregnancy complications during ANC visit; and blood pressure taken during ANC visit.

Figure 2 Trends in the six antenatal care (ANC) indicators used in the analysis



Three of these indicators—having at least four ANC visits, attending ANC before 4 months of pregnancy, and told of signs of pregnancy complications during ANC visit—increased significantly between the surveys in 2010 and 2014-15. Three ANC components—blood pressure taken, took iron, and told of pregnancy complications—had relatively high percentages in both surveys, at 70%-85%. In comparison, the indicator concerning receipt of at least two injections of tetanus toxoid vaccines had percentages below 40% in both surveys.

A more detailed description of each ANC indicator follows, with a look at disparities by education, wealth quintile, and region.

3.1.1 Antenatal care visits

About a third of women studied had the recommended four or more ANC visits for their most recent pregnancy in 2010. This increased significantly to 43% in 2014-15. Table 2 shows that in both surveys women differed significantly by education level in attending ANC. There were also significant

differences by wealth quintile in 2010, and by region in 2014-15. In both surveys, the proportion of women who had four or more ANC visits increased with increasing education level.

As Figure 3 shows, there were some large increases between the surveys in attending ANC. One of the largest was for the middle wealth quintile, where the percentage of women who had four or more ANC visits increased by 12 percentage points. This reduced the gaps between the wealth quintiles for this indicator. This finding is also supported by the results from the concentration index (CIx) by wealth, shown in Table 9. The concentration index was significantly different from zero in the 2010 survey (CIx=0.046, p-value=0.033), but in 2014-15 the concentration index decreased and was not significantly different from zero (CIx=0.029, p-value=0.207), indicating that equality was likely reached for this indicator by 2014-15. Relatively large increases were also observed for women in the South and West regions; the gaps between the regions remained, however, with Kigali city and the East region having the lowest percentage of women attending at least four ANC visits, at 38% and 37% respectively. In the South region slightly more than half of women age 15-49 attended at least four ANC visits for their most recent birth.

Table 2 **Among women age 15-49 who had a birth in the past 2 years, the percentage who had at least four ANC visits and who had their first ANC visit before 4 months of pregnancy for their most recent birth by background characteristics**

	At least 4 ANC visits					ANC visit before 4 months of pregnancy				
	2010		2015			2010		2015		
	% [C.I.]	p[1]	% [C.I.]	p[1]	Diff.[2]	% [C.I.]	p[1]	% [C.I.]	p[1]	Diff.[2]
Total	**36.2 [34.2,38.2]**		**43.4 [41.3,45.5]**		**7.2***	**40.1 [38.0,42.2]**		**54.3 [52.2,56.5]**		**14.2***
Education		*		*			*		*	
None	32.7 [28.7,37.0]		34.4 [29.6,39.5]		1.7	33.3 [29.4,37.4]		45.2 [40.0,50.5]		11.9*
Primary	35.8 [33.6,38.0]		43.4 [41.0,45.9]		7.6*	40.2 [37.9,42.6]		53.9 [51.5,56.3]		13.7*
Secondary +	45.7 [40.6,51.0]		51.6 [46.2,56.8]		5.8	51.8 [45.8,57.8]		64.7 [59.6,69.4]		12.8*
Wealth Quintile		*					*			
Lowest	35.0 [31.3,38.8]		40.7 [36.8,44.7]		5.7*	35.9 [32.0,40.0]		52.3 [48.4,56.2]		16.4*
Second	34.9 [31.3,38.6]		43.4 [39.3,47.7]		8.6*	36.4 [32.8,40.1]		51.7 [47.6,55.7]		15.3*
Middle	33.3 [29.4,37.5]		45.2 [40.8,49.7]		11.9*	41.2 [37.0,45.5]		59.0 [54.5,63.4]		17.8*
Fourth	36.4 [32.1,41.0]		44.4 [39.9,48.9]		7.9*	41.9 [37.7,46.2]		53.5 [49.2,57.8]		11.6*
Highest	42.8 [38.2,47.5]		44.2 [39.8,48.7]		1.4	48.4 [43.7,53.2]		56.1 [50.9,61.1]		7.7*
Region				*					*	
Kigali city	33.5 [26.8,41.0]		38.0 [33.2,43.2]		4.5	35.4 [29.5,41.8]		47.3 [41.0,53.7]		11.9*
South	39.9 [36.3,43.6]		50.9 [47.0,54.8]		11.1*	43.5 [39.4,47.6]		59.5 [55.7,63.1]		16.0*
West	35.8 [31.9,40.0]		44.8 [40.4,49.3]		9.0*	37.7 [33.0,42.5]		52.3 [47.5,57.1]		14.7*
North	39.3 [33.7,45.3]		46.9 [41.3,52.7]		7.6	42.0 [36.8,47.4]		57.1 [51.5,62.5]		15.1*
East	32.1 [28.5,36.0]		36.7 [32.3,41.2]		4.5	40.2 [36.3,44.3]		53.6 [49.1,57.9]		13.3*

Notes: * Indicates a significant p-value less than 0.05.
[1]p-value significance of the covariate in each survey.
[2]Difference between the two surveys with the p-value significance of the difference.

Figure 3 **Percentage of women age 15-49 who had four or more ANC visits for their most recent birth in the 2 years before the survey, by background characteristics**

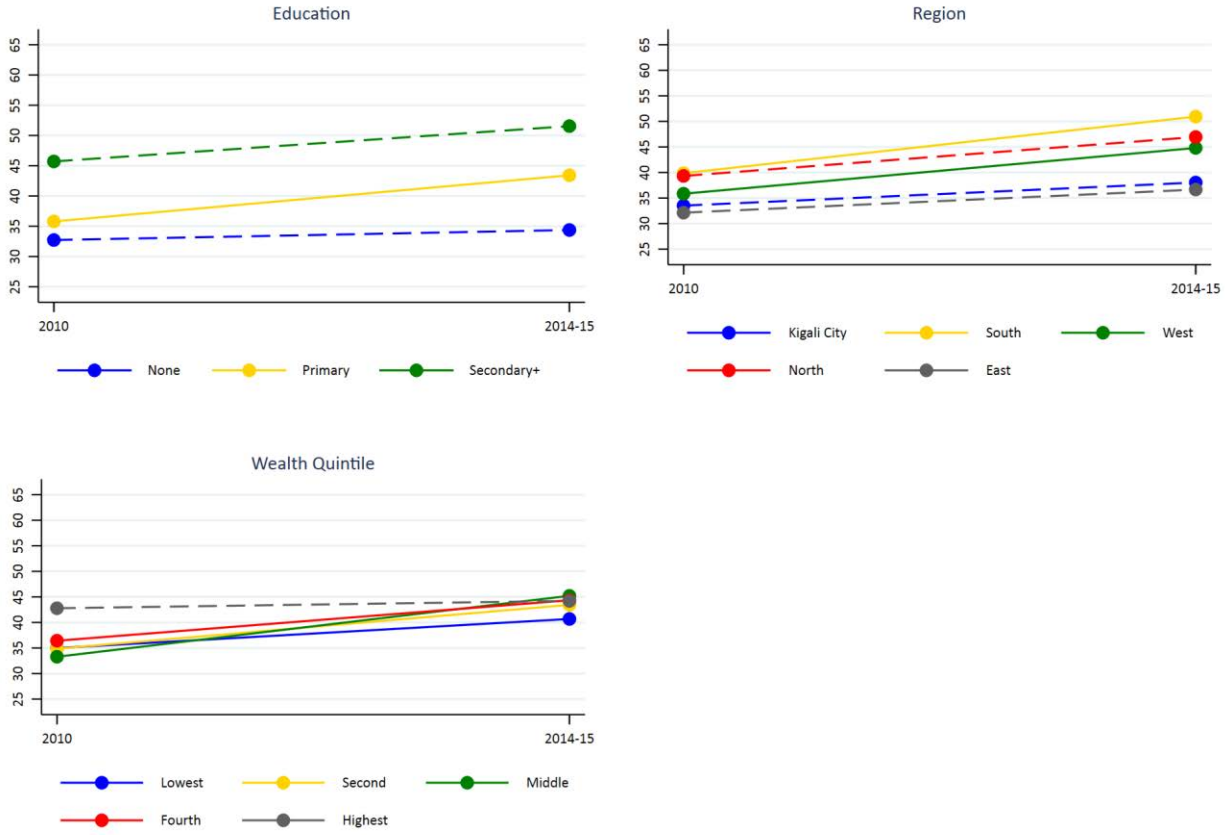
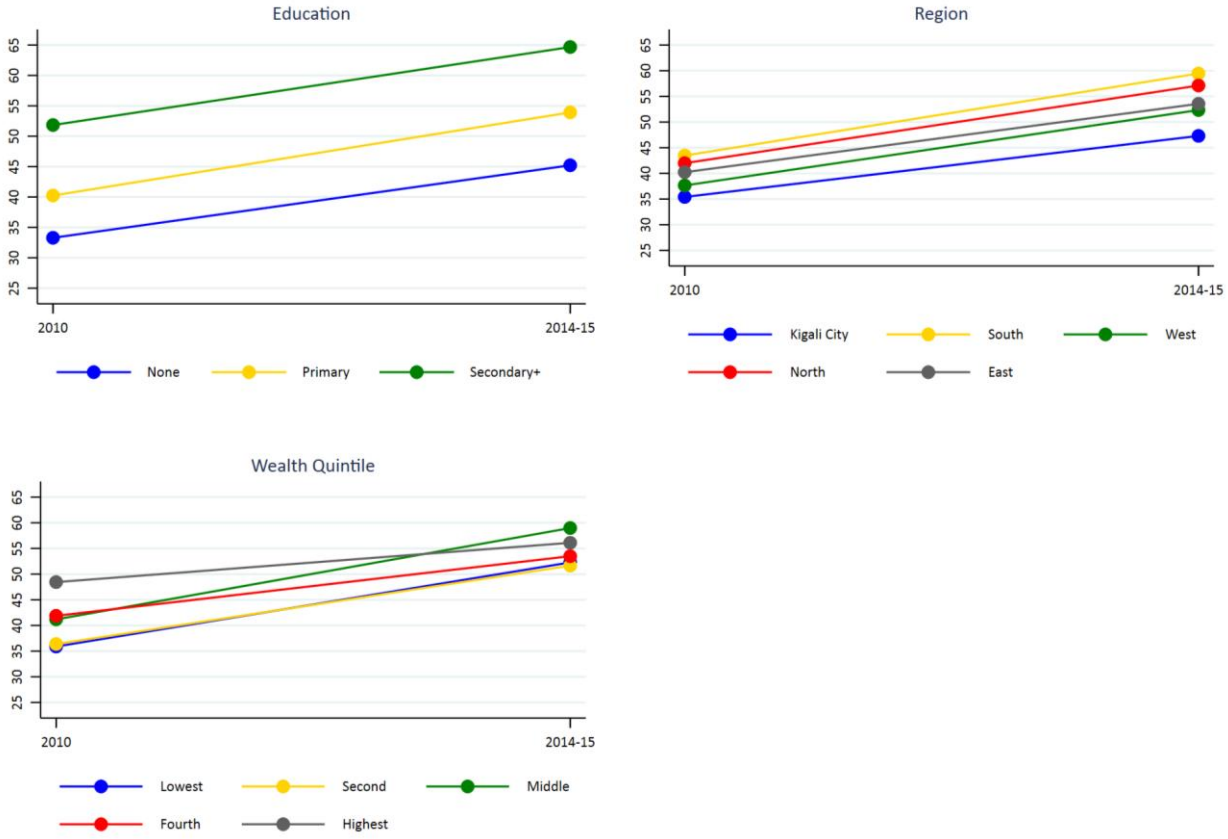


