Are family planning program benefits equitably shared among population sub-groups in Africa?**

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1. Introduction

Underlying the Sustainable Development Goals (SDG) is the principle of ensuring that no one is left behind in the process of moving from lower to higher development levels. Within the SDGs, Goal 3.7 addresses the need to ensure universal access to reproductive health care services. Most of the available evidence on equitable access to services and equitable distribution of program benefits has addressed equity through only one of its dimensions – wealth status/quintiles. Within family planning (FP) programs, group differences in modern contraceptive use or in uptake of specific methods have usually been used as proxies for inequities in FP programs. It is important to note that group differentials in contraceptive use might not necessarily imply inequity as such differences might be partially caused by non-access factors that include attitudes, cultural norms and beliefs. Hardee et al., 2019 noted, for instance, that "Equity in family planning does not mean that all groups use contraception – or certain methods of contraception – necessarily at equal rates. Equity for family planning implies that all groups have the same access to information and services, and to all available methods of contraception, and that they are able to make decisions about their fertility and their use of contraception and act on those decisions. Equity implies that all groups have the same access to quality services, including removal of contraceptives, and that there are no differences in how they are treated by providers". The ability of individuals to realize their reproductive health intentions goes beyond access to and use of modern contraception. Multiple individual and society level factors including knowledge, attitudes, cultural norms, empowerment, beliefs as well as perceived need for contraception are often at play individually or collectively.

Studies have also varied in the way equity is measured. For example, Ross (2015) used the inter-survey difference in the quintile gaps in contraceptive use[1] to determine changes in inequity. Using this approach he found that the gap between the poor and the rich had reduced from 20.4 percentage points at the initial survey to 15.4 percentage points at the later survey and that the reductions were greater among countries that had stronger program effort scores. Using the percentage of women whose demand for modern contraception was met in the most recent DHS, Ortayli and Malarcher (2010) found that inequalities were present in all three dimensions of inequity (economic, social and geographical), more so for women ages 15-19 years. In their analysis of DHS data from 41 countries, Gillepsie et al (2010) used the concentration index (CI) to determine inequality in unwanted fertility, the dependent variable, and contraceptive use, the independent variable. They found that high unwanted fertility and low contraceptive use were more concentrated among poorer population sub-groups relative to the richer counterparts, a situation that was noted to represent an inequity. Gillespie et al also found that there were significant positive correlations between the CI for unwanted fertility and the CI for modern contraceptive use. In addition, a positive association also existed between the CI for modern contraceptive use and CI for the measure of family planning information availability (radio messages, knowledge of service and contact with field workers). A recent analysis of DHS Data from

[1] The quintile gap in contraceptive use is defined as the percentage point difference between the contraceptive use of the poorest quintile and the contraceptive use of the richest quintile in each of the first and second surveys included in the analysis. The gap change is the difference between the quintile gap at the initial survey and the quintile gap at the later survey.

USAID family planning priority countries[2] also revealed significant sub-population group variations in mCPR, percent demand satisfied and unwanted fertility for each of the countries. Although the analysis found that tremendous progress had been made on these indicators in many of the countries over the past decade, significant disparities still exist by residence, education, wealth quintiles and by age group, revealing potential inequalities in the distribution of these conditions. The analysis did not explore further to understand whether these inequalities represented inequities within these national programs (Feyisetan et al. 2018).

It should be noted that virtually all analyses of equity have focused on the economic dimension of inequity and have used mCPR as the dependent variable. In this analysis, three equity dimensions - wealth quintile, education and residence - are used and there are three major variables of interest: unwanted fertility (a measure of ability of women to realize their reproductive intentions - a reduction of which is one of the long-term goals of family planning programs[3]) ; the demand for contraception that is satisfied by a modern method (a measure of access to FP services); and the percentage of women who did not receive FP information from the radio, television or newspaper/magazine (a measure of exposure to information on FP services from the mass media)[4]. This analysis focuses on examining whether women with unwanted fertility are equitably distributed across population sub-groups defined by the equity dimensions. An equitable distribution occurs when a population sub-group's share of women with unwanted fertility is equal (or approximately equal) to their proportionate share of the total population at risk of having children. Because of the observed strong relationship between total fertility rate (of which unwanted fertility is a part) and the demand satisfied by a modern method (see figure 5a), the analysis also examines whether the distribution of women with demand for family planning satisfied by the equity dimensions is correlated with the observed distribution of women with unwanted fertility. Consequently, our major hypothesis is that the distribution of women with unwanted fertility and the distribution of women whose demand for family planning is satisfied by a modern method by the equity dimensions will be negatively correlated with each other. We also hypothesize that lack of access to information about family planning services from the mass media outlets (radio, TV and newspapers/magazines) will limit women's awareness about family planning services, thereby impacting their ability to make informed decisions about and take actions to realize their family size intentions. Since equity analysis requires the existence of population sub-group differences in the variables of interest, this analysis includes a determination of whether population sub-group differences

[2] The USAID FP priority countries are Afghanistan, Bangladesh, Democratic Republic of the Congo, Ethiopia, Ghana, Haiti, India, Kenya, Liberia, Madagascar, Malawi, Mali, Mozambique, Nepal, Nigeria, Pakistan, Philippines, Rwanda, Senegal, South Sudan, Tanzania, Uganda, Yemen and Zambia.

[3] The closer the level is to zero, the greater the benefits derived from family planning programs in terms of avoiding excess births.

[4] The StatCompiler has four indicators on exposure to FP program through the mass media: FP information received from the radio; FP information received from the television, FP information received from the newspaper/magazine and FP information not received from any of the three media outlets. Our initial plan was to examine the effects of a variable 'exposure to FP information from any mass media outlet' on demand satisfied. Since we could not obtain this variable by adding the first three categories together because they are not mutually exclusive, we chose the last indicator which is exclusive of the other three indicators. Consequently, our analysis focuses on non-exposure rather than exposure to FP messages from mass media outlets.

(inequalities) exist in the three variables by the three equity dimensions above. We also examine how the population sub-group differences have changed in the past two decades. In addition, we examine whether reducing inequalities in the demand for contraception that is satisfied by a modern method could be associated with or lead to reductions in inequalities in unwanted fertility. The role of information disseminated through the mass media on the demand for contraception that is satisfied by a modern method is also examined. More specifically we examined:

1. The levels of and changes in unwanted fertility, the percent of demand for contraception that is satisfied by a modern method and non-exposure to family planning information from the mass media in the past two decades (2000- 2018).
2. The inequalities (measured by concentration indices) in unwanted fertility, the percent of demand for contraception that is satisfied by a modern method and access (or non-access) to family planning information from the mass media by education, residence and wealth quintile.
3. How the inequalities in the three variables (using the CIs) correlate with one another within each of the three dimensions of equity.

2. Methods:

The analysis uses Demographic and Health Survey (DHS) data from 29[5] African countries. A DHS, conducted by Macro International, is a nationally representative cross-sectional survey that uses a stratified cluster probability sampling design, with clusters providing the primary sampling unit. Within each selected cluster, households in which eligible respondents will be interviewed are randomly selected using a probability sampling technique[6]. The values of the variables of interest were extracted from the Demographic and Health Surveys (DHS) Statcompiler (www.statcompiler.com, which contains data from surveys conducted at different points in time. Because of the desire to examine changes in the variables of interest within the past two decades, only countries with two or more surveys after 2000 were included in the analysis. For each county, two surveys were selected with the first one conducted before 2010 and the second one after 2010. Where feasible we selected two surveys that were conducted about ten years apart to allow time for notable changes in fertility levels and patterns.

As indicated above, the three major variables for this analysis are unwanted fertility, the percentage of demand for contraception that is satisfied by a modern method and the percentage of women not exposed to family planning messages disseminated through any of the mass media channels - radio, television or the newspaper/magazine. The unwanted fertility rate (UFR) is estimated as the difference between the total fertility rate (TFR) and the wanted fertility rate (WFR). The DHS provides estimates of

[5] The 29 African countries are Benin, Burkina Faso, Burundi, Congo. Congo DR, Cote d'Ivoire, Egypt, Ethiopia, Ghana, Guinea, Kenya, Lesotho, Liberia, Malawi, Mali, Mozambique, Namibia, Niger, Nigeria, Rwanda, Senegal, Sierra Leone, South Africa, Tanzania, Togo, Uganda, Zambia, and Zimbabwe

[6] Although a few of the countries have more recent data on contraceptive use from the Multiple Indicator Cluster Survey (MICS), the AIDS Indicator Survey (AIS) or the Malaria Indicator Survey (MIS), such data could not be used for this analysis for two reasons: (i) The fertility measure of interest (unwanted fertility) could not be obtained from such surveys; and (ii) The desired measures of access or exposure to contraceptive services/information are either not available in these surveys or unavailable by desired dimensions of equity (education, wealth quintile and place of residence).

TFR and WFR. The TFR is the total number of births a woman would have at the end of her childbearing period if she passed through this period bearing children at the observed age-specific rates. In line with the DHS definition, for this analysis we consider a birth as wanted if the number of children living at the time of conception is less than the ideal number reported by the female respondent. If the number of living children was equal to or greater than the ideal number of children, we classify the birth as unwanted.

For this analysis we assume that each woman has a level of demand for family planning that is informed by the desired number of children to have and the desired time to have them. This level of demand is estimated in DHS from responses to a series of questions on desired number of children, use of contraception and desire for another child. The total demand for family planning is broken into three components – demand satisfied by a modern method, demand satisfied by a traditional method and demand not satisfied by any method. We classify women who either desired no additional children or wanted to postpone/delay the next childbirth and were using a modern method at the time of the survey as having their demand for family planning satisfied by a modern method. Women who either desired no additional children or wanted to postpone/delay the next child birth and were using a traditional method were classified as having their demand for family planning satisfied by a traditional method[7]. Those who either desired no additional children or wanted to postpone the next child and were not using any type of method were classified as having their demand for family planning unmet. The proportion of women whose demand is satisfied by a modern method is thus the number of women in the first category divided by the total number of women in the three categories. In the rest of this paper, we will sometimes refer to this variable simply as 'demand satisfied'. Compared to contraceptive use, this indicator is less influenced by cultural beliefs and attitudes since it is the percentage of each population sub-group's total demand for contraception that is satisfied with modern contraceptive methods. With the demand for family planning satisfied by a modern method, what we are comparing between groups is not the levels of need or use (which might be influenced by cultural norms, beliefs and attitudes) but the percentage of expressed/ascribed/implied need that is satisfied by a modern method. Consequently, the population sub-group differences in this variable tend to more accurately reflect differences in access to FP program services than contraceptive use.

We measure exposure to FP messages by the percentage of women of reproductive ages who had not heard of FP from any of three mass media sources; the radio, the television and newspaper. In the rest of this paper, we will sometimes refer to this variable simply as 'non-exposure to family planning information through mass media'. As indicated above, the three dimensions of equity included in the analysis are place of residence, education and wealth quintiles. These equity dimensions are measured as defined in DHS: women living in the rural areas and those living in the urban areas (place of residence); women with no formal education, women with primary education, women with secondary education and women with post-secondary education (education); women in the lowest, second lowest, middle, fourth and highest wealth quintiles (wealth quintiles- as defined by Macro International from information on household assets).

[7] Women using traditional methods are assumed to have an unmet need for modern contraception.

We estimated concentration indices to determine whether women who have unwanted fertility, who have their demand for family planning satisfied or who did not receive FP messages from any of the three mass media outlets were disproportionately concentrated among some population sub-groups defined by levels of the three equity dimensions[8]. Pearson's correlation coefficients were used to examine whether the distributions of women with unwanted fertility were correlated with the distributions of women who have their demand for contraception satisfied by a modern method or who did not receive FP information from any of the three mass media sources within each equity dimension. The significance of the correlations between the CIs for unwanted fertility and the CIs for demand satisfied and between the CIs for demand satisfied and the CIs for non-exposure to family planning information from the identified outlets was determined at p<=0.05.

