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Family Planning Progress in 113 Countries Using a New Composite Progress Index

Aalok Ranjan Chaurasia

Ravendra Singh

MLC Foundation
'Shyam' Institute

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Abstract

In this paper, we construct a composite index to measure family planning progress in 113 countries that is based on the concept of the agility of the family planning services delivery system in meeting the family planning needs of women and men. The proposed composite index is an improvement over the existing linear approaches of measuring family planning progress. Application of the composite index to 113 countries suggests that family planning progress remains far from satisfactory in more than 40 per cent countries and there is substantial inter-country variation in the agility of the family planning services delivery system in meeting family planning needs of women and men. The analysis also suggests that the progress has reversed in many countries. The inter-country variation in family planning progress is found primarily to be the result of the inter-country variation in progress in meeting the demand of permanent methods. The analysis calls for the reinvigoration of family planning efforts to meet the target set under the United Nations 2030 Sustainable Development Agenda.

Keywords

Family Planning, Progress, Countries, Composite Index, Met demand, Method-mix

Introduction

Family planning progress is commonly measured in terms of contraceptive prevalence (CPR) which is defined as the proportion of women aged 15-49 years, married or in-union, who or whose sexual partner is currently using, a contraceptive method, regardless of the method used (WHO, 2014). The rationale for using CPR may be traced in the strong negative relationship between CPR and total fertility rate (TFR) based on cross-country data (Bongaarts, 1978; Bongaarts and Potter, 1983; Ross and Mauldin, 1996; Jain, 1997; Tsui, 2001; Stover, 1998; United Nations, 2020). Srinivasan (1993) has, however, argued that high correlations observed between TFR, and CPR based on cross-country data mask significant differences that exist in their association between subsets of countries, between regions within a country and over time within the same country. He also argued that CPR-TFR relationship may also be influenced by targeting of family planning efforts. There are many studies that have highlighted the inconsistency in the relationship between CPR and TFR, especially, in the context of sub-Saharan Africa (United Nations, 2020; Westoff and Bankole, 2001; Adamchak and Mbizvo 1990; Bongaarts 1987; Thomas and Mercer 1995; Jurczynska, Kuang, and Smith 2016; Jain et al, 2014). There are also studies that have attempted made to explain this inconsistency (Bongaarts, 2015; 2017; Biestsch et al, 2021; Choi et al, 2018). For example, Bongaarts (2017) has argued that conventional cross-sectional analyses of TFR-CPR relationship produce biased results, in part because technical factors, in particular postpartum overlap, create a downward bias in the effect of contraceptive prevalence on fertility in sub-Saharan Africa. He also observed that, more importantly, the cross-sectional ordinary least square (OLS) regression parameters have a bias due to confounding country fixed effects.

Measuring family planning progress in terms of CPR has limitations. First, a proportion of married/in-union women may not be using a contraceptive method because they either want a child or are sterile. This proportion varies from population to population so that it is difficult to establish a universal upper limit of CPR construct a scale to measure and monitor family planning progress. Second, CPR does not take into consideration the family planning method choice which is a key principle of both quality of care and rights-based family planning. Method choice has also been suggested as a guide for optimal family planning services delivery (WHO, 2014). Method choice is linked with family building strategy which is different at different stages of the family building process and reflects both supply and demand of family planning services. It is, therefore, emphasized that measuring and monitoring family planning progress should not be limited to just counting the number of women using a family planning method but should also take into consideration the method choice of the range and types of family planning methods being used (United Nations, 2019).

Recently, demand for family planning satisfied by modern methods has been advocated as an indicator to measure family planning progress (FP2020, nd). This indicator is also a progress indicator of Goal 3.7 of the United Nations 2030 Sustainable Development Agenda (United Nations, 2015). The term 'demand' in the indicator, however, does not reflect the stated desire of women to use modern family planning methods. It is derived by combining the prevalence of modern methods and unmet need of either spacing or limiting birth (FP2020, nd). Similarly, the term "satisfied" in the "demand satisfied" does not reflect satisfaction of women with the method they are using but could be interpreted as the total potential demand met by the use of modern family planning methods (FP2020, nd). This indicator also has two limitations. Like CPR, it also does not consider method choice. Second, it does not distinguish between the demand of modern spacing methods and demand of permanent methods. This distinction is important as the context of using modern spacing methods is different from that of using permanent methods. Permanent methods are irreversible so they are used only when the family building process is complete. Modern spacing methods are reversible and are used any time during the family building process. Not distinguishing between the two is equal to the implicit but very strong assumption of perfect substitutability between the two which may lead to erroneous conclusions about family planning progress.