Table 2 also shows that in 2014-15 more than half of Rwandan women age 15-49 went for their first ANC visit before 4 months of pregnancy with their most recent birth. This was a significant increase of 14 percentage points from 40% in 2010. Significant differences were found for this indicator by education and wealth quintile in the 2010 survey and by education and region in 2014-15. In both surveys the percentage of women attending their first ANC visit before 4 months increased with increasing education level. In 2010, this percentage also increased with increasing wealth quintile.

The increases between the two surveys shown in Figure 4 narrowed the gaps between the wealth quintiles, but the gaps remained unchanged for education and region. The largest increase was for the middle wealth quintile, at approximately 18 percentage points. The improvements seen in this indicator by wealth quintile was also observed from the concentration index results. In 2010, the concentration index was significantly different from zero (CIx=0.093, p-value<0.001) but not in 2014-15 (CIx=0.033, p-value=0.167). The decrease in the concentration index between the surveys was also significant (p-value=0.031). This indicates that equality by wealth was reached in 2014-15 for this indicator. Increases in the percentage of women who had an ANC visit before 4 months of pregnancy were found by all subgroups, which all showed increases of more than 10 percentage points except for the highest wealth quintile, which increased by 8 percentage points. In 2014-15, the South region had the highest percentage of women going to their first visit before 4 months of their most recent pregnancy, at 60%, followed by the North region, at 57%. Kigali city had the lowest percentage for this indicator, at 47%.

Figure 4 **Percentage of women age 15-49 who had their first ANC visit before 4 months of pregnancy for their most recent birth in the 2 years before the survey, by background characteristics**



3.1.2 Antenatal care components

Table 3 summarizes the results for the four essential ANC components. Approximately 8 in every 10 women age 15-49 had taken iron supplements for their most recent pregnancy, unchanged between 2010 and 2014-15. Significant increases between the two surveys were found only for the lowest wealth quintile, from 74% to 79%, and for Kigali city, from 79% to 85%. As Figure 5a shows, increases in iron intake among women between the two surveys narrowed the gaps by education and by wealth quintile but not by region. Table 3, which shows no statistical differences in iron intake in the 2014-15 survey by education or wealth quintile, supports the finding in Figure 5a. The largest disparities in 2014-15 were by region, where 71% of women in the East region took iron supplements compared with 90% in the North region. The concentration index by wealth was not significantly different from zero in both surveys, as Table 9 shows (CIx=0.019 in 2010, CIx=0.007 in 2014-15). This indicates that equality by wealth quintile was reached for this indicator.

Table 3 **Among women age 15-49 who had a birth in the past 2 years, the percentage who had the specified ANC component for their most recent birth by background characteristics**

	Took iron tablets or syrup during the pregnancy of their last birth					Received at least 2 tetanus toxoid injections during the pregnancy of their last birth					Informed of signs of pregnancy complications during their ANC visit					Had their blood pressure taken during their ANC visit				
	2010		2015			2010		2015			2010		2015			2010		2015		
	% [C.I.]	p[1]	% [C.I.]	p[1]	Diff.[2]	% [C.I.]	p[1]	% [C.I.]	p[1]	Diff.[2]	% [C.I.]	p[1]	% [C.I.]	p[1]	Diff.[2]	% [C.I.]	p[1]	% [C.I.]	p[1]	Diff.[2]
Total	**78.1 [76.4,79.7]**		**79.4 [77.6,81.0]**		**1.3**	**35.0 [33.1,36.9]**		**33.3 [31.5,35.0]**		**-1.7**	**72.2 [70.3,74.0]**		**79.6 [77.9,81.1]**		**7.3***	**85.3 [83.7,86.7]**		**84.4 [82.5,86.1]**		**-0.9**
Education		*					*		*			*		*					*	
None	73.7 [69.5,77.5]		77.6 [72.8,81.8]		4.0	26.6 [22.9,30.7]		26.2 [22.0,30.9]		-0.4	71.6 [67.4,75.5]		73.1 [67.7,77.8]		1.4	84.4 [80.4,87.6]		81.1 [75.8,85.5]		-3.3
Primary	78.8 [76.7,80.7]		79.7 [77.7,81.6]		0.9	35.6 [33.6,37.7]		31.5 [29.3,33.7]		-4.2*	71.6 [69.5,73.6]		79.7 [77.8,81.5]		8.1*	85.1 [83.2,86.7]		83.6 [81.5,85.5]		-1.5
Secondary +	80.8 [75.6,85.2]		79.2 [74.8,83.1]		-1.6	45.1 [39.8,50.6]		48.3 [43.7,53.0]		3.2	78.6 [73.1,83.2]		84.8 [81.2,87.7]		6.2*	88.4 [84.1,91.6]		91.2 [88.2,93.4]		2.8
Wealth Quintile		*					*					*					*		*	
Lowest	74.4 [70.7,77.7]		79.2 [75.8,82.3]		4.9*	34.7 [31.2,38.2]		36.2 [32.8,39.8]		1.5	73.6 [70.2,76.8]		75.8 [72.2,79.0]		2.2	84.7 [81.7,87.2]		84.5 [81.4,87.2]		-0.2
Second	76.6 [73.1,79.7]		77.1 [73.3,80.5]		0.5	33.9 [30.4,37.5]		32.5 [28.7,36.7]		-1.3	69.2 [65.5,72.8]		78.5 [75.0,81.6]		9.2*	82.0 [78.8,84.8]		83.0 [79.8,85.9]		1.0
Middle	80.2 [76.5,83.3]		80.4 [76.2,84.0]		0.2	36.1 [32.1,40.2]		29.7 [26.0,33.6]		-6.4*	70.1 [66.1,73.8]		79.8 [76.5,82.8]		9.8*	83.8 [80.4,86.7]		78.4 [73.9,82.3]		-5.4*
Fourth	81.9 [78.5,84.9]		78.5 [74.4,82.1]		-3.4	32.3 [28.3,36.6]		27.4 [23.7,31.4]		-4.9	74.7 [70.8,78.2]		80.7 [77.1,83.8]		6.0*	86.4 [83.2,89.1]		83.2 [79.5,86.4]		-3.2
Highest	79.2 [75.6,82.4]		81.9 [78.3,85.1]		2.8	38.6 [34.6,42.7]		39.7 [36.0,43.5]		1.1	74.1 [69.2,78.5]		84.6 [80.6,88.0]		10.5*	91.0 [87.8,93.4]		93.5 [90.3,95.7]		2.5
Region		*		*			*		*			*		*			*		*	
Kigali city	78.5 [73.6,82.7]		84.9 [81.7,87.7]		6.5*	38.3 [33.3,43.6]		39.8 [35.1,44.8]		1.5	73.1 [67.5,78.0]		85.2 [79.2,89.7]		12.2*	93.8 [88.1,96.8]		97.0 [94.7,98.4]		3.2
South	80.1 [76.6,83.2]		83.4 [80.1,86.2]		3.3	38.6 [34.7,42.6]		32.3 [28.7,36.1]		-6.2*	77.3 [73.5,80.6]		83.6 [80.5,86.3]		6.3*	90.5 [87.7,92.7]		91.1 [88.2,93.3]		0.6
West	73.7 [70.1,77.0]		76.7 [73.0,80.0]		2.9	35.8 [32.1,39.6]		37.7 [34.1,41.4]		1.9	66.0 [61.6,70.0]		70.9 [67.0,74.4]		4.9	79.9 [76.5,82.9]		84.3 [80.7,87.2]		4.3
North	86.6 [82.0,90.1]		89.6 [85.6,92.6]		3.0	31.9 [26.9,37.3]		30.4 [26.3,34.8]		-1.5	73.7 [69.4,77.6]		85.0 [80.9,88.4]		11.3*	89.6 [86.3,92.2]		82.8 [78.0,86.7]		-6.8*
East	75.7 [71.8,79.3]		70.7 [66.4,74.7]		-5.0	31.2 [27.7,35.0]		28.8 [25.2,32.7]		-2.4	73.2 [69.3,76.7]		78.4 [75.0,81.6]		5.3*	80.2 [76.4,83.6]		74.3 [69.6,78.5]		-5.9*

Notes: * Indicates a significant p-value less than 0.05.
[1]p-value significance of the covariate in each survey.
[2]Difference between the two surveys with the p-value significance of the difference.