3. Results

3.1. *Levels of and trends in unwanted fertility, percent of demand for contraception satisfied by a modern method and access to family planning information through mass media by the three equity dimensions*

Figures 1-3 show the levels, differentials and changes in unwanted fertility, demand satisfied and the percentage of women who have not heard family planning messages from any of the mass media channels (radio, television and newspaper/magazines), respectively. Figure 1 shows that although levels of unwanted fertility have declined over time across population sub-groups defined by levels of the three equity dimensions, considerable population sub-group differences still exist. The figure shows that women living in rural areas had significantly higher unwanted fertility than their urban-based counterparts at both surveys (0.93 in the urban vs. 0.61 in the rural at Survey 1 and 0.85 in the urban vs. 0.49 in the rural at Survey 2). With respect to education, the mean unwanted fertility was highest among women with primary education and lowest among women with post-secondary education at both surveys (0.97 among women with primary education vs. 0.27 among women with post-secondary education at Survey 1 and 0.85 among women with primary education vs. 0.23 among women with post-secondary education at Survey 2). Unwanted fertility also varies by wealth quintiles- women in the lowest wealth quintile had the highest levels and those in the highest wealth quintile the lowest levels at the two surveys (1.00 among women in the lowest quintile vs. 0.60 among women in the highest quintile at Survey 1 and 0.96 among women in the lowest quintile vs. 0.43 among women in the highest quintile Survey 2). This result shows that unwanted fertility decreased as women's household wealth status improved. Figure 2 shows that the percentage of women whose demand for contraception was satisfied by a modern method increased over time among all population subgroups but substantial population sub-group differences still exist. The increases were bigger among women in the rural areas, women with no education and those in the lowest wealth quintile. However, the demand satisfied was significantly higher in the urban than rural areas at the two surveys (49% in the urban vs. 30% in the rural area at Survey 1, and 58% in the urban vs. 45% in the rural area at Survey 2). Women with no education had the lowest levels of demand satisfied and those with post-secondary education had the highest levels (23% of women with no education vs. 62% of women with post-secondary education at

[8] See PovertyNet, World Bank, Quantitative Techniques for Health Equity Analysis, Technical Note #7

Survey 1, and 39% of women with no education vs. 66% of women with post-secondary education at Survey 2). Also, the demand satisfied increases with wealth quintile with women in the lowest and highest wealth quintiles having the lowest and highest values, respectively, at both surveys (23% of women in the lowest wealth quintile vs. 52% of women in the highest wealth quintile at Survey 1, and 38% of women in the lowest quintile vs. 60% of women in the highest wealth quintile at Survey 2).

Figure 3 shows a slight increase in the percentages of women who have not received information from any of the three mass media channels. The figure also shows that considerable population sub-group differences still exist in non-exposure to family planning information from the mass media channels. For instance, women in the rural areas were more likely than their urban counterparts to report non exposure to mass media FP messages at the two surveys (59% in the rural areas vs. 36% in the urban at Survey 1, and 61% in the rural vs. 41% in the urban area at Survey 2). With respect to education, the percentage reporting non-exposure to mass media FP messages was highest among women with no education and lowest among women with post-secondary education at the two surveys (65% among women with no education vs. 18% among women with post-secondary education at Survey 1, and 68% among women with no education vs. 23% among women with post-secondary education at Survey 2). The women in the lowest wealth quintile were most likely and those in the highest quintile least likely to report non-exposure to mass media FP planning messages at the two surveys (71% among women in the lowest quintile vs. 32% among women in the highest quintile at Survey 1 and 72% among women in the lowest quintile vs. 35% among women in the highest quintile at Survey 2)

*3.2. **Inequalities in unwanted fertility, demand for contraception satisfied by a modern method and access to family planning information through mass media outlets by education, residence and wealth status (Concentration indices)***

As indicated earlier, the major focus of this analysis is an examination of whether women with unwanted fertility, women who have their demand for contraception satisfied by a modern method or women who did not receive a family planning message from any of the mass media outlets are disproportionately concentrated among some population sub-groups defined by where they live (urban or rural), education and wealth status. If so, are the uneven distributions of women with unwanted fertility by the equity dimensions correlated with the uneven distributions of women who had their demand for contraception satisfied by a modern method? Also, are the uneven distributions of women with demand satisfied correlated with those of women who had no access to family panning information disseminated through the mass media outlets? The levels of unevenness (inequality) in the distributions of unwanted fertility and the contraception variables by the equity dimensions were measured by concentration indices[9]. Figure 4 shows the levels of and trends in the concentration indices for unwanted fertility, percent demand for family planning that is satisfied by a modern method and

[9]The further the concentration indices are from zero, the greater the unevenness in the distribution of women (inequality) by the equity dimension. A negative value shows that women with unwanted fertility, who had their demand for contraception satisfied by a modern method or women who did not receive FP information through the radio, television or newspaper/magazine are disproportionately concentrated among the rural women (residence) and women at lower levels of education (education) and wealth status (wealth quintiles); on the other hand, a positive value indicates that women with these conditions are disproportionately concentrated among urban women and women at higher levels of education and wealth quintiles.

percent not exposed to mass media family planning messages by the three equity dimensions. For unwanted fertility, the CIs are negative for all equity dimensions indicating that women with unwanted fertility were disproportionately concentrated among the rural women, women with no or little education and those at lower levels of the wealth quintiles. In addition, the unevenness in the distribution of unwanted fertility by the equity dimensions increased slightly between surveys 1 and 2 and is most pronounced when examined by wealth status, followed by education and residence.

The CIs for the percentage of women whose demand for contraception is satisfied by a modern method are positive, implying that women whose demand for contraception is satisfied by a modern method are disproportionately concentrated among the urban, highly educated women and women in higher wealth quintiles. Unlike the trend in unwanted fertility, the unevenness in the distribution of women whose demand for contraception is satisfied by a modern method declined between the two surveys, indicating improved proportionate distribution in favor of women in the rural areas and those at lower levels of education and wealth quintiles over time. As with unwanted fertility, the unevenness in the distribution of women with demand for contraception satisfied by a modern method is most pronounced when examined by wealth status, followed by education and residence.

The negative CIs for non-exposure to mass media family planning messages show that women who did not obtain FP information through these outlets were disproportionately concentrated among the rural women, women with no or little education and those at lower levels of the wealth quintiles. The CIs remained the same for the two surveys, indicating that there is no change in the proportionate distribution of women not exposed to mass media FP information over time. Similar to both unwanted fertility and women whose demand for contraception is satisfied by a modern method, the unevenness in the proportionate distribution of women with no access to mass media FP messages is most pronounced when examined by wealth status, followed by education and residence.

3.3. ***Correlations between inequality in unwanted fertility and inequality in percent demand satisfied (CIs) by residence, education and wealth status.***

Using four criteria, one of which is undesirability of unwanted fertility, Gilepsie et al (2007) noted that the disproportionate concentration of women with unwanted fertility among the poor reflects the disproportionate concentration of women who were not using contraception among them. The authors argued that by promoting more equitable access to family planning information and services, differences in unwanted fertility will reduce. The current analysis builds upon these assumptions but uses the percent of demand satisfied by a modern method instead of modern contraceptive use[10]; we also added two equity dimensions of education and residence. For this analysis, we hypothesize that the disproportionate concentration of unwanted fertility among women in rural areas, with lower levels of education and in lower wealth quintiles will be reduced by better satisfying their demand for modern contraception. Although unwanted fertility might result from contraceptive use failure, we assume that in most cases unwanted fertility results from not using a modern method to back up a desire to delay or prevent a pregnancy. As part of the analysis, we also examine whether improving exposure of rural

[10] We indicated earlier in the methods section why we prefer demand satisfied to contraceptive use.

women and those with lower levels of education and in lower wealth quintiles to mass media FP information will improve the fraction of their demand that is satisfied by a modern method.

The correlations between the inequality in unwanted fertility and inequality in the demand for contraception that is satisfied by a modern method are presented in figures 5-7, by residence, education and wealth quintile, respectively. As discussed in the methods section, the levels of correlations between the inequalities in the three variables were determined using the Pearson's correlation coefficients and the strength of the association was determined to be significant at P- value of <= 0.05.

Figure 5 shows that at survey 1 there was an insignificant positive correlation (r=0.205, p = 0.284) between the inequality in unwanted fertility and inequality in the demand satisfied by residence. However, by survey 2, the positive correlation between the two inequalities by residence has become statistically significant (r = 0.464, p = 0.011) suggesting that as more women in rural areas had their demand for contraception satisfied by a modern method, their disproportionately high share of women with unwanted fertility became significantly reduced. Figure 6 shows that the inequality in unwanted fertility by education and the inequality in demand for contraception that is satisfied by a modern method by education are significantly positively correlated at both surveys (r=0.506, p=0.005, survey 1; r=0.447, p=0.015, survey 2). The significant positive correlations suggest that when the percentage of demand for contraception that is satisfied by a modern method increases among the lower educated women, their levels of unwanted fertility and consequently their disproportionately high share of women with unwanted fertility might decline significantly. As observed for residence an insignificant positive correlation exists between the inequality in unwanted fertility by wealth quintiles and inequality in demand satisfied by wealth quintile at survey 1 (Figure 7). However, at the time of Survey 2, a statistically significant positive correlation existed between the inequality in unwanted fertility by wealth quintile and inequality in demand satisfied by wealth quintile (r=0.263, p=0.168, survey 1; r=0.568, p=0.001, survey 2). The significant positive correlation at Survey 2 suggests that when the percentage of the demand for contraception that is satisfied by a modern method increases among women at lower levels of the wealth quintile, their levels of unwanted fertility and consequently their disproportionately high share of women with unwanted fertility might reduce significantly.

3.4. ***Correlations between inequality in the demand satisfied by a modern method and inequality in non-exposure to family planning information from mass media outlets (CIs) by residence, education and wealth status.***

As a part of the DHS, women are asked to state whether they have heard or seen family planning messages on the radio, television or newspaper/magazine. As explained earlier, this analysis uses the percentage of women who have not received family planning messages from any mass media outlet, one of the indicators created in StatCompiler to assess access to mass media FP information. As part of this analysis, we also examine whether the distributions of women who have not heard about family planning from any mass media channel are correlated with the distributions of women whose demand for contraception was satisfied by a modern method within the three equity dimension. The correlations between the inequality in the demand for contraception that is satisfied by a modern method and the

inequality in the percentage of women who have not received mass media FP information are shown in figures 8-10, by the three equity dimensions.

Figure 8 shows a non- statistically significant negative correlation between the inequality in the percentage of women not exposed to mass media FP information by residence and the inequality in demand satisfied by residence at the two surveys. This observation implies that a reduction in the disproportionate rural concentration of women with no exposure to FP messages from the mass media channels may not necessarily be associated with significant increases in the proportion of women in the rural areas whose demand for contraception is satisfied by a modern method. Similar non-significant but positive correlations exist between the inequality in the percentage not exposed to mass media FP information by education and inequality in demand satisfied by education (Figure 9) and between the inequality in the percentage not exposed to mass media FP information by wealth quintiles and inequality in demand satisfied by wealth quintile (Figure 10). The non- statistically significant positive correlations might reflect a situation in which considerable proportions of women not exposed to mass media FP messages were exposed to information from other sources such as inter-personal, small group and community level meetings.