The FP2030 measurement framework has recommended a set of outcome indicators to measure family planning progress (FP2020, nd) but falls short of combining these indicators into a single composite index of family planning progress. In this paper, we combine demand of modern spacing methods, demand of permanent methods and method choice to construct a composite index to measure family planning progress. The index presents the 'big picture' by offering a rounded assessment of progress. It follows the progress triangle approach which measures the agility of the family planning services delivery system in meeting the family planning needs of women and men (Nold and Michel, 2016). Application of the composite index to 113 countries suggests that, in majority of the countries, family planning progress is far from satisfactory in terms of meeting the demand of either modern spacing methods or permanent methods or in terms of method choice and in many countries, progress appears to have reversed. The proposed composite index can be decomposed into the change in different outcome indicators of the family planning services delivery system.

The paper is organized as follows. The next section constructs the composite index to measure family planning progress section three describes the data used to analysing family planning progress in 113 countries. The paper is based on the database of survey-based country level estimates of method-specific prevalence and unmet need for spacing and limiting maintained by the United Nations Population Division (United Nations, 2020). Section four measures family planning progress in 113 countries in terms of the proposed composite index of family planning progress. Section five categorises countries into mutually exclusive groups based on the progress in different dimensions of family planning services delivery following the classification modelling approach. Progress in family planning during the period 2010 through 2019 has been analysed in section six of the paper. This section also analyses the relative contribution of the progress in different dimensions of family planning services delivery to overall family planning progress in each country to identify the relative importance of the progress in different dimensions to the overall progress. The last section of the paper discusses the findings of the analysis in the context of the progress in family planning in meeting the family planning needs of women and men.

Composite Family Planning Progress Index

Let c_s denotes the prevalence of modern spacing methods, c_p denotes the prevalence of permanent methods, c_t denotes the prevalence of traditional methods, u_s denotes the unmet need for spacing, and u_p denotes the unmet need for limiting. Then, assuming that the prevalence of traditional methods reflects the unmet need of modern spacing methods, an index p_s reflecting the met demand of modern spacing methods can be defined as

$$p_s = \frac{c_s}{c_s + c_t + u_s} \quad (1)$$

Similarly, and index p_p reflecting the met demand of permanent methods can be defined as

$$p_p = \frac{c_p}{c_p + u_p} \quad (2)$$

Both p_s and p_p range from 0 to 1 and the higher the indexes the better the progress in meeting respectively the needs of modern spacing methods and the needs of permanent methods and vice versa.

On the other hand, there is no standard indicator to measure family planning progress in terms of family planning method choice (Bertrand et al, 2014). The family planning method-mix or the proportionate distribution of family planning users by method is recommended as one of the key indicators of method choice (Measure Evaluation, 2018). Family planning method-mix is also an outcome indicator identified in the FP2030 Measurement Framework (FP2020, nd). A dispersed method-mix reflects expanded method choice whereas a method-mix dominated by one or two methods, or skewed method-mix, reflects limited method choice. Method-mix is influenced

by many factors including poor capacity of the system in providing methods of choice to women, poor counselling and policy and provider bias, and cultural norms and societal preferences, although it is argued that cultural and social barriers or myths or misconceptions can be overcome through effective counselling (Yeakey and Gilles, 2017). However, it is also naïve to believe that just one or two family planning methods can meet the diverse family planning needs of women and men during different stages of the family building process. It may, therefore be argued that a measure of the skewness in the family planning method-mix, can serve as an indicator of family planning method choice.