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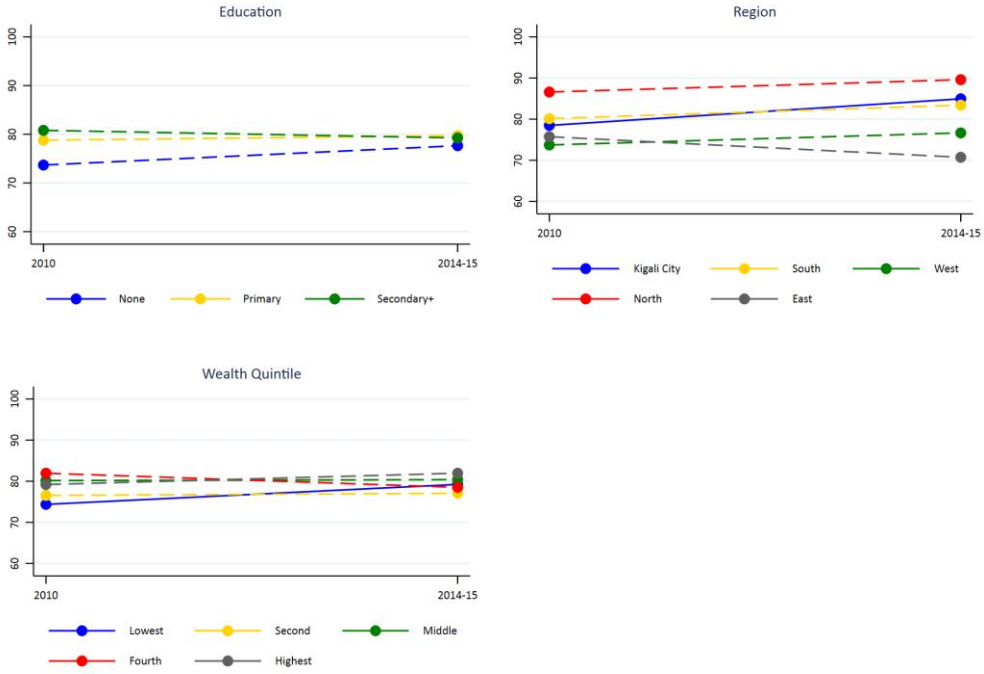
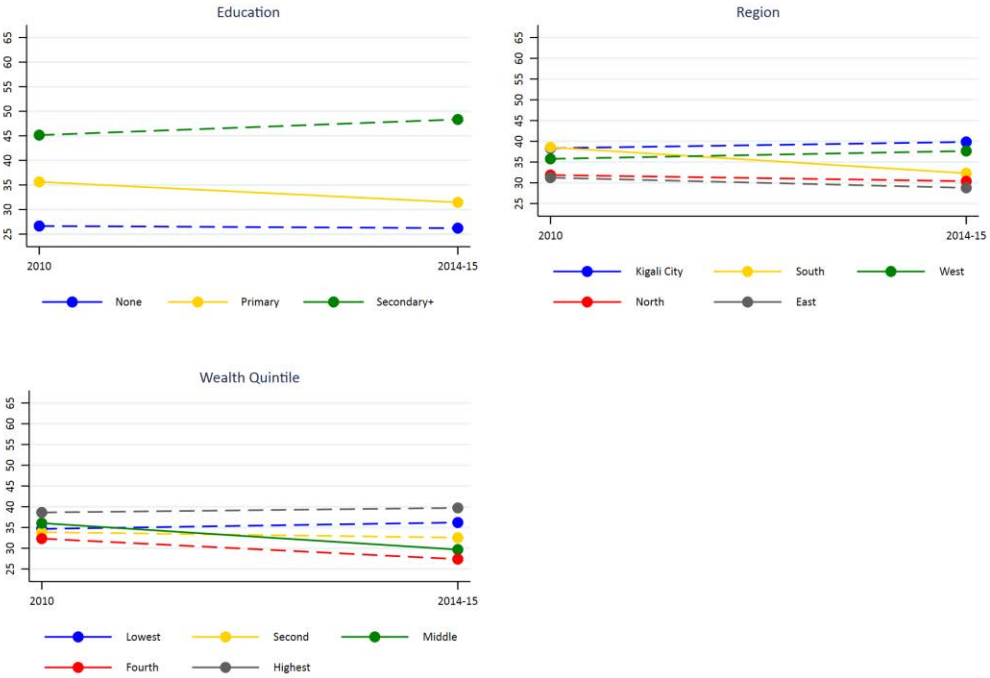
Figure 5 **Percentage of women age 15-49 who had the following ANC components for their most recent birth in the 2 years before the survey, by background characteristics**

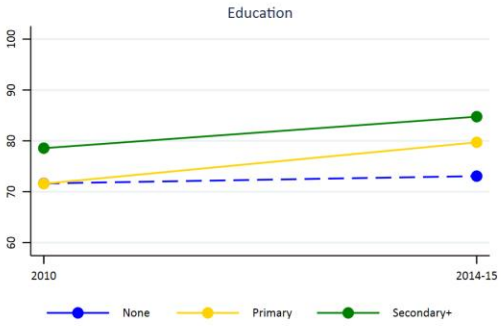
5a Took iron tablets or syrup during pregnancy

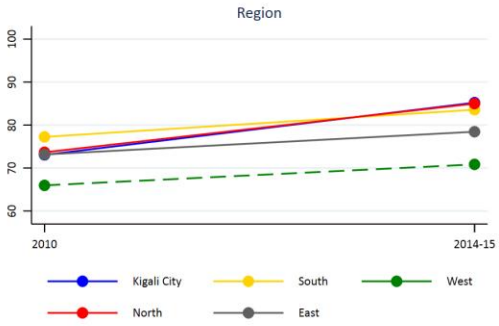


5b Had at least two tetanus toxoid injections

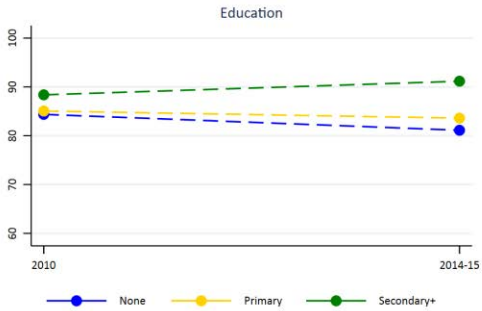


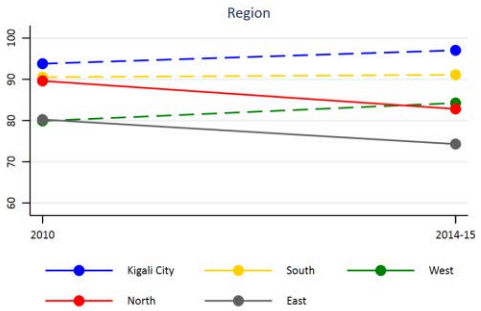
5c Were informed of signs of pregnancy complications during their ANC visit

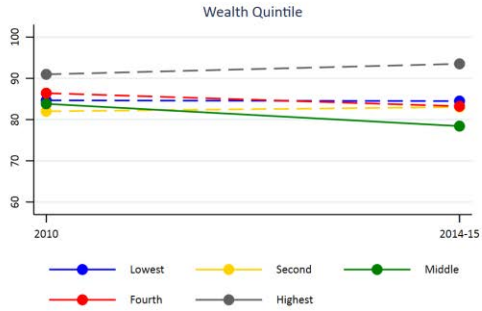




5d Had their blood pressure taken during their ANC visit







Almost a third of women age 15-49 had at least two tetanus toxoid injections during their pregnancy with their most recent birth. As Table 3 shows, this remained unchanged between the two surveys. Figure 5b shows significant decreases in the indicator for women with primary education (from 36% in 2010 to 32% in 2014-15), women in the middle wealth quintile (from 36% to 30%), and women in the South region (from 39% to 32%). No other changes between the two surveys were significant. The concentration index by wealth was not significantly different from zero for each survey (CIx=0.011 in 2010, CIx=0.006 in 2014-15), and there was no significant change in the index. Figure 5b also shows that disparities persisted by education and region, and increased somewhat by wealth quintile.

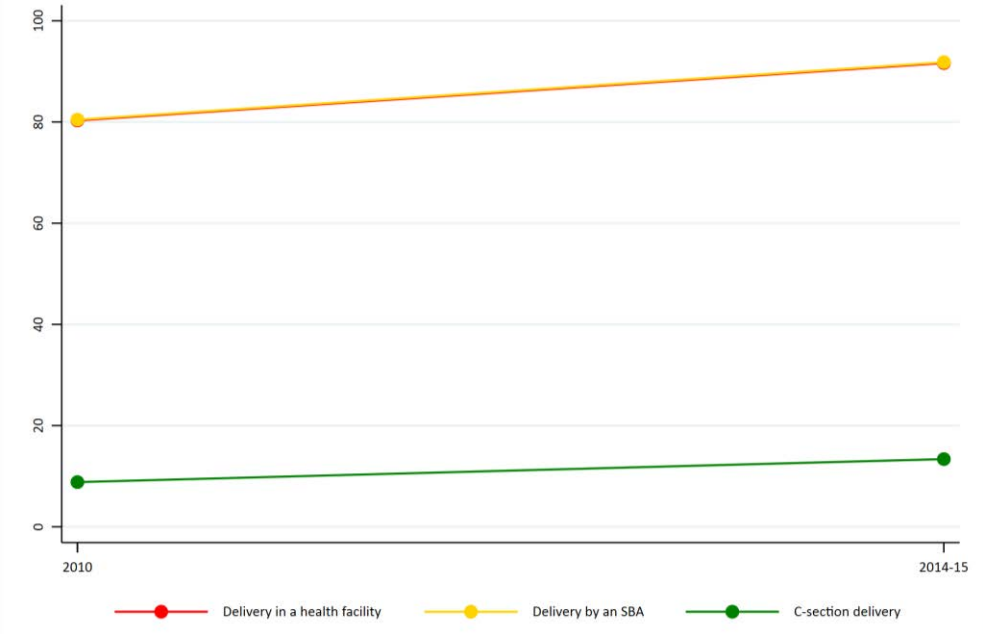
For women who received ANC, 72% were informed of pregnancy complications in 2010, increasing significantly to 80% in 2014-15. Figure 5c shows significant increases by all subgroups except for women with no education, the lowest wealth quintile, and the West region, where changes were not significant. In 2010, there were significant differences in this indicator by education and region, and in 2014-15 significant differences by education, region, and wealth quintile, indicating that disparities increased by wealth. The results of the concentration index support this finding, showing a significant increase in the concentration index between the surveys toward greater inequality (CIx=0.024 in 2010, CIx=0.061 in 2014-15). In 2010, the percentage of women being told about the signs of pregnancy complications during an ANC visit increased with women's increasing education level, and in 2014-15 increased with increasing wealth quintile.