4. Discussion

A significant progress has been made to increase awareness and use of family planning in most of the low income countries following the inclusion of measures of access to and use of contraception in the Millenial Development Goals (MDG) and the Sustainable Development Goals (SDG). In addition, the launching of the Family Planning 2020 (FP2020) initiative and increased availability of evidence linking fertility rates with countries' ability to benefit from the demographic dividend have added to increased country support and commitment to family planning programs. Despite the progress that has been made in reducing the gap in access to and use of modern contraception between population sub-groups, disparities in fertility and use of contraceptive methods by residence, education and wealth status are still present in most of these countries. As remarked by Gillespie et al, disparities in the distribution of total fertility rates and contraceptive use may not represent inequities as they may not reflect the desires for children or contraception within the different subpopulations. Data from DHS has shown that women and couples living in rural settings, with lower education, and in lower wealth quintiles tend to desire more children than their counterparts in urban, with higher education and in higher wealth quintiles, respectively. Taking the above observations into account, we identified unwanted fertility as an appropriate measure of the long-term benefits of family planning programs as well as equity.

A key objective of this analysis was to examine whether the benefits of family planning programs are equitably shared among population sub-groups. Currently the performance of family planning program is often measured by mCPR, which measures access to and use of modern contraception but does not take into account women's and or couples preferences for the number of children desired or expressed need for contraception. For this analysis we used percent of demand satisfied by a modern method as the independent variable given that its estimation takes into account women's expressed need for contraception. We also assumed that the level of unwanted fertility is a reflection of how much a family

planning program has helped individuals or population sub-groups achieve their reproductive intentions. The lower the level of unwanted fertility, the higher the benefits of the FP program in terms of preventing excess births. By its definition, unwanted fertility is excess births over what the women desired to have and probably would have prevented had they adequate access to the means to do so. Thus, women with higher burdens of unwanted fertility are likely to be those who have not been able to adequately access the family planning program services. In this analysis, we see the demand for contraception that is satisfied by a modern method as a measure to address the issue of unwanted fertility and therefore enabling women to realize their reproductive intentions. Consequently, we examined the extent to which the demand for contraception of different population sub-groups was satisfied by a modern method. Also, in terms of awareness generation on availability of services, we examined the extent to which exposure/non-exposure to information disseminated through the radio, television or newspaper/magazine influences the amount of demand for contraception that was satisfied by a modern method.

Our results show that in the 29 African countries included in this study, unwanted fertility declined over the same period that demand satisfied by a modern method and non-exposure to mass media family planning information increased. We also found that despite the reductions over time, disparities still exist in unwanted fertility, demand for family planning satisfied by a modern method and access to mass media FP information by residence, education and wealth quintiles[11]. The analysis by Choi and Short-Fabric (2018) also showed that although between-group disparities in demand satisfied have declined as demand satisfied increased, the disparities still exist. Our analysis shows that rural women and women with lower levels of education and at lower levels of the wealth quintile still lag behind with respect to reducing levels of unwanted fertility and having their demand for contraception satisfied by a modern method. In addition we found significant positive correlations between the CIs for unwanted fertility and CIs for demand satisfied suggesting that unwanted fertility of rural women and women at lower levels of education could be reduced significantly by more adequately satisfying their demand for contraception by a modern method.

Despite the persistent disparities in the analysis, the inter-survey increases in use of modern contraception were bigger among women in the rural areas, women with no education and those in the lowest wealth quintile. This suggests that recent shifts in programming in most of these countries that has targeted rural women are beginning to pay off. Fortunately, there are evidence- based practices that can be used to address the inequities highlighted in this analysis – the High Impact Practices. For instance, many countries have adopted policies that support task-shifting of the provision of family planning services to health provider cadres that are readily available in rural areas. Countries have also tested and are implementing strategies such as vouchers, social marketing, social franchising and community insurance that address financial barriers to family planning services. Preliminary evidence on the implementation of these strategies is emerging and has shown some success in addressing these inequities.

[11] Across countries, there are wide variations in levels of unwanted fertility, demand satisfied by a modern method and non-exposure to FP information from the mass media outlets. Also, the inequalities in these variables vary considerably across the countries.

We also found that there was great overlap between the three equity dimensions. A high proportion of women at lower levels of education and wealth quintile are also in the rural areas. Consequently, programs designed to reach rural women will also likely reach significant proportions of women at lower levels of education and wealth quintile.

The variable, non-exposure to family planning messages delivered through the mass media channels of the radio, television or the newspaper/magazine, was included in this analysis to determine whether increased exposure to FP information through these outlets will increase women's chances of having their demand for contraception satisfied by a modern method. In their paper, Gillespie et al (2007) found that increased exposure to family planning information disseminated on the radio had high potential to increase modern contraceptive use. Unlike the findings by Gillepsie and others, our findings suggest that increased exposure to information disseminated through any of the three sources may not have significant impact on the demand for contraception satisfied by a modern method[12]. Rather than suggesting that investments in FP information dissemination are no more necessary to improve uptake of family planning services, our results may be reflecting the changing structure of information delivery strategies over the years. Information sharing on FP has gradually moved from the big media channels to inter-personal contact, small group and community level meetings. Unfortunately, we do not have the data to determine how information obtained from these new strategies affect FP service uptake.

In summary, our analysis shows that over time there have been significant reductions in unwanted fertility and significant increases in the demand for contraception that is satisfied by a modern method. However, there are still considerable disparities by residence, education and wealth quintiles and FP programs need to implement evidence based interventions at scale in order to reduce these gaps further and help women and couples achieve their reproductive intentions.

[12] We examined the correlations between the CIs for non-exposure to information disseminated from the three sources and the CIs for modern contraceptive use and the results are similar to what we reported here.

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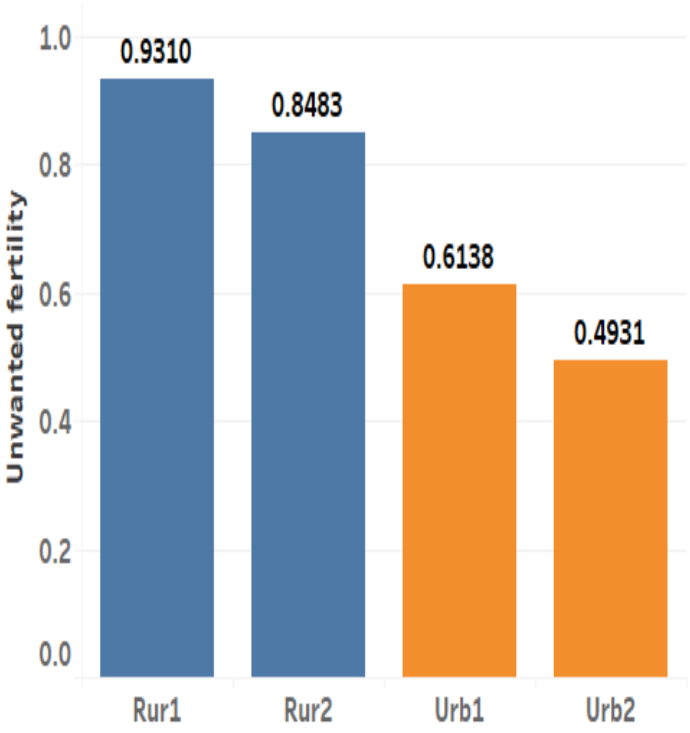
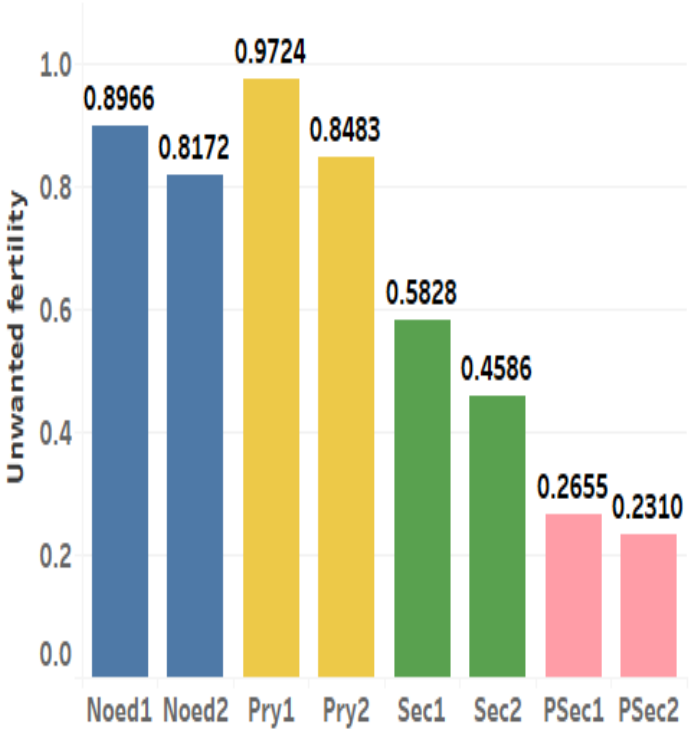
Figure 1. Despite declines in unwanted fertility over time, some differences still exist