There are different approaches that have been suggested to measure the skewness in the family planning method-mix. The method-mix is termed as skewed if the proportionate share of a single method in the total family planning use is at least 50 per cent (Bertrand et al. 2014; Seiber et al. 2007; Sullivan et al. 2015). This approach of measuring method-mix classifies the method-mix in only two categories - skewed and not skewed. It does not measure skewness in the method-mix on a scale and, therefore, has limited use in measuring family planning progress. Another approach suggested is based upon comparing the observed method-mix with some pre-specified standard or benchmark (Bertrand et al. 2000). There is, however, no universal benchmark so that measurement of skewness in method-mix, in this approach, is contingent upon the benchmark adopted. This method also does not measure skewness in method-mix on a scale. The third approach uses average deviation which is a statistical measure of dispersion in the distribution to measure the skewness in method-mix (Ross et al. 2015; Bertrand et al. 2020). The average deviation, by definition, is a measure of dispersion in the distribution, not concentration. Dispersion measures are influenced by both degree of concentration and the number of units (Foldvary 2006).

Chaurasia (2021) has recently proposed an index to measure the skewness in the method-mix that defines skewness in the method-mix on a scale. The index is based on the concept of the dominance of one family planning method over other methods available and the higher the index the higher the skewness in the method-mix. If x_j is the proportionate prevalence of the family planning method j among n family planning methods available or the proportion of total family planning users using the method j, then the method skew index, s, proposed by Chaurasia (2021) is defined as

$$s = \sqrt{\frac{\sum x_j^2 - \left(\frac{1}{n}\right)}{1 - \left(\frac{1}{n}\right)}} \; when\; n > 1 \; and \; s = 1 \; when \; n = 1; \; \sum_{j=1}^{n} x_j = 1 \qquad (3)$$

The index s is invariant to the number of family planning methods available and the higher the index the higher the skewness in the method-mix. When entire family planning use is confined to only one method s=1. When family planning use is evenly distributed across different family planning methods available, s=0. Based on the method skew index, s, an index to measure the method choice may be defined as

$$p_q = 1 - s \qquad (4)$$

The index p_q ranges between 0 and 1 and the higher the index, the expanded the method choice and vice versa. When p_q=0, the entire family planning use is confined to one method only so that there is no method choice.

A composite index of family planning progress may be constructed combining indexes p_s, p_p and p_q through an aggregation function such as simple arithmetic mean, geometric mean, or generalised mean. The value of the composite index depends upon the aggregation function used, although, the upper and lower limits of the composite index remain unchanged. Using the same values of p_s, p_p, and p_q, the composite index is the highest when simple arithmetic mean is used but the lowest when the three indexes are multiplied. When the generalised mean is used, the composite index is sensitive to the power of the mean.

Alternatively, the three indexes reflecting the met demand of modern spacing methods, the met demand of permanent methods and family planning method choice can be combined to constitute the triangle as shown in figure 1 to reflect the family planning progress. In this conceptualisation, the area of the triangle may serve as the composite index to measure and monitor family planning progress. This approach of measuring and monitoring progress is widely used in economics and in private sector management (Albach and Moerke 1995; Bogan and English 1994; Domptin 1997). It has also been used in the analysis of the labour-market performance (Schütz, Speckesser and Schmid, 1998) and in measuring the external adaptability of the higher education institutions (Zeine et al, 2014). We use this approach, in this paper, to measure and monitor family planning progress in the context of meeting diverse family planning needs of women and men.

Figure 1 suggests that family planning progress triangle comprises of three sub-triangles, all of which have the common vertex and same angle at vertex. This means that the area, A, of the triangle is the sum of the area of the three sub-triangles. In other words, the area of the family planning progress triangle can be calculated as