Eighty-five percent of women had their blood pressure taken during an ANC visit for their most recent birth, unchanged between the two surveys. There was also no change for most subgroups except for a significant decline for the East and North regions and the middle wealth quintile. As Figure 5d shows, the largest disparities for this indicator are by region, at 74% in the East region compared with 97% in Kigali city. The concentration index by wealth was approximately 0.05 in both surveys and significantly different from zero in each survey.

3.2 Delivery

Three delivery indicators were examined: delivery in a health facility, delivery with assistance from a skilled birth attendant (SBA), and delivery by Caesarean section (C-section). As Figure 6 shows, all three indicators increased significantly between the two surveys. Delivery in a health facility and delivery by an SBA are almost identical, with overlapping lines in Figure 6. This indicates that virtually all deliveries in a health facility are performed by a skilled birth attendant, and vice versa. C-section delivery increased slightly between the two surveys but remained below 15%.

Figure 6 Trends in the three delivery indicators used in the analysis



3.2.1 Place of delivery and assistance during delivery

As Table 4 shows, the results for the two indicators concerning delivery are similar: at about 8 in every 10 women for delivery in a health facility and for delivery with a skilled birth attendant in 2010, and this increased significantly to about 9 in every 10 women in 2014-15. Increases were also found for all subgroups, with the largest increases of about 15 percentage points for the second wealth quintile and the North region for both indicators. In 2014-15, the East region had the lowest percentages for delivery in health facility and for delivery with skilled assistance, at 90% for both indicators. Kigali city had the highest, at 96% for both indicators. Women with no education had the lowest percentage for both indicators among all subgroup categories, with about 82% for delivery in a health facility and for delivery by an SBA in 2014-15, although this was an increase from 70% in 2010. Figures 7a and 7b show that disparities between the subgroups appear to be decreasing in the most recent survey. For wealth quintile, this is supported by the results from the concentration index, shown in Table 9, that the index decreased significantly toward zero (i.e., toward more equality) for both indicators, from a concentration index of about 0.14 in 2010 to 0.09 in 2014-15.

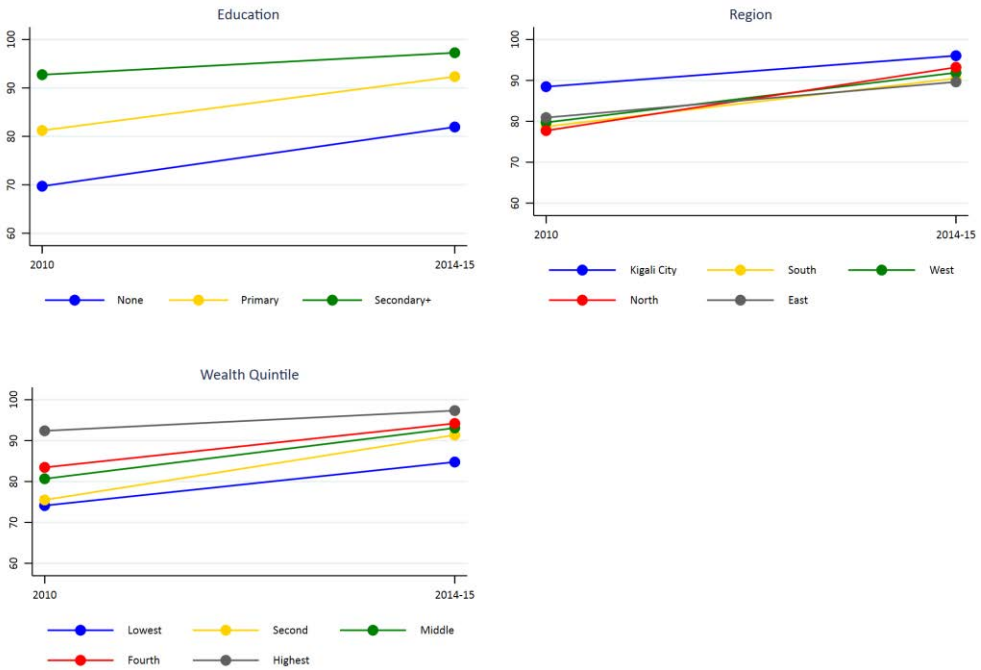
Table 4 **Among women age 15-49 who had a birth in the past 2 years, the percentage who delivered in a health facility and with the assistance of a skilled birth attendant**

	Delivery in a health facility					Delivery by a skilled birth attendant				
	2010		2015			2010		2015		
	% [C.I.]	p[1]	% [C.I.]	p[1]	Diff.[2]	% [C.I.]	p[1]	% [C.I.]	p[1]	Diff.[2]
Total	**80.3 [78.4,82.1]**		**91.7 [90.2,92.9]**		**11.3***	**80.5 [78.5,82.3]**		**91.8 [90.4,93.0]**		**11.4***
Education		*		*			*		*	
None	69.7 [64.8,74.2]		81.9 [76.4,86.4]		12.2*	69.9 [65.1,74.4]		82.5 [77.0,87.0]		12.6*
Primary	81.2 [79.3,83.0]		92.3 [90.9,93.5]		11.1*	81.4 [79.4,83.1]		92.4 [91.0,93.6]		11.0*
Secondary +	92.7 [88.9,95.3]		97.3 [95.3,98.4]		4.5*	93.1 [89.0,95.7]		97.6 [95.6,98.7]		4.5*
Wealth Quintile		*		*			*		*	
Lowest	74.1 [70.5,77.4]		84.8 [81.2,87.8]		10.7*	74.2 [70.6,77.4]		85.3 [81.7,88.2]		11.1*
Second	75.5 [71.6,79.0]		91.4 [88.7,93.5]		15.9*	75.9 [72.0,79.3]		91.5 [88.9,93.6]		15.6*
Middle	80.7 [76.9,84.0]		93.1 [89.7,95.4]		12.4*	80.7 [77.0,83.9]		93.2 [89.9,95.5]		12.6*
Fourth	83.4 [79.6,86.7]		94.2 [91.8,95.9]		10.8*	83.8 [80.1,87.0]		94.0 [91.6,95.8]		10.2*
Highest	92.4 [89.7,94.4]		97.3 [95.6,98.4]		5.0*	92.4 [89.6,94.4]		97.5 [95.8,98.5]		5.1*
Region				*						
Kigali city	88.5 [83.2,92.2]		96.0 [93.6,97.6]		7.6*	88.5 [83.0,92.3]		96.2 [93.9,97.7]		7.7*
South	78.7 [75.2,81.9]		90.5 [87.1,93.1]		11.8*	79.0 [75.5,82.0]		91.0 [87.7,93.5]		12.0*
West	79.7 [74.8,83.9]		91.9 [88.1,94.5]		12.1*	80.0 [75.1,84.2]		91.8 [88.0,94.4]		11.8*
North	77.7 [72.7,82.0]		93.2 [89.8,95.6]		15.5*	78.4 [73.7,82.4]		93.1 [89.6,95.5]		14.7*
East	80.9 [77.3,84.1]		89.6 [86.6,92.0]		8.7*	80.7 [76.9,83.9]		89.9 [86.9,92.3]		9.3*

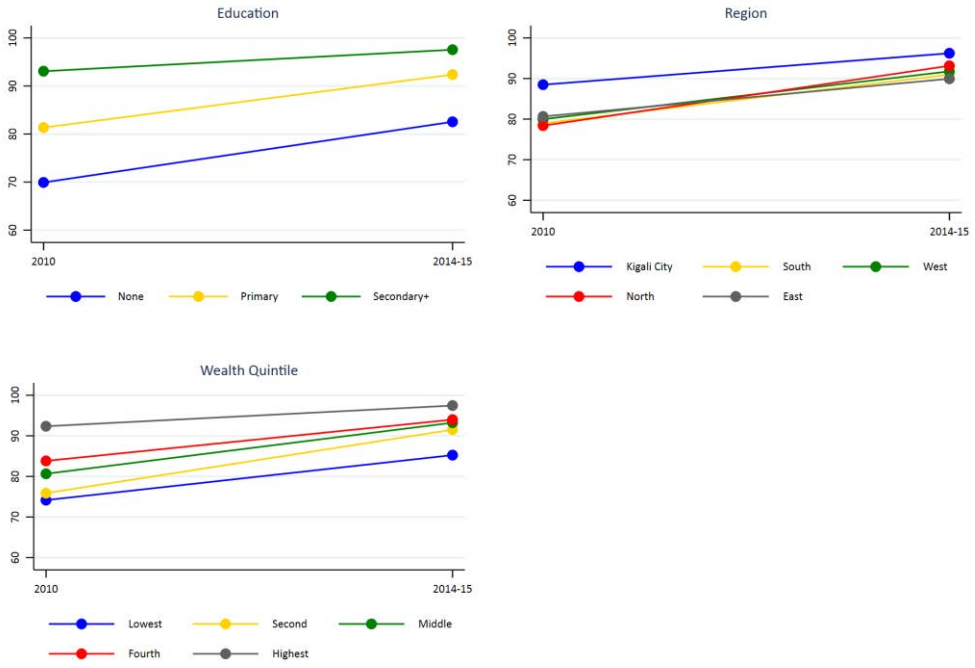
Notes: * Indicates a significant p-value less than 0.05; [1]p-value significance of the covariate in each survey; [2]Difference between the two surveys with the p-value significance of the difference.