By residence



By education



By Wealth Quintile

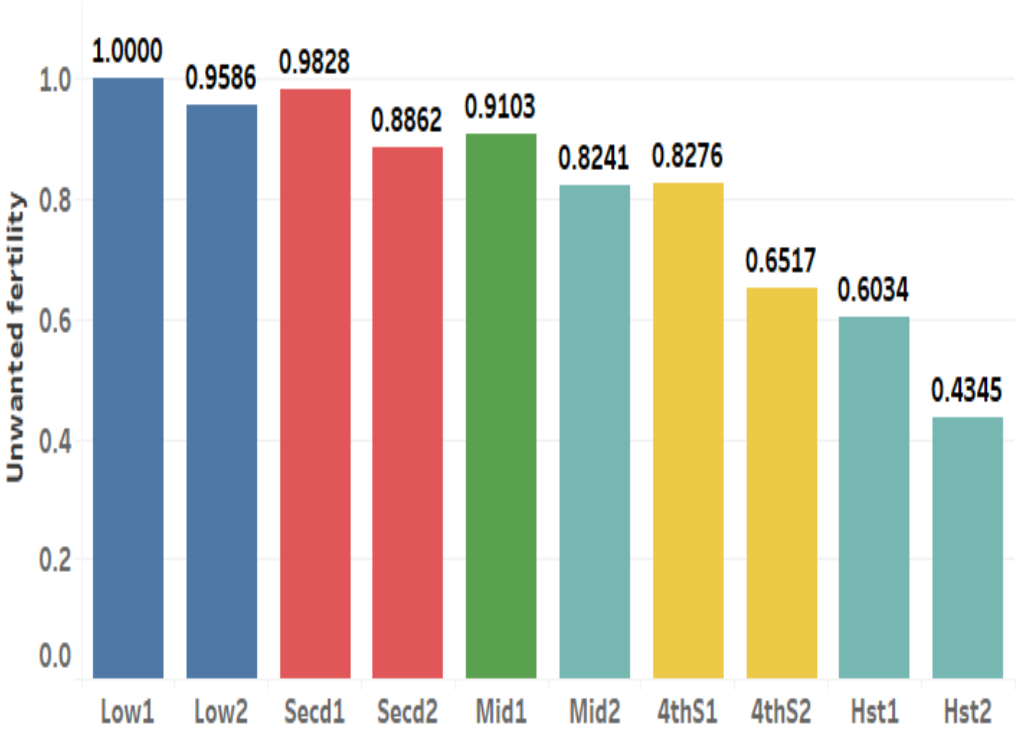
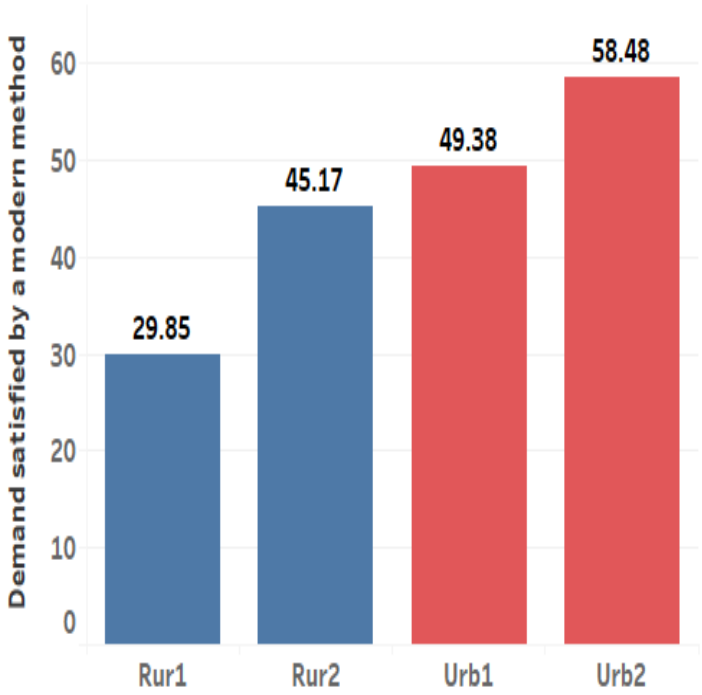
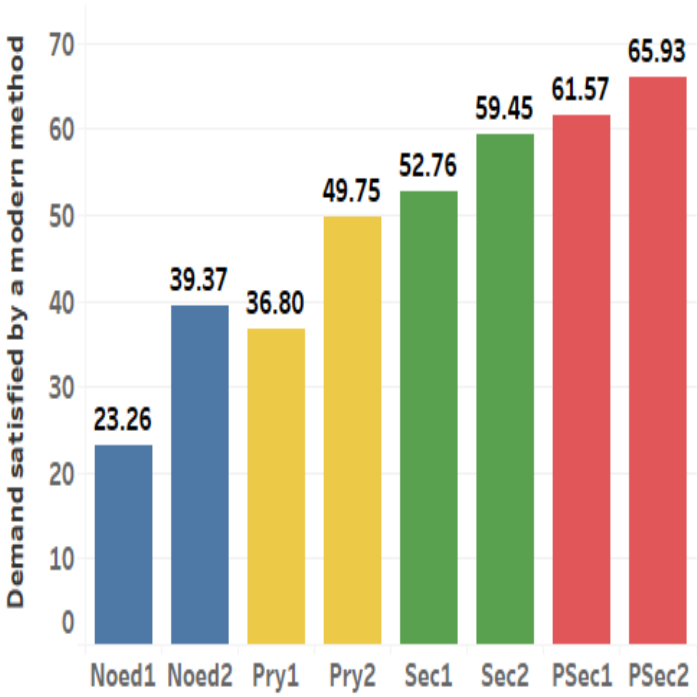


Figure 2. Despite some increases in demand satisfied by a moderen method over time, some differences still exist

By residence



By education



By Wealth Quintile

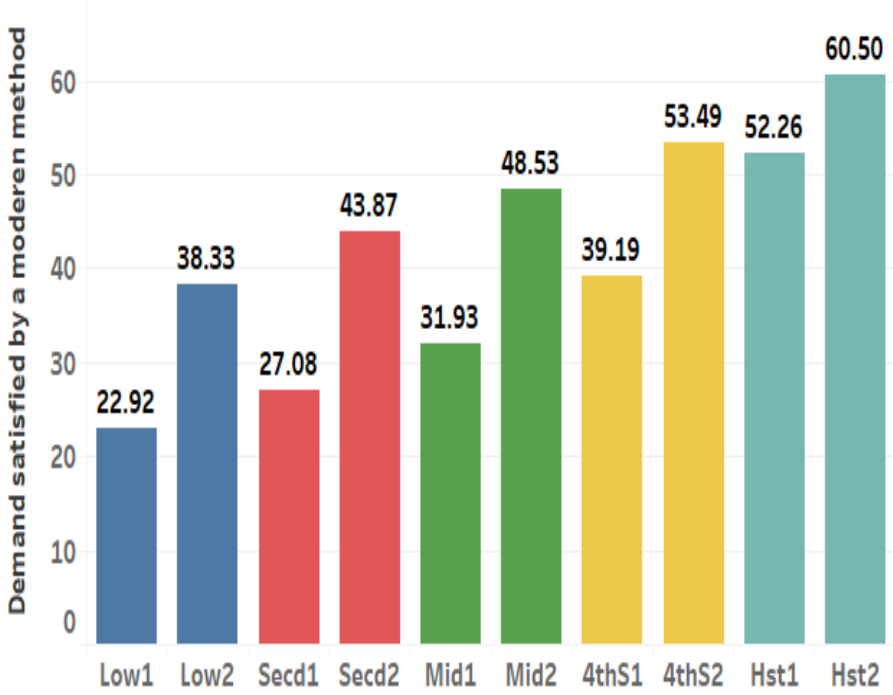


Figure 3. Considerable differences exist in the percentage not exposed to FP messages through radio, television or newspaper/magazine by:

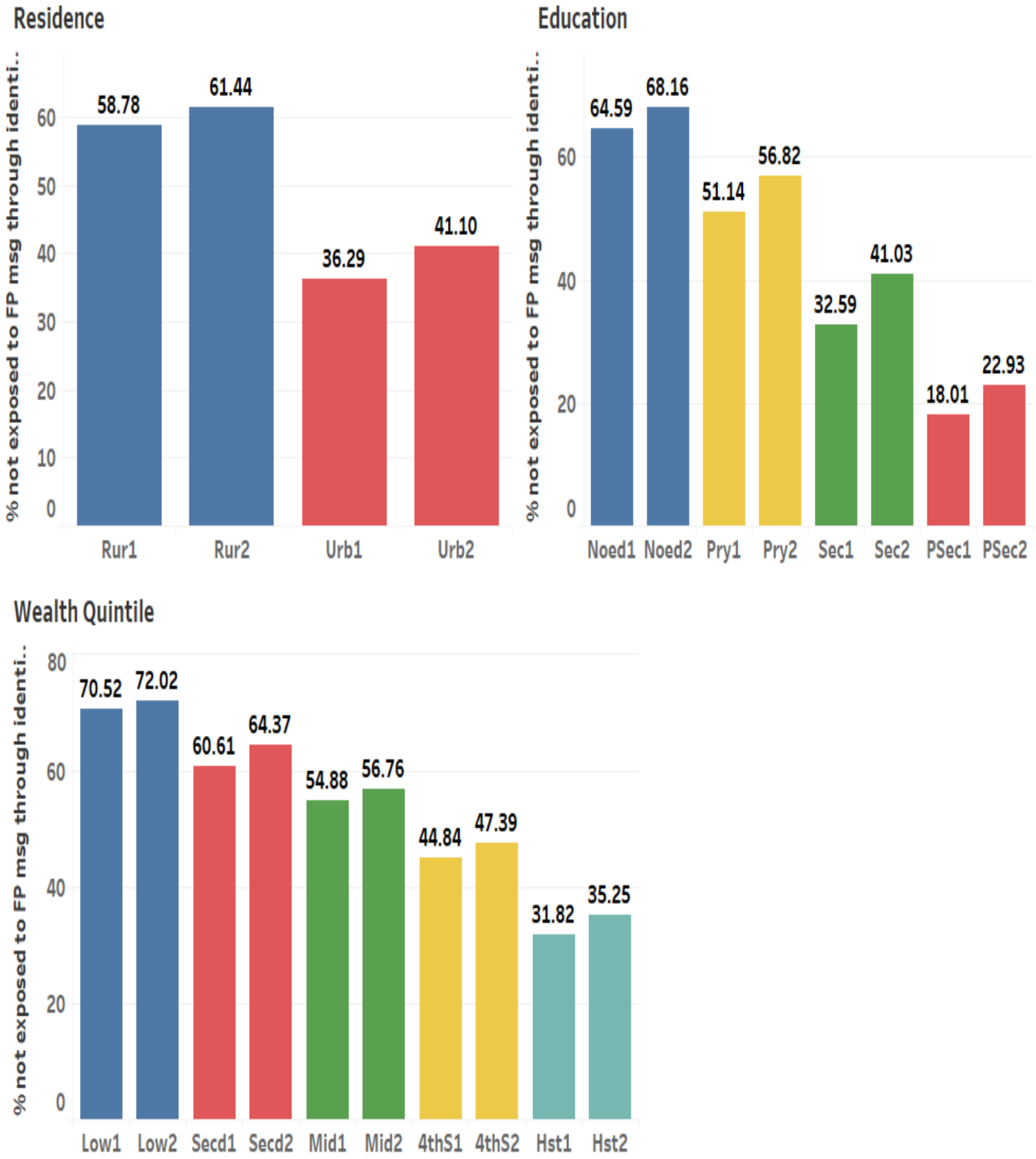


Figure 4. Concentration indices show that women with unwanted fertility, demand satisfied and not exposed to FP messages through radio,TV or newspaper are disproportionately distributed by residence, education and wealth quintile

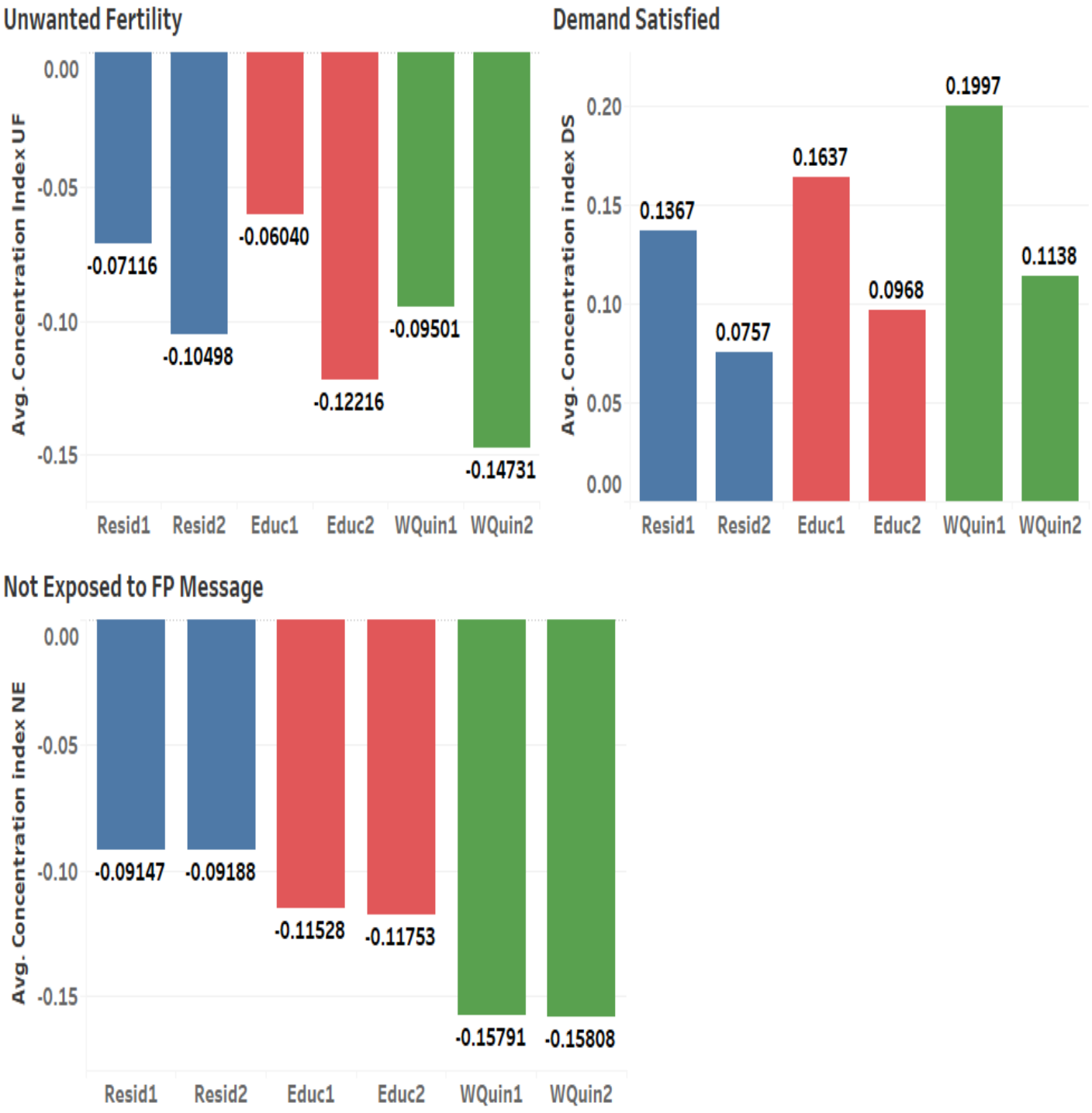


Figure 5a. Highly significant negative correlation between total fertility rate and demand satisfied by a modern method:

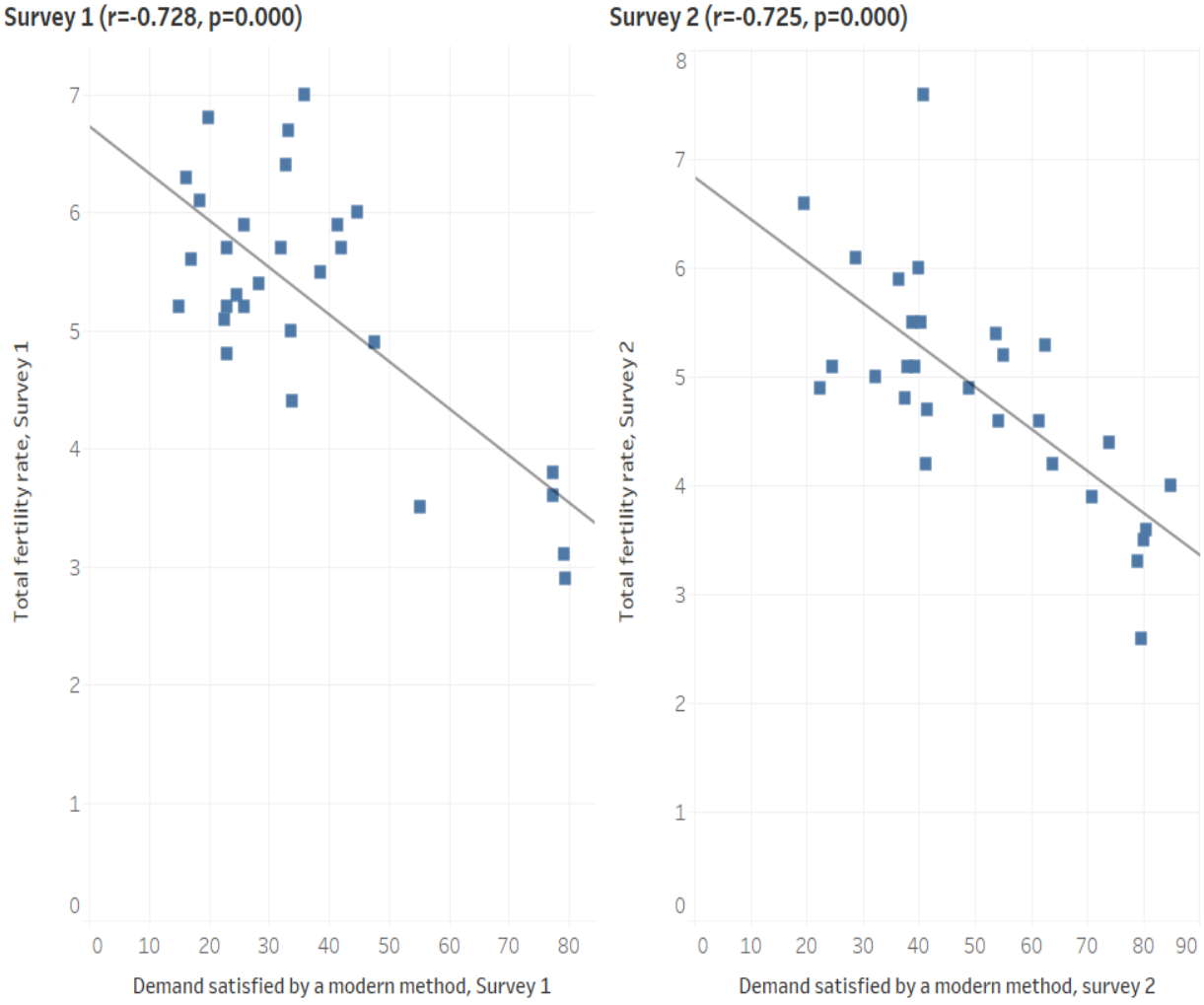


Figure 5. The insignificant positive correlation between the concentration indices of unwanted fertility and demand satisfied by residence at survey 1 became highly significant at survey 2

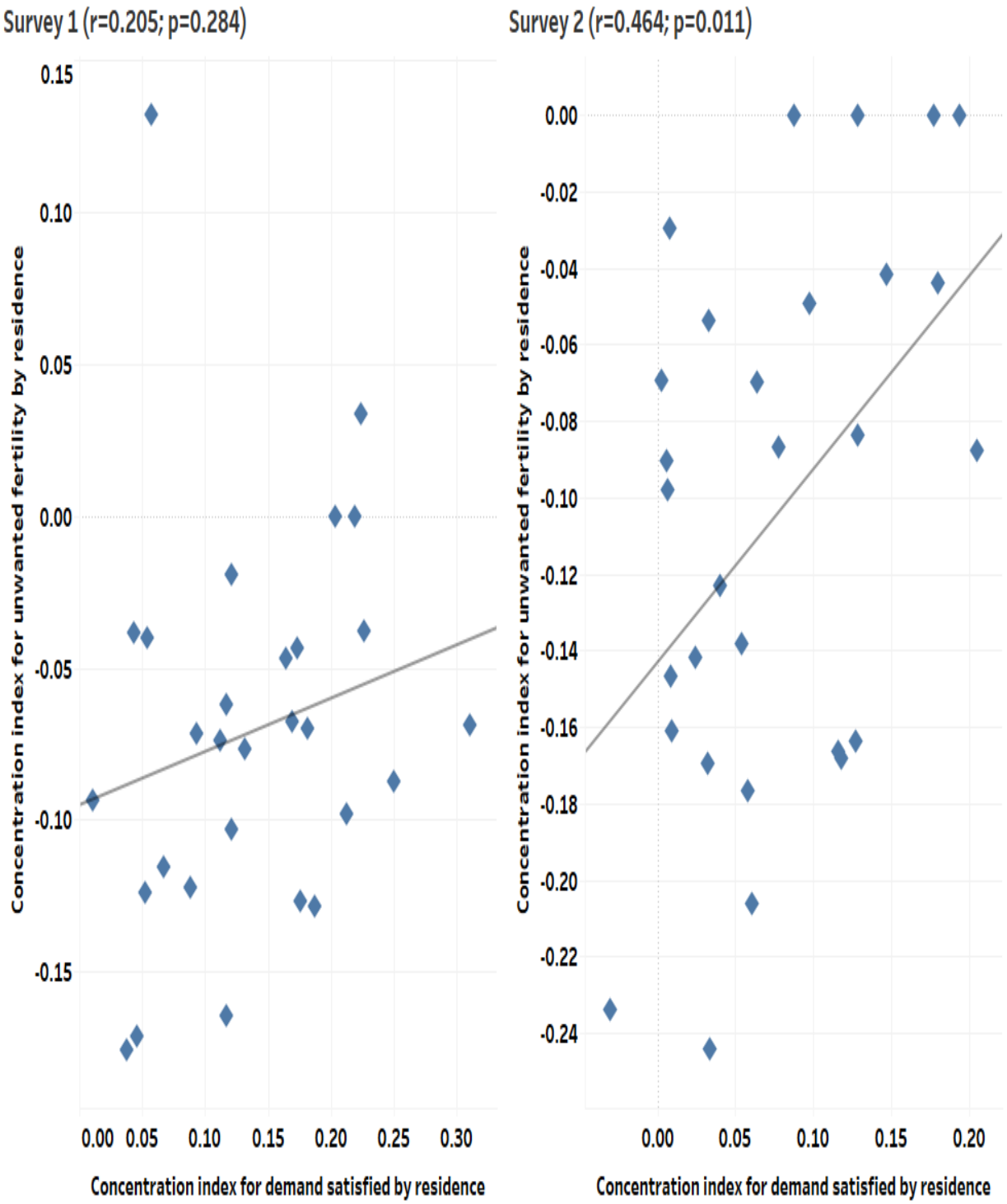


Figure 6. Highly significant positive correlation between concentration indices of unwanted fertility and demand satisfied by education

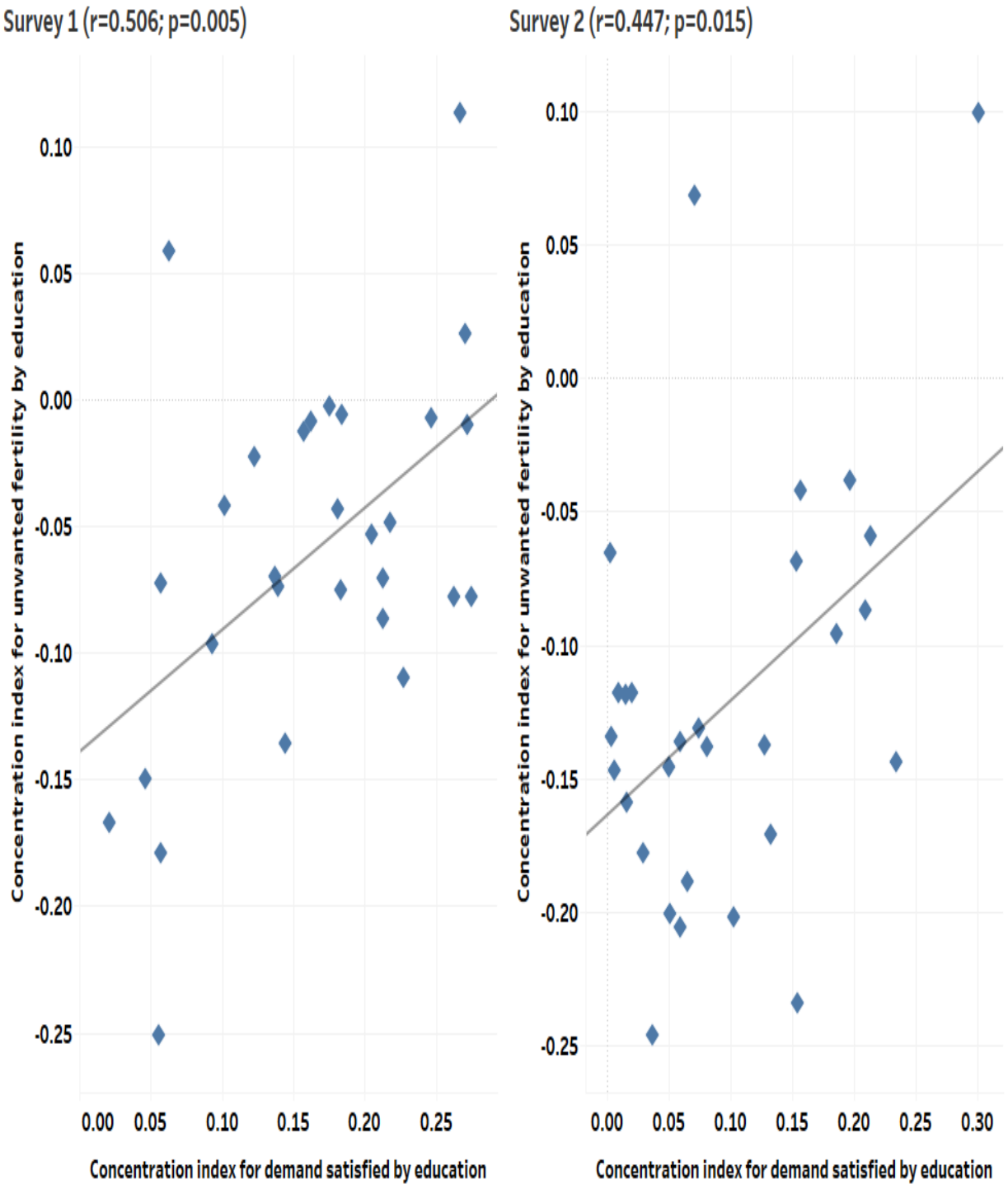


Figure 7. The insignificant positive correlation between concentration infices of unwanted fertility and demand satisfied by wealth quintiles at survey 1 became highly significant at survey 2