Figure 7 **Percentage of women age 15-49 who had their most recent birth assisted by a skilled birth attendant or delivered in a health facility in the 2 years before the survey, by background characteristics**

7a Delivery in a health facility



7b Delivery by skilled birth attendant



3.2.2 C-section delivery

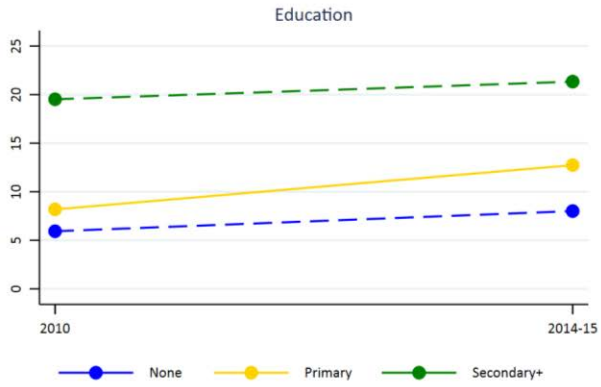
Table 5 shows that, in 2010, 9% of women age 15-49 delivered their most recent birth by C-section. This increased significantly to 12% in 2014-15. C-section delivery differed by all background characteristics in each survey. In each survey, C-section delivery increased with increasing education and increasing wealth quintile, except for the fourth wealth quintile in 2010. Kigali city had the highest C-section delivery rates in both surveys (18% in 2010 and 22% in 2014-15). Delivery by C-section increased significantly for the South and West regions, but this does not appear to have reduced the disparities between the regions, as Figure 8 shows. By region in 2014-15, C-section delivery ranged from 9% in the North region to 22% in Kigali city. The results from the concentration index in Table 9 indicate that disparities by wealth quintile increased significantly between surveys (CIx=0.056 in 2010, CIx=0.099 in 2014-15, p-value of increase =0.013). Figure 8 indicates that this disparity mainly reflects the highest wealth quintile compared with the others. In 2014-15, 24% of women in the highest wealth quintile delivered by C-section compared with 10% of women in the lowest quintile.

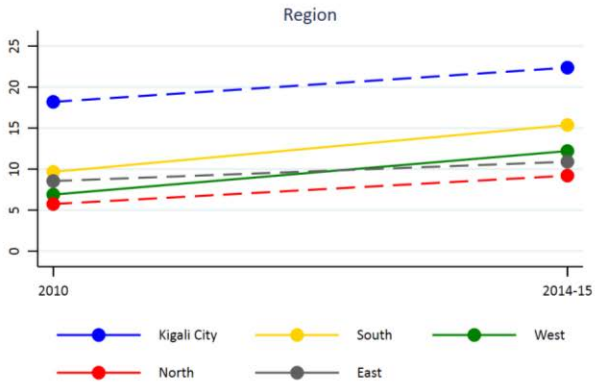
Table 5 **Among women age 15-49 who had a birth in the past 2 years, the percentage who delivered by Caesarean section**

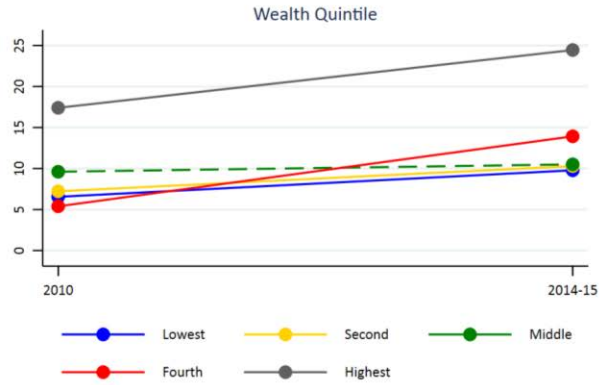
	2010		2015		
	% [C.I.]	p[1]	% [C.I.]	p[1]	Diff.[2]
Total	**8.8 [7.9,9.9]**		**13.4 [12.1,14.7]**		**4.5***
Education		*		*	
None	5.9 [4.2,8.3]		8.0 [5.6,11.3]		2.1
Primary	8.2 [7.1,9.5]		12.7 [11.3,14.3]		4.6*
Secondary +	19.5 [15.8,23.9]		21.3 [17.8,25.3]		1.8
Wealth Quintile		*		*	
Lowest	6.6 [4.9,8.7]		9.8 [7.8,12.2]		3.2*
Second	7.2 [5.6,9.3]		10.3 [8.2,12.8]		3.1*
Middle	9.6 [7.5,12.2]		10.5 [8.1,13.6]		0.9
Fourth	5.4 [3.8,7.7]		13.9 [11.0,17.5]		8.5*
Highest	17.4 [14.7,20.5]		24.4 [21.3,27.9]		7.0*
Region		*		*	
Kigali city	18.2 [14.4,22.8]		22.4 [18.4,26.9]		4.2
South	9.7 [7.6,12.3]		15.4 [12.6,18.6]		5.7*
West	6.9 [5.2,9.1]		12.2 [9.7,15.2]		5.3*
North	5.7 [4.0,8.3]		9.2 [6.8,12.4]		3.5
East	8.5 [6.7,10.8]		10.9 [8.9,13.3]		2.4

Notes: * Indicates a significant p-value less than 0.05.;[1]p-value significance of the covariate in each survey; [2]Difference between the two surveys with the p-value significance of the difference.

Figure 8 **Percentage of women age 15-49 who delivered their most recent birth by Caesarean section in the 2 years before the survey, by background characteristics**







3.3 Postnatal Care

The early postnatal period is critical to maternal and child health. In sub-Saharan Africa, half of all postnatal maternal deaths occur during the week after childbirth and, of these, most occur within the first 24 hours (The Partnership for Maternal, Newborn, and Child Health 2006). Health check-ups during the first 48 hours after childbirth are an important strategy to detect complications and prevent maternal and child deaths. In Rwanda, the prevalence of postnatal check-ups within the first 2 days after birth improved dramatically, more than doubling between 2010 and 2014-15 among women age 15-49 with a birth in the past 2 years (Table 6).

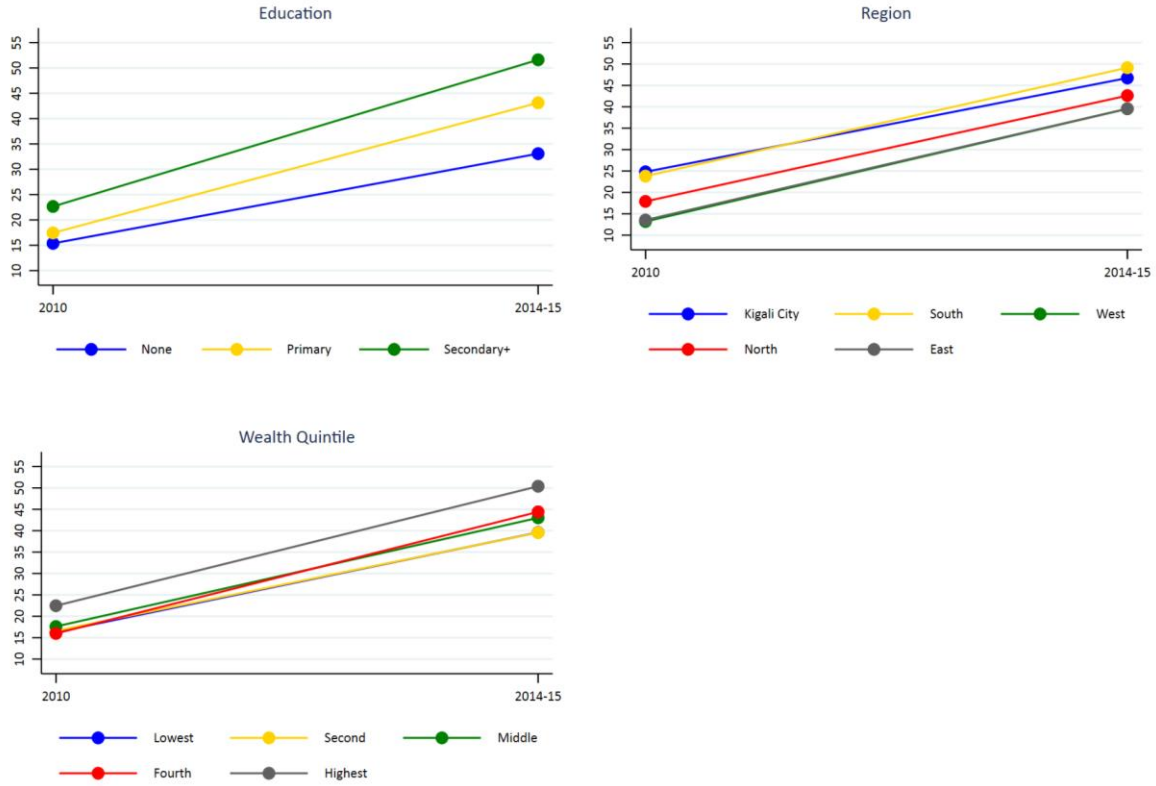
All subgroups by women's education, household wealth quintile, and region experienced a statistically significant increase in early postnatal check-ups between the surveys. Within each survey, however, postnatal care differs significantly by these indicators. As Figure 9 illustrates, disparities in postnatal care between groups by education and wealth worsened over the 5-year period. Specifically, the gap between women with no education and women with secondary education increased from 7 percentage points in 2010 to 19 percentage points in 2014-15, and the gap between women in the lowest and the highest wealth quintiles widened from 6 to 11 percentage points. Table 9 shows that disparities by wealth quintile increased significantly, with a significant increase in the concentration index (CIx=0.033 in 2010, CIx=0.082 in 2014-15, p-value of increase =0.042). Regional disparities persist, but Kigali city, with the highest level of postnatal care in 2010, experienced the smallest increase, 22 percentage points, while the West region, with the lowest level of postnatal care, experienced the largest increase, 26 percentage points.

Table 6 **Among women age 15-49 who had a birth in the past 2 years, the percentage who received a postnatal check-up within 2 days of delivering the most recent birth**

	2010		2015		
	% [C.I.]	p[1]	% [C.I.]	p[1]	Diff.[2]
Total	**17.6 [16.2,19.1]**		**43.0 [41.0,45.1]**		**25.5***
Education		*		*	
None	15.4 [12.7,18.5]		33.1 [28.8,37.7]		17.7*
Primary	17.4 [15.8,19.2]		43.1 [40.8,45.5]		25.7*
Secondary +	22.7 [18.5,27.5]		51.6 [47.1,56.1]		29.0*
Wealth Quintile		*		*	
Lowest	16.3 [13.7,19.2]		39.6 [36.0,43.3]		23.3*
Second	16.6 [13.9,19.8]		39.6 [36.1,43.2]		22.9*
Middle	17.6 [14.4,21.4]		43.0 [38.8,47.4]		25.4*
Fourth	16.0 [13.0,19.5]		44.4 [39.9,49.0]		28.4*
Highest	22.5 [19.1,26.3]		50.4 [45.8,54.9]		27.9*
Region		*		*	
Kigali city	24.8 [20.9,29.1]		46.7 [40.4,53.2]		21.9*
South	23.8 [20.6,27.3]		49.2 [45.0,53.3]		25.4*
West	13.2 [10.7,16.2]		39.5 [35.2,44.0]		26.3*
North	17.9 [14.3,22.2]		42.6 [38.0,47.4]		24.7*
East	13.6 [11.1,16.4]		39.6 [35.6,43.7]		26.0*

Notes: * Indicates a significant p-value less than 0.05.
[1]p-value significance of the covariate in each survey.
[2]Difference between the two surveys with the p-value significance of the difference.