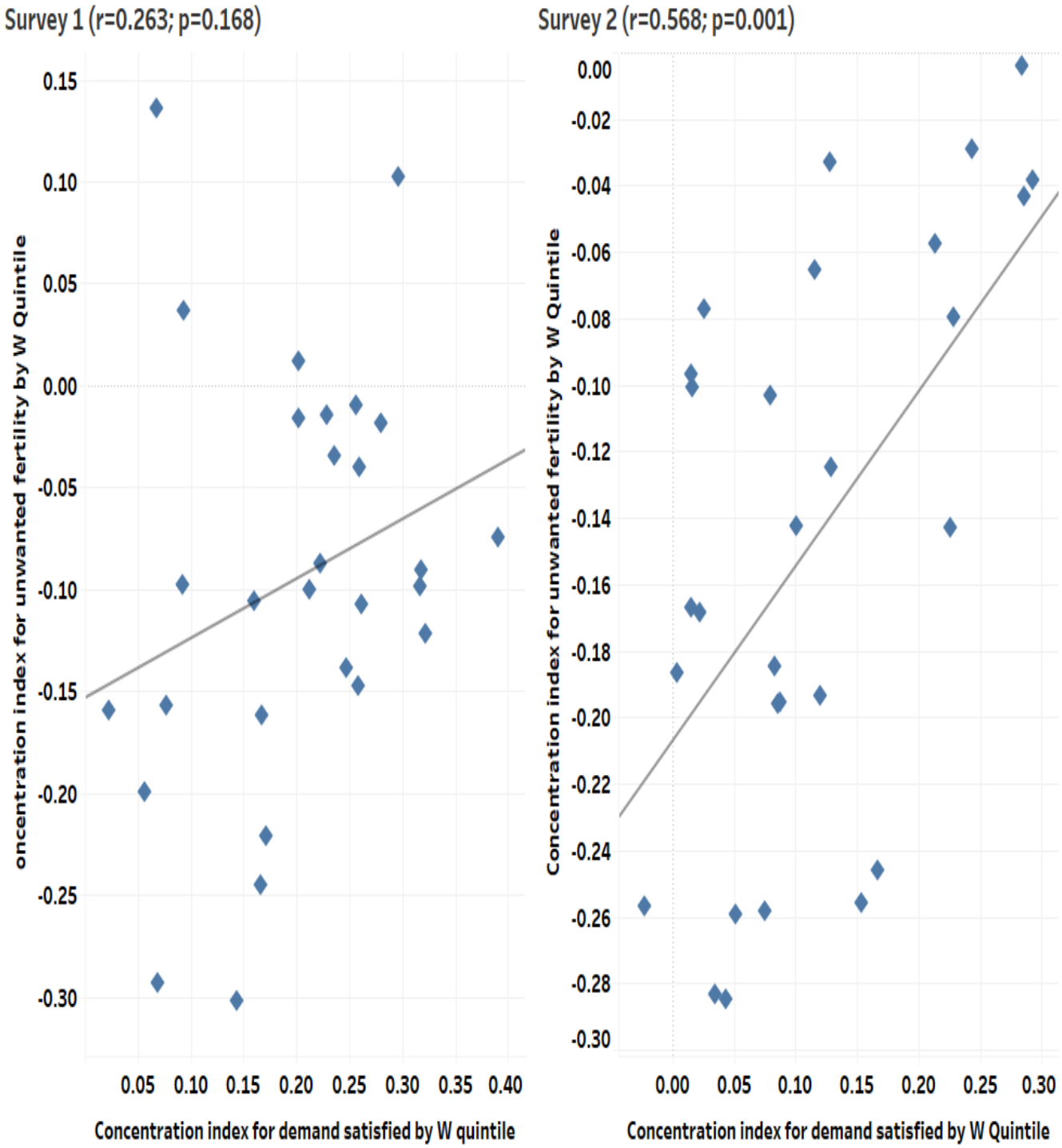
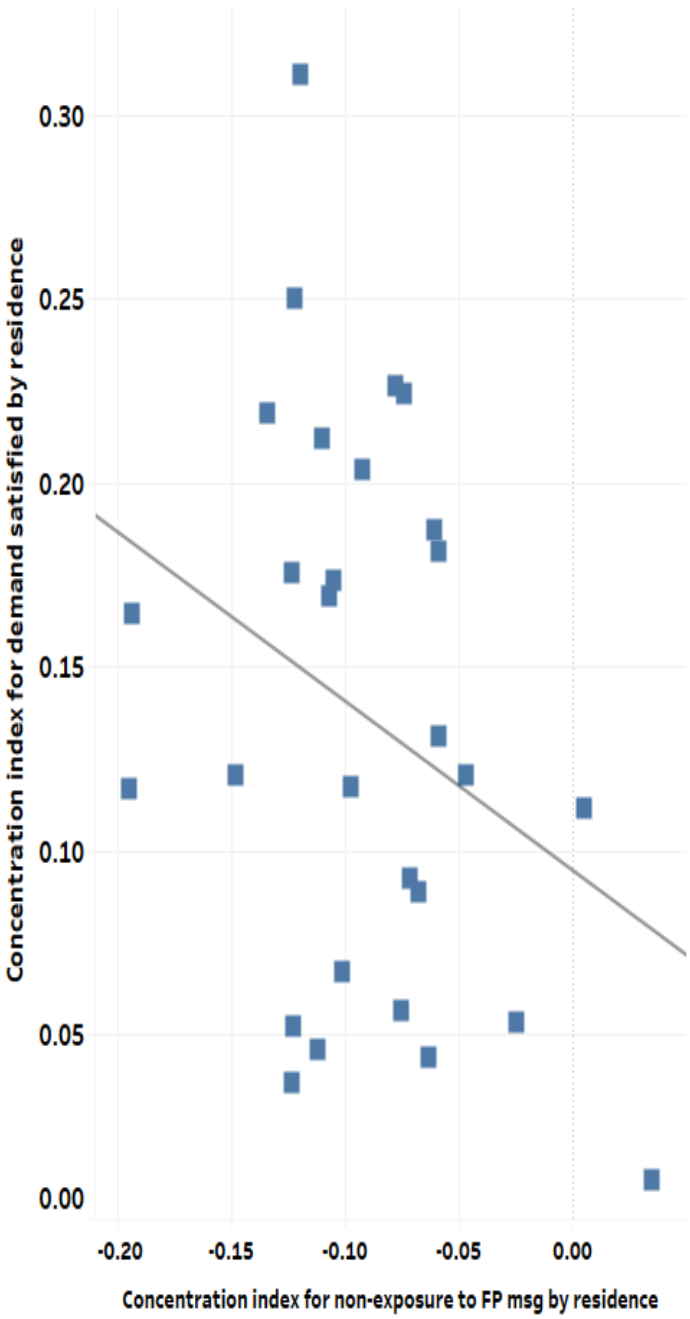


Figure 8. Insignificant negative correlations between concentration indices of demand satisfied and non-exposure to FP messages through radio, TV or nespapwer/magazine by:

Residence, Survey 1 (r=-0.304, p=0.109)



Residence, Survey 2 (r=-0.084, p=0.664)