Figure 9 **Percentage of women age 15-49 who received a postnatal check-up within 2 days of delivering their most recent birth in the 2 years before the survey, by background characteristics**



3.4 Problems accessing health care

During the women's interview, survey respondents are asked about problems in getting medical care. The question is phrased: *"Many different factors can prevent women from getting medical advice or treatment for themselves. When you are sick and want to get medical advice or treatment, is each of the following a big problem or not?"* The four possible problems women were then asked about are: getting permission to go to the doctor; getting money needed for advice or treatment; the distance to the health facility; and not wanting to go alone.

Table 7 shows the percentage of women age 15-49 affirming each possible problem in both surveys overall and by women's education, household wealth, and region. As Table 7 and Figure 10 show, the most frequently reported overall problem was getting money for treatment, with 53% of respondents reporting it as an issue in 2010, and 49% in 2014-15, a statistically significant decrease between surveys. The second issue most frequently reported was the distance to the health facility, at 26% in 2010 and 22% in 2014-15, a statistically significant decline. Not wanting to go alone to the facility was the third most frequently reported issue, at 17% in 2010 and 18% in 2014-15; the increase was not statistically significant. In 2010 and 2014-15, 3% of women who had given birth in the past 2 years reported that getting permission to seek medical treatment was a big problem. As Table 7 shows, problems getting medical care tended to differ significantly by education level, wealth, and region in both surveys, with the exception of getting permission to seek medical advice, which did not differ significantly by education in either survey.

Concentration indices of problems accessing medical care by wealth shown in Table 9 indicate that all are negative, meaning women in the higher wealth quintiles are less likely to experience problems getting care than women in the lower quintiles. Table 9 also shows that, with the exception of getting permission to seek medical care in 2010, the wealth inequality in all four possible problems in both surveys was also statistically significant. Also, the difference in concentration indices between surveys for all four possible access-related problems was negative and statistically significant, indicating increased inequality in these measures over the survey period.

Table 7 **Among women age 15-49, the percentage who reported serious problems in accessing health care for themselves when they were sick, by reason**

	Getting permission to go					Getting money for treatment					Distance to facility					Not wanting to go alone				
	2010		2015			2010		2015			2010		2015			2010		2015		
	% [C.I.]	p[1]	% [C.I.]	p[1]	Diff.[2]	% [C.I.]	p[1]	% [C.I.]	p[1]	Diff.[2]	% [C.I.]	p[1]	% [C.I.]	p[1]	Diff.[2]	% [C.I.]	p[1]	% [C.I.]	p[1]	Diff.[2]
Total	**2.6 [2.3,2.9]**		**2.7 [2.4,3.0]**		**0.1**	**53.0 [51.6,54.4]**		**49.3 [48.0,50.7]**		**-3.7***	**26.1 [24.5,27.8]**		**21.6 [19.9,23.3]**		**-4.6***	**17.1 [16.2,18.0]**		**17.6 [16.7,18.6]**		**0.5**
Education		*		*			*		*			*		*			*		*	
None	2.4 [1.8,3.2]		3.0 [2.3,3.9]		0.6	68.1 [65.8,70.4]		67.7 [64.7,70.4]		-0.5	30.2 [27.6,33.0]		27.2 [24.4,30.3]		-3	18.5 [16.8,20.3]		17.1 [15.3,19.1]		-1.4
Primary	2.5 [2.2,2.9]		2.7 [2.3,3.2]		0.2	53.6 [52.1,55.0]		53.3 [51.9,54.7]		-0.3	26.5 [24.8,28.2]		22.9 [21.1,24.8]		-3.6*	17.5 [16.5,18.5]		18.9 [17.8,20.0]		1.4
Secondary +	2.9 [2.3,3.7]		2.3 [1.9,3.0]		-0.5	36.2 [33.7,38.8]		28.8 [26.9,30.8]		-7.4*	20.8 [18.5,23.3]		15.0 [13.2,16.9]		-5.8*	14.2 [12.6,16.0]		14.5 [13.0,16.2]		0.3
Wealth Quintile		*		*			*		*			*		*			*		*	
Lowest	3.2 [2.4,4.1]		4.0 [3.2,4.9]		0.8	74.3 [72.2,76.4]		77.4 [75.5,79.2]		3.1*	31.3 [28.8,34.0]		29.5 [26.7,32.5]		-1.8	22.1 [20.1,24.1]		23.4 [21.5,25.4]		1.3
Second	2.6 [2.0,3.3]		2.7 [2.1,3.4]		0.1	61.4 [59.1,63.6]		63.0 [60.7,65.3]		1.6	28.2 [25.9,30.5]		28.3 [25.5,31.3]		0.2	18.3 [16.7,20.2]		20.7 [18.9,22.7]		2.4
Middle	2.0 [1.5,2.7]		2.4 [1.9,3.2]		0.4	55.2 [53.0,57.3]		51.0 [48.8,53.3]		-4.2*	28.6 [26.1,31.2]		22.9 [20.6,25.4]		-5.7*	18.6 [17.0,20.3]		19.3 [17.5,21.1]		0.7
Fourth	1.4 [1.1,2.0]		2.6 [2.0,3.4]		1.2*	45.1 [42.8,47.4]		36.2 [33.8,38.6]		-8.9*	27.8 [25.2,30.6]		21.9 [19.5,24.6]		-5.9*	15.6 [14.1,17.3]		16.7 [15.0,18.6]		1.1
Highest	3.6 [2.9,4.3]		1.8 [1.3,2.5]		-1.7*	31.9 [29.6,34.2]		24.1 [21.9,26.3]		-7.8*	15.9 [13.9,18.1]		7.7 [6.5,9.1]		-8.2*	11.6 [10.3,13.0]		9.6 [8.2,11.2]		-1.9
Region		*		*			*		*			*		*			*		*	
Kigali city	4.4 [3.6,5.4]		1.7 [1.0,2.8]		-2.7*	38.8 [34.7,43.1]		33.6 [29.6,37.9]		-5.2	15.2 [12.5,18.4]		10.2 [6.8,15.0]		-5.0	11.1 [9.3,13.2]		9.2 [6.8,12.3]		-1.9
South	3.3 [2.6,4.0]		2.4 [1.8,3.2]		-0.8	64.4 [62.1,66.8]		57.4 [54.6,60.3]		-7.0*	30.8 [27.6,34.2]		23.9 [20.4,27.7]		-6.9*	19.5 [17.7,21.3]		17.0 [15.1,19.0]		-2.5
West	1.3 [0.9,2.0]		3.7 [3.0,4.5]		2.4*	50.5 [47.1,53.9]		55.4 [52.5,58.2]		4.9*	20.7 [17.7,24.1]		26.3 [22.9,30.1]		5.6*	12.8 [11.3,14.5]		26.2 [23.9,28.5]		13.4*
North	3.3 [2.5,4.4]		4.2 [3.5,5.1]		0.9	46.1 [43.2,49.0]		46.7 [43.5,49.8]		0.5	21.5 [18.3,25.0]		18.4 [14.9,22.4]		-3.1	20.4 [18.4,22.7]		16.8 [14.9,18.8]		-3.7*
East	1.8 [1.3,2.4]		1.5 [1.0,2.2]		-0.2	56.0 [53.2,58.8]		46.4 [43.6,49.2]		-9.7*	35.6 [31.5,39.9]		23.4 [20.0,27.2]		-12.2*	19.7 [17.7,21.9]		15.8 [13.8,18.0]		-3.9*

Notes: * Indicates a significant p-value less than 0.05.
[1]p-value significance of the covariate in each survey.
[2]Difference between the two surveys with the p-value significance of the difference.

Figure 10 **Trends in reporting of four different problems in accessing health care, women age 15-49**

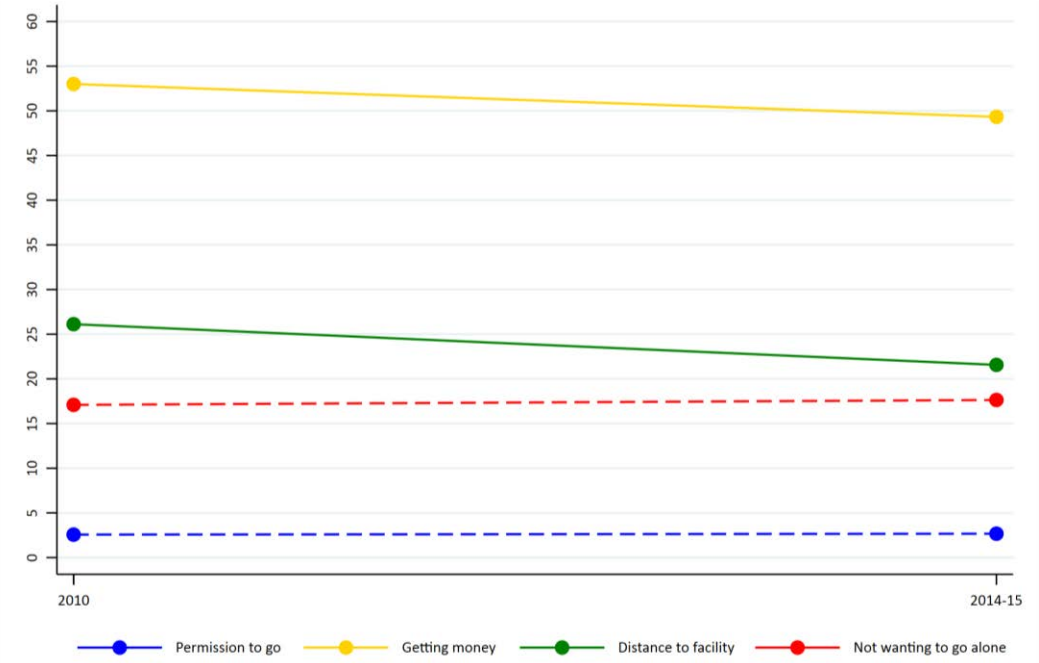


Table 8 shows the percentage of women reporting at least one of the four access-related problems in 2010 and in 2014-15, overall and by education level, wealth quintile, and region. The majority of women in both surveys reported at least one problem getting medical care—61% in 2010 and 59% in 2014-15—a statistically significant decline between surveys. Reporting at least one problem differed, and was statistically significant, by education level, wealth, and region in 2010 and in 2014-15. As Table 8 and Figure 11 illustrate, the greatest declines in reporting at least one problem accessing health care by education occurred among women with secondary or higher education, from 46% to 40%, a statistically significant decline. Meanwhile, women with no education experienced a modest decrease that was not statistically significant, from 74% to 73%. All regions except the West and North experienced a decrease in reporting at least one problem getting access to medical care, and the decline was statistically significant in the East and South regions. Notably, the West region experienced a statistically significant increase in the percentage of women reporting at least one problem accessing medical care.

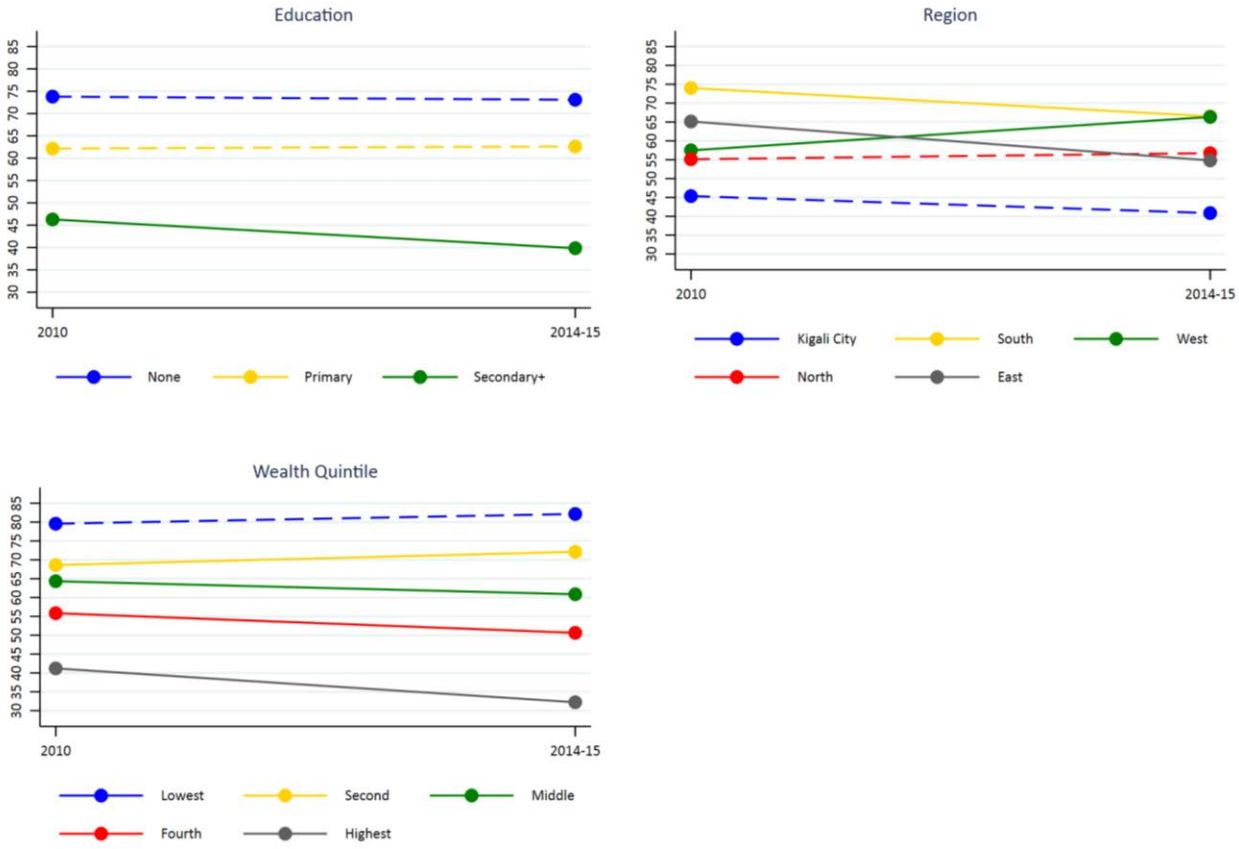
Among women who had given birth in the past 2 years, those in the highest wealth quintile experienced the greatest percentage-point decline in reporting at least one problem accessing medical care, from 41% in 2010 to 32% in 2014-15, a statistically significant difference. Meanwhile the percentage of women in the lowest wealth quintile reporting at least one problem appeared to increase, from 80% in 2010 to 82% in 2014-15, but the difference was not statistically significant. Concentration indices shown in Table 9 confirm statistically significant disparities by wealth in both surveys, as well as a statistically significant increase in the inequality of reporting at least one problem accessing medical care by household wealth status.

Table 8 **Among women age 15-49, the percentage who reported at least one serious problem in accessing health care for themselves when they were sick**

	2010		2015		
	% [C.I.]	p[1]	% [C.I.]	p[1]	Diff.[2]
Total	**61.4 [59.9,62.9]**		**58.6 [57.1,60.0]**		**-2.8***
Education		*		*	
None	73.8 [71.6,75.9]		73.1 [70.3,75.7]		-0.7
Primary	62.2 [60.7,63.7]		62.6 [61.1,64.1]		0.5
Secondary +	46.3 [43.6,49.0]		39.8 [37.6,42.2]		-6.4*
Wealth Quintile		*		*	
Lowest	79.6 [77.5,81.5]		82.2 [80.4,83.8]		2.6
Second	68.6 [66.4,70.7]		72.1 [70.0,74.2]		3.5*
Middle	64.3 [62.1,66.5]		60.9 [58.6,63.1]		-3.4*
Fourth	55.9 [53.4,58.3]		50.6 [47.9,53.4]		-5.2*
Highest	41.2 [38.8,43.7]		32.2 [29.9,34.7]		-9.0*
Region		*		*	
Kigali city	45.4 [41.4,49.4]		40.9 [36.5,45.3]		-4.5
South	74.0 [71.6,76.3]		66.5 [63.5,69.4]		-7.5*
West	57.5 [54.0,60.9]		66.3 [63.5,69.1]		8.9*
North	55.1 [51.9,58.2]		56.7 [53.3,60.2]		1.6
East	65.1 [61.8,68.3]		54.8 [51.8,57.8]		-10.3*

Notes: * Indicates a significant p-value less than 0.05. [1]p-value significance of the covariate in each survey. [2]Difference between the two surveys with the p-value significance of the difference.

Figure 11 **Percentage of women age 15-49 who had at least one problem accessing health care, by background characteristics**



3.5 Summary of disparities by wealth quintile

Table 9 summarizes the disparities for all the indicators by wealth quintile, using results from the concentration index. The concentration index takes into consideration all the wealth quintiles in its calculation. Except for the indicators of problems accessing health care, all the concentration index values in both surveys are positive, indicating that the indicator is more concentrated in the wealthier households. Ideally, we would like to see a concentration index that is not significantly different from zero; this would indicate that equality between the wealth quintiles was reached for the indicator. This only occurred for a few indicators. In 2010, three ANC components—taking iron supplements, having at least two tetanus toxoid injections, and being informed of the signs of pregnancy complications—had concentration indices that were not significantly different from zero. In 2014-15, the concentration index for being informed of pregnancy complications was significantly different from zero due to a significant increase in the concentration index from 2010. Having a serious problem getting permission to seek health care had a concentration index that was not significantly different from zero in 2010, but this became significant in 2014-15 due to a significant decline in the concentration index. However, the concentration index moved further away from zero (greater negative value), which is not the desirable outcome. In fact, as Figure 12 shows, all the indicators of problems accessing health care showed a significant decrease in the concentration index, but this was toward a greater negative value for the index, suggesting increased inequality in these outcomes by wealth. The concentration indices for C-section delivery and PNC check-up within 2 days of delivery both significantly increased between the two surveys toward greater inequality.