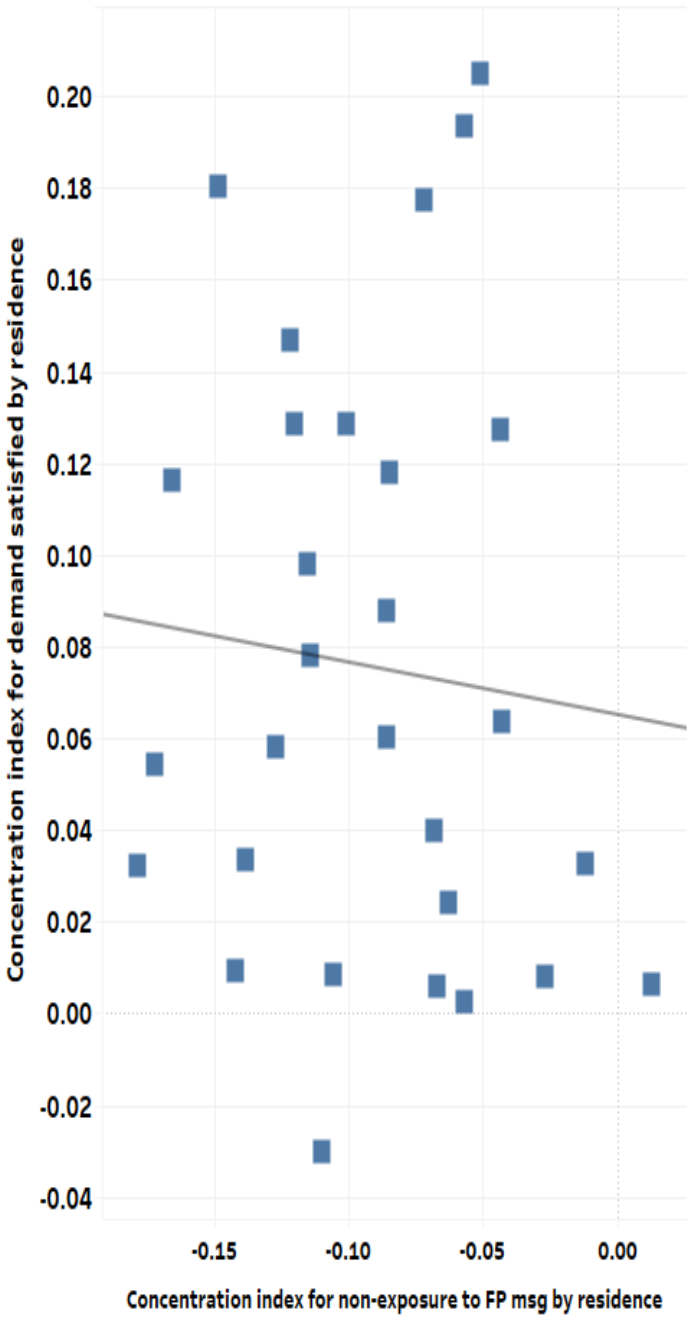
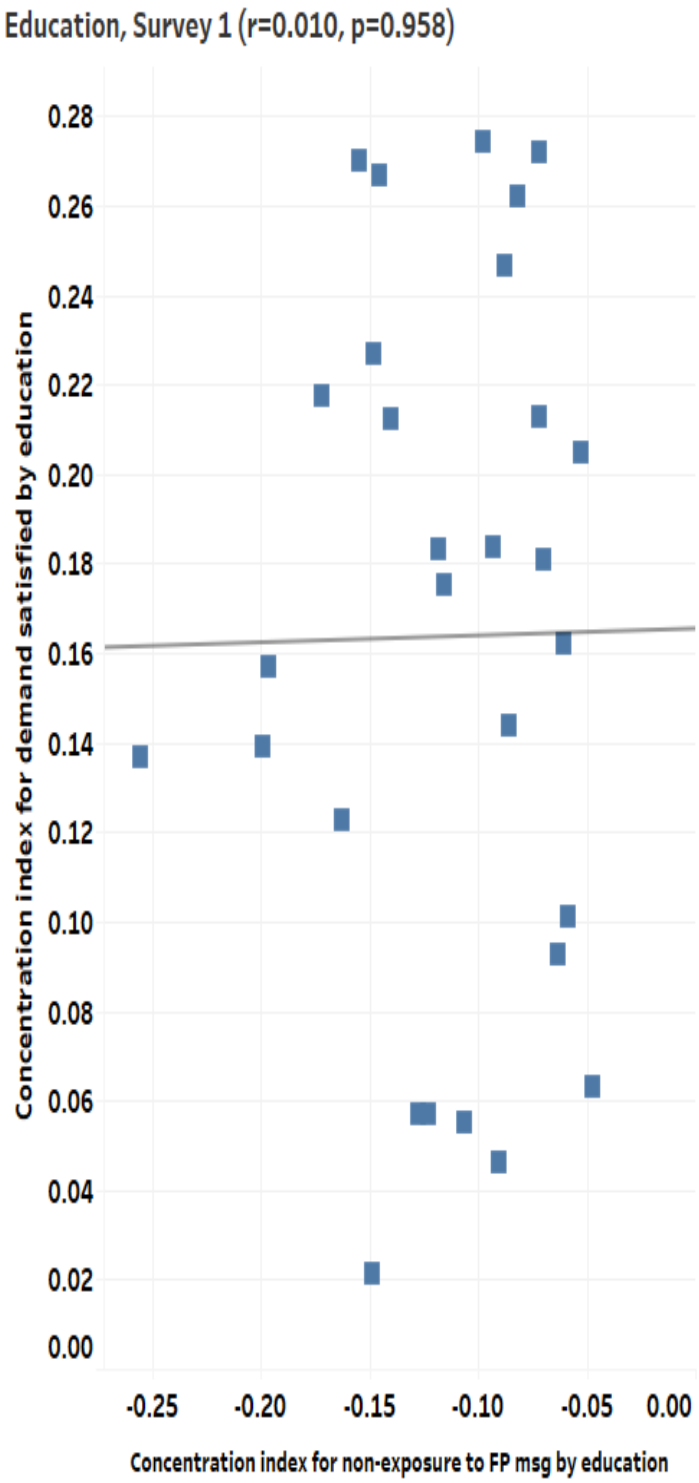


Figure 9. Insignificant correlation between concentration indices of demand satisfied and non-exposure to FP msg through radio, TV or newspaper/magazine by:



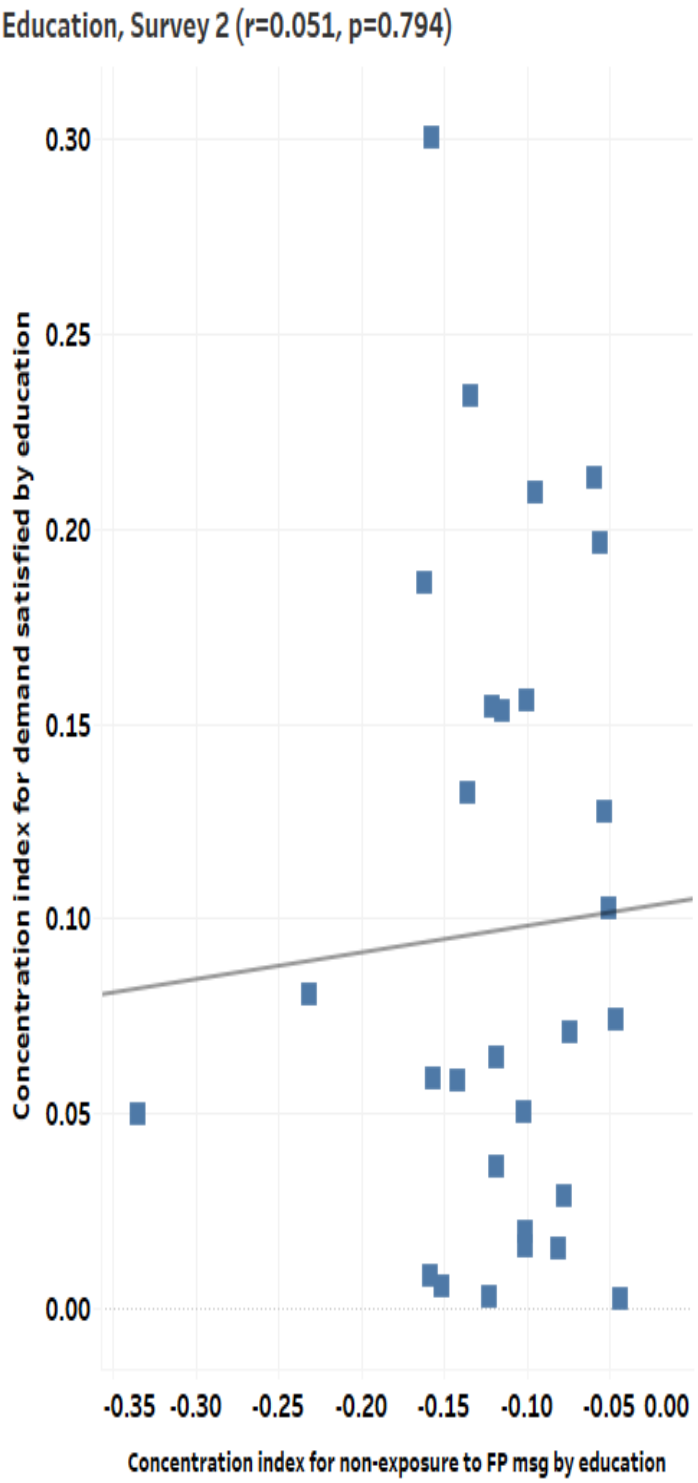
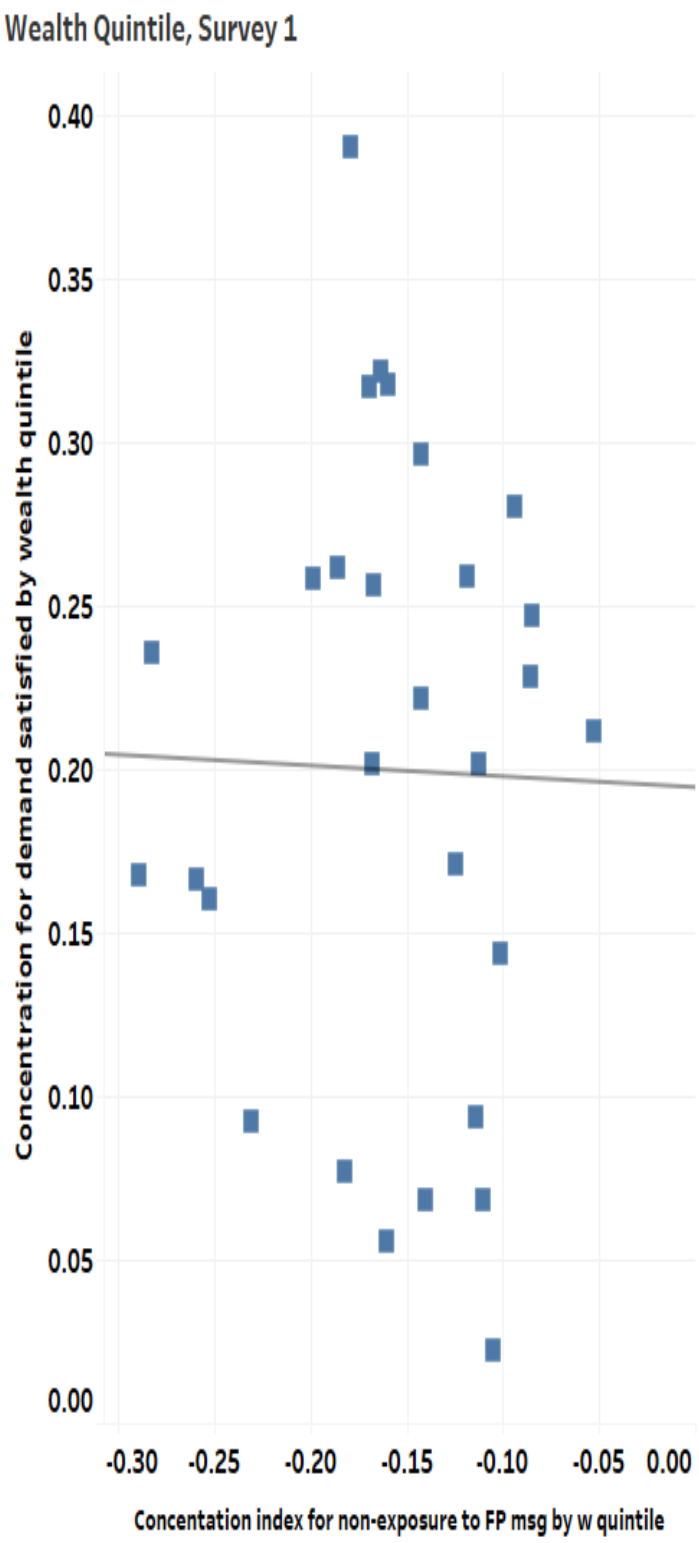
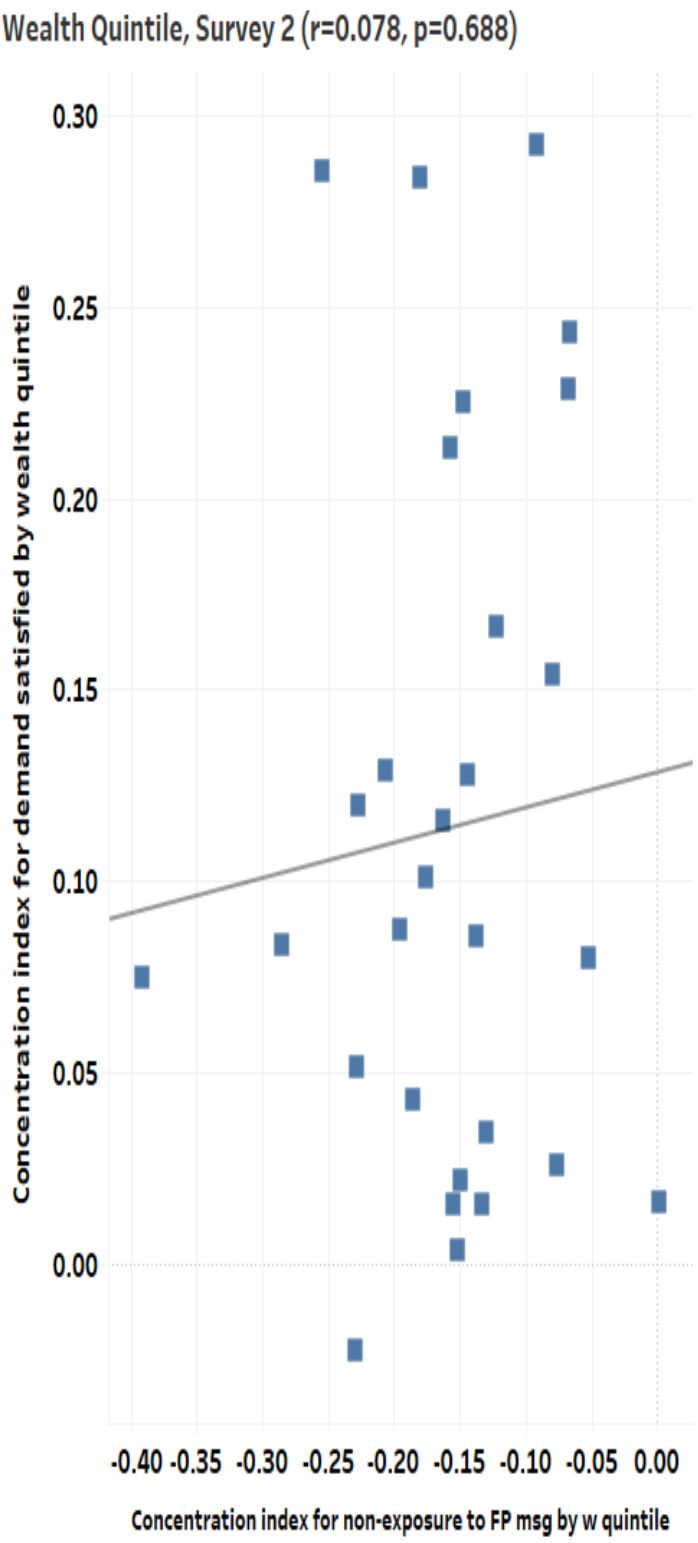


Figure 10. Insignificant correlation between the concentration indices of demand satisfied and non-exposure to FP messages through radio, TV or newspaper/magazine by:





Appendix 1. Concentration index of unwanted fertility by equity dimensions

Country	Residence Survey 1	Residence Survey 2	Education Survey 1	Education Survey 2	Wealth Quintile Survey 1	Wealth Quintile Survey 2
Benin	-0.0740	-0.0867	-0.0531	-0.0959	-0.0999	-0.1248
Burkina Faso	-0.0691	-0.0418	-0.0781	-0.0422	-0.0747	-0.0573
Burundi	-0.0399	-0.0537	-0.0419	-0.1313	0.0368	-0.0771
Cameroon	-0.1269	-0.0839	0.0263	-0.1435	-0.1071	-0.1428
Congo	-0.0715	-0.1639	-0.1358	-0.2018	-0.3022	-0.2558
Congo Democratic Republic	-0.0699	0.0000	-0.0862	-0.0385	-0.0147	-0.0287
Cote d'Ivoire	-0.0680	-0.1681	-0.0489	-0.2341	-0.1218	-0.2462
Egypt	-0.0937	-0.0982	-0.1669	-0.0658	-0.1594	-0.1008
Ethiopia	-0.0983	-0.1766	-0.0704	-0.2055	-0.0904	-0.1425
Ghana	-0.1647	-0.2340	-0.0701	-0.1470	-0.1619	-0.2566
Guinea	-0.0377	-0.0877	-0.0088	-0.0595	-0.0398	-0.0798
Kenya	-0.1158	-0.1695	-0.0737	-0.1458	-0.2451	-0.2583
Lesotho	-0.1224	-0.1418	-0.0965	-0.1777	-0.2209	-0.2833
Liberia	-0.0438	-0.1380	-0.0023	-0.1380	-0.0873	-0.1848
Malawi	-0.0383	-0.0906	-0.0723	-0.1342	-0.0978	-0.1671
Mali	0.0000	-0.0439	-0.0057	-0.0685	-0.0100	-0.0430
Mozambique	0.0000	0.0000	-0.0073	-0.0869	0.1023	-0.0381
Namibia	-0.1241	-0.2443	-0.1794	-0.2463	-0.1568	-0.2846
Niger	0.1322	0.0000	0.0584	0.0682	0.1363	-0.0329
Nigeria	-0.0618	0.0000	0.1134	0.0995	-0.0164	-0.0036
Rwanda	-0.0192	-0.0296	-0.0433	-0.1186	0.0119	-0.0968
Senegal	0.0334	-0.1663	-0.0103	-0.1888	-0.0181	-0.1935
Sierra Leone	-0.0873	-0.0494	-0.1097	-0.1712	-0.0988	-0.0654
South Africa	-0.1713	-0.0696	-0.2512	-0.1589	-0.2934	-0.1865
Tanzania	-0.1034	-0.1609	-0.0228	-0.1182	-0.1057	-0.2592
Togo	-0.1284	-0.0699	-0.0778	-0.1374	-0.1383	-0.1029
Uganda	-0.0767	-0.1231	-0.0750	-0.1364	-0.1478	-0.1953
Zambia	-0.0471	-0.2063	-0.0126	-0.2005	-0.0346	-0.1958
Zimbabwe	-0.1758	-0.1466	-0.1497	-0.1181	-0.1998	-0.1683

Appendix 2. Concentration index of demand satisfied by equity dimensions

Country	Residence Survey 1	Residence Survey 2	Education Survey 1	Education Survey 2	Wealth Quintile Survey 1	Wealth Quintile Survey 2
Benin	0.0048	-0.1145	-0.0526	-0.1620	-0.0529	**-0.2065**
Burkina Faso	-0.1199	-0.1220	-0.0974	-0.1005	-0.1795	**-0.1574**
Burundi	-0.0247	-0.0117	-0.0585	-0.0465	-0.1138	**-0.0760**
Cameroon	-0.1233	-0.1010	-0.1548	-0.1343	-0.1861	**-0.1475**
Congo	-0.0718	-0.0437	-0.0858	-0.0505	-0.1015	**-0.0802**
Congo Democratic Republic	-0.0592	-0.0569	-0.0716	-0.0561	-0.**0860**	**-0.0670**
Cote d'Ivoire	-0.1069	-0.0846	-0.1717	-0.1211	-0.1639	**-0.1220**
Egypt	0.0346	0.0128	-0.1488	-0.0443	-0.1053	**0.0013**
Ethiopia	-0.1101	-0.1269	-0.1401	-0.1423	-0.1597	**-0.1763**
Ghana	-0.1950	-0.1099	-0.2556	-0.1520	-0.2889	**-0.2299**
Guinea	-0.0780	-0.0509	-0.0603	-0.0594	-0.1187	**-0.0676**
Kenya	**-0.1015**	-0.1787	**-0.1989**	-0.3355	**-0.2592**	**-0.3913**
Lesotho	-0.0681	-0.0629	-0.0633	-0.0777	-0.1243	**-0.1296**
Liberia	-0.1055	-0.1719	-0.1155	-0.2321	-0.1424	**-0.2847**
Malawi	-0.0636	-0.0671	-0.1274	-0.1227	-0.2313	**-0.1549**
Mali	-0.1345	-0.1488	-0.0929	-0.1153	-0.1672	**-0.2550**
Mozambique	-0.0923	-0.0717	-0.0880	-0.0951	-0.1422	**-0.0912**
Namibia	-0.1232	-0.1386	-0.1229	-0.1185	-0.1825	**-0.1853**
Niger	-0.0756	-0.0857	-0.0475	-0.0744	-0.1107	**-0.1437**
Nigeria	-0.0975	-0.1200	-0.1455	-0.1576	-0.1681	**-0.1799**
Rwanda	-0.0469	-0.0268	-0.0697	-0.0816	-0.1127	**-0.1336**
Senegal	-0.0744	-0.1659	-0.0716	-0.1190	-0.0939	**-0.2273**
Sierra Leone	-0.1223	-0.1154	-0.1478	-0.1360	-0.1692	**-0.1622**
South Africa	-0.1119	-0.0568	-0.1062	-0.1014	-0.1402	**-0.1524**
Tanzania	-0.1485	-0.1421	-0.1625	-0.1587	-0.2527	**-0.2281**
Togo	-0.0610	-0.0429	-0.0815	-0.0536	-0.0848	**-0.0522**
Uganda	-0.0591	-0.0684	-0.1179	-0.1565	-0.1984	**-0.1958**
Zambia	-0.1936	-0.0859	-0.1962	-0.1022	-0.2828	**-0.1379**
Zimbabwe	-0.1238	-0.1058	-0.0903	-0.1012	-0.1603	**-0.1500**

Appendix 3. Concentration index of non-exposure to mass media FP messages by equity dimensions

Country	Residence Survey 1	Residence Survey 2	Education Survey 1	Education Survey 2	Wealth Quintile Survey 1	Wealth Quintile Survey 2
Benin	0.1259	**0.0827**	0.2005	**0.1332**	0.2833	**0.1699**
Burkina Faso	0.3436	**0.2221**	0.2748	**0.2185**	0.4404	**0.3194**
Burundi	0.0530	**0.0246**	0.1213	**0.0674**	0.1145	**0.0265**
Cameroon	0.2691	**0.2091**	0.3988	**0.3353**	0.4059	**0.3385**
Congo	0.1283	**0.1486**	0.1556	**0.1085**	0.1731	**0.1817**
Congo Democratic Republic	0.2572	**0.2791**	0.2730	**0.2672**	0.3642	**0.3331**
Cote d'Ivoire	0.2416	**0.1263**	0.2797	**0.1704**	0.4462	**0.1973**
Egypt	0.0240	**0.0159**	0.0217	**-0.0078**	0.0340	**0.0192**
Ethiopia	0.2144	**0.0671**	0.2491	**0.0856**	0.3795	**0.1476**
Ghana	0.1200	**-0.0541**	0.1786	**0.0466**	0.1656	**-0.0259**
Guinea	0.2601	**0.1724**	0.2111	**0.1311**	0.3239	**0.2187**
Kenya	0.0585	**0.0269**	0.2305	**0.0752**	0.2091	**0.0847**
Lesotho	0.0766	**0.0287**	0.1241	**0.0405**	0.2078	**0.0465**
Liberia	0.2033	**0.0688**	0.1874	**0.1378**	0.2774	**0.0998**
Malawi	0.0374	**0.0091**	0.0814	**0.0089**	0.1064	**0.0220**
Mali	0.3850	**0.2485**	0.2730	**0.1878**	0.4527	**0.3816**
Mozambique	0.2852	**0.2558**	0.3396	**0.3031**	0.4332	**0.4190**
Namibia	0.0973	**0.0550**	0.1096	**0.0629**	0.1450	**0.0653**
Niger	0.3936	**0.1776**	0.2891	**0.1312**	0.4390	**0.2282**
Nigeria	0.2121	**0.2652**	0.4423	**0.4445**	0.3774	**0.4582**
Rwanda	0.1428	**0.0131**	0.2290	**0.0246**	0.2485	**0.0218**
Senegal	0.3050	**0.1650**	0.3535	**0.1028**	0.3626	**0.1695**
Sierra Leone	0.3128	**0.1557**	0.2861	**0.1208**	0.4012	**0.1783**
South Africa	0.0833	**0.0075**	0.1121	**0.0443**	0.1287	**0.0154**
Tanzania	0.1704	**0.0307**	0.1942	**0.0435**	0.2502	**0.1051**
Togo	0.1450	**0.0344**	0.2488	**0.1130**	0.2425	**0.0496**
Uganda	0.1356	**0.0393**	0.2112	**0.0769**	0.3079	**0.1086**
Zambia	0.2223	**0.0773**	0.2063	**0.0803**	0.3152	**0.1136**
Zimbabwe	0.0571	**0.0256**	0.0775	**0.0323**	0.0849	**0.0351**