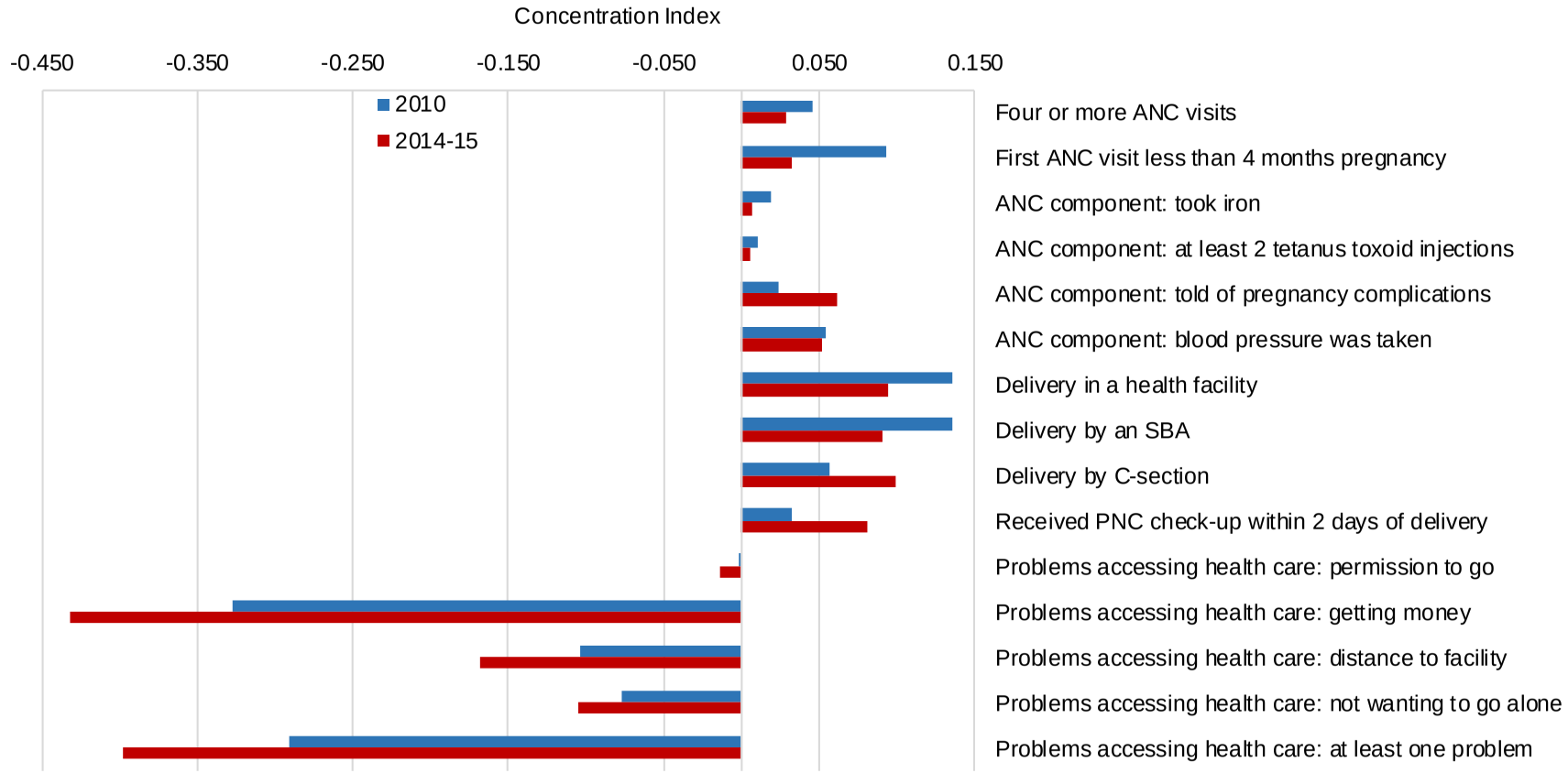
Table 9 Concentration index by wealth quintile for each indicator with tests of significance for each survey and for the difference between the surveys

Indicator	2010	p^1	2014-15	p^1	Diff.	p^2	p^3
Four or more ANC visits	0.046	**0.033**	0.029	0.207	-0.017	0.295	0.705
First ANC visit less than 4 months pregnancy	0.093	**<0.001**	0.033	0.167	-0.061	**0.031**	0.969
ANC component: took iron	0.019	0.208	0.007	0.581	-0.012	0.282	0.718
ANC component: at least 2 tetanus toxoid injections	0.011	0.470	0.006	0.732	-0.005	0.409	0.591
ANC component: told of pregnancy complications	0.024	0.115	0.061	**<0.001**	0.037	0.962	**0.038**
ANC component: blood pressure was taken	0.054	**<0.001**	0.052	**<0.001**	-0.002	0.445	0.555
Delivery in a health facility	0.136	**<0.001**	0.094	**<0.001**	-0.041	**0.024**	0.976
Delivery by an SBA	0.135	**<0.001**	0.091	**<0.001**	-0.045	**0.015**	0.985
Delivery by C-section	0.056	**<0.001**	0.099	**<0.001**	0.043	0.987	**0.013**
Received PNC check-up within 2 days of delivery	0.033	**0.048**	0.082	**<0.001**	0.049	0.958	**0.042**
Problems accessing health care: permission to go	-0.0002	0.964	-0.014	**<0.001**	-0.014	**0.006**	0.994
Problems accessing health care: getting money	-0.327	**<0.001**	-0.432	**<0.001**	-0.105	**<0.001**	1.000
Problems accessing health care: distance to facility	-0.104	**<0.001**	-0.168	**<0.001**	-0.064	**<0.001**	1.000
Problems accessing health care: not wanting to go alone	-0.077	**<0.001**	-0.105	**<0.001**	-0.028	**0.023**	0.977
Problems accessing health care: at least one problem	-0.290	**<0.001**	-0.398	**<0.001**	-0.107	**<0.001**	1.000

Notes: Significant p-values are indicated in bold; p^1 - two sided p-value to test if CI is different from zero; p^2 - one sided p-value for testing CIx 2015 < CIx 2010 (CI decreased); p^3 - one sided p-value for testing CIx 2015 > CIx 2010 (CI increased).

Some improvements were also observed according to the concentration index. Having at least four ANC visits and having the first ANC visit before 4 months of pregnancy had concentration indices that were significantly different from zero in 2010, but in 2014-15 both indicators had concentration indices that were not significantly different from zero. The ANC components of taking iron supplements and receiving at least two tetanus toxoid injections had concentration indices that remained not significantly different from zero in 2014-15. A significant move toward more equality between the wealth quintiles was observed for the indicators of first ANC visit before 4 months of pregnancy, delivery in a health facility, and delivery assisted by an SBA.

Figure 12 The concentration index for all indicators used in the analysis in both surveys



4 CONCLUSIONS AND RECOMMENDATIONS

Over the past 20 years, Rwanda has undergone rapid changes in its health sector. It has implemented a community-based health insurance program, strengthened local health systems, increased the numbers of community health workers, and undertaken a number of initiatives to improve maternal and child health. As several studies have documented, these improvements and initiatives in Rwanda's health sector have been followed by dramatic improvements in health outcomes: substantial increases in maternal and child survival, supplementation, immunization, and other gains in women's and children's health, along with a decline in fertility. Recently, however, Rwanda has experienced some stagnation in maternal health indicators that warrant additional investigation.

Our study assessed the levels, trends, and inequalities in maternal health indicators in Rwanda from 2010 to 2014-15 among women age 15-49, using nationally and regionally representative data from the Demographic and Health Surveys. We analyzed DHS data for 15 key indicators of maternal health: six related to antenatal care, three related to delivery, one related to postnatal care, and five related to barriers to accessing medical care. Levels and trends in these indicators were analyzed overall and by three background characteristics: women's education level, wealth quintile, and region. We tested the statistical significance of changes in these indicators between surveys in 2010 and 2014-15, both nationwide and by background characteristic, as well as the significance of the association between background characteristics and these maternal health outcomes. The concentration index was also used to examine inequalities in indicators between household wealth index quintiles. Tests showed whether the outcome was statistically significantly different from zero, a value indicating perfect equality between the all quintiles, whether the change in the concentration index between surveys was statistically significant, and if so, in what direction.

Our analysis found that, among women age 15-49 who had given birth in the 2 years before the survey, there was a statistically significant increase in the proportion who attended the recommended four or more antenatal care visits for their most recent pregnancy. Additionally, this group experienced a significant increase in having received at least one antenatal care visit before 4 months of pregnancy. The increases occurred across most subgroups, and according to the concentration index for the most recent survey, these two indicators did not significantly differ from a value indicating equality between the wealth quintiles. The percentage of women who had given birth in the 2 years before the survey completing the ANC components for their most recent pregnancy was relatively high (70%-80%) for all components except for receiving at least two tetanus toxoid vaccine shots, which was much lower, at about a third of women in both surveys. The results for the concentration index analysis showed several improvements in the ANC indicators, except a significant increase toward greater inequalities by wealth for being told of the signs of pregnancy complications during the ANC visit, indicating that this indicator is becoming more concentrated among women with greater household wealth.

The results for delivery in a health facility and delivery with skilled birth attendance were almost identical, and generally indicate that these indicators are almost reaching universal coverage. The significant increases overall reached 92% for both surveys and both indicators. The increases were among all subgroups, and the results for the concentration index indicate that these indicators are moving significantly toward more equality among the wealth quintiles. On the other hand, while prevalence of C-section delivery increased significantly, the concentration index indicates that the increase was accompanied by a greater inequality by household wealth and is becoming more concentrated among

women in wealthier households. C-section rates were also significantly higher in Kigali city compared with other regions. While C-section delivery can save lives of the mother and child when complications arise during delivery, the overuse of C-section delivery when it is not necessary should be avoided. Awareness campaigns on the risks of elective C-sections are recommended and especially focused on reaching wealthier households.

Among women age 15-49 who gave birth in the past 2 years, the percentage reporting a postnatal check-up within the first 2 days for their most recent birth doubled between surveys in 2010 and 2014-15. Nevertheless, only a minority of mothers in Rwanda (43%) received a postnatal check-up within 2 days after birth. While all subgroups experienced an increase in postnatal care, it remains significantly disparate by women's education, wealth quintile, and region; moreover, there is evidence of increased inequality in postnatal care between the richest and poorest households.

Two key barriers to accessing medical care when sick—getting money for treatment and distance to a health facility—were significantly less frequently reported in 2014-15 than 2010, as was at least one barrier to obtaining health care. Two other key barriers—getting permission to go, and not wanting to go alone—did not change significantly. With the exception of getting permission to seek health care, as measured by education level, women's reporting all four barriers and reporting any single barrier remained significantly different by education, wealth, and region. The evidence suggests that these wealth disparities are widening.

Overall, our evidence shows substantial improvements for six of nine key indicators of antenatal care, delivery care, and postnatal care in Rwanda from 2010 to 2014-15, as well as a reduction in two of four barriers to medical care and a decrease in reported barriers to care. This is good news. However, a majority of women age 15-49 who gave birth in the past 2 years still receive fewer than the recommended number of ANC visits, do not receive a postnatal check-up within 2 days, and report at least one serious problem in accessing health care.

Our study also shows that disparities in these outcomes persist by education, wealth, and region. Eleven of the 15 health indicators were significantly unequal by household wealth quintile in both surveys. Moreover, 8 of 15 indicators were significantly more unequal by household wealth status in 2014-15 than in 2010—being told of the signs of pregnancy complications, delivery by C-section, received PNC check-up within 2 days, all four barriers to medical care, and reporting at least one access-related problem. In contrast, having an ANC visit before 4 months of pregnancy, delivering in a health facility, and delivery by an SBA were significantly less concentrated by wealth over the study period. It can sometimes happen that gains occur faster among the wealthiest than among the poorest. Nevertheless, as maternal health care continues to improve in Rwanda, we recommend additional initiatives and outreach to socially disadvantaged groups, including women with no education, the poorest, and those in more disadvantaged regions, in order to ensure maternal health equity in Rwanda.

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