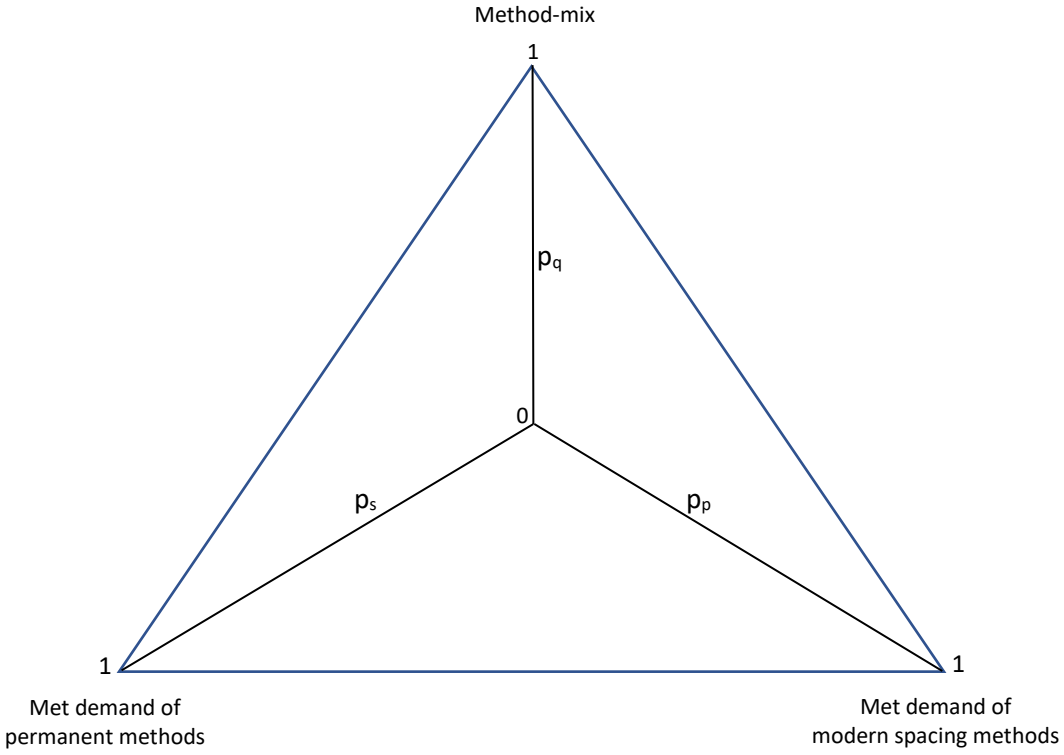

Figure 1: The family planning progress triangle

$$A = \frac{p_s * p_p * \text{Sin}(360^o/3)}{2} + \frac{p_p * p_q * \text{Sin}(360^o/3)}{2} + \frac{p_q * p_s * \text{Sin}(360^o/3)}{2}, \text{ or}$$

$$A = \frac{1}{2}\left(p_s * p_p + p_p * p_q + p_q * p_s\right) * \text{Sin}(360^o/3) \quad (5)$$

When $p_s = p_p = p_q = 0$, $A = 0$. When $p_s = p_p = p_q = 1$, the area of the family planning progress triangle is the maximum and is given by

$$A_{max} = \frac{1*1*\text{Sin}\,(360^o/3)}{2} + \frac{1*1*\text{Sin}\,(360^o/3)}{2} + \frac{1*1*\text{Sin}\,(360^o/3)}{2} = \frac{3}{2}\text{Sin}\,(360^o/3) \quad (6)$$

Dividing (5) by (6), the normalised area of family planning progress triangle, A_n, which varies between 0 (minimum) to 1 (maximum) is given by

$$A_n = \frac{A}{A_{max}} = \frac{\frac{1}{2}(p_s*p_p+p_p*p_q+p_q*p_s)*\text{Sin}(360^o/3)}{\frac{3}{2}\text{Sin}(360^o/3)} = \frac{(p_s*p_p+p_p*p_q+p_q*p_s)}{3} \quad (7)$$

There are two problems in using A_n as a composite index of measuring and monitoring family planning progress. First, the increase in A_n with the increase in the indexes p_s, p_t and p_q is not linear but concave so that with the increase in the indexes p_s, p_t and p_q the increase in A_n becomes faster. For example, when p_s=p_p=p_q=0.200, A_n=0.040 and when p_s=p_p=p_q=0.300, A_n=0.090 which means that an improvement of 0.100 in each of the three indexes leads to an increase of 0.050 in A_n. However, when p_s=p_p=p_q=0.700, A_n =0.490 and when p_s=p_p=p_q=0.800, A_n =0.640 so that the same improvement of 0.100 in each of the three indexes leads to an increase of 0.150 in the index A_n. This is not the desirable property of any index which is designed to measure and monitor progress. Ideally, the progress scale should be linear.

The second problem with A_n as the index to measure and monitor family planning progress is that it gives equal weight to the three dimensions of the family planning needs of women and men irrespective of the progress in the respective dimensions. From the perspective of measuring and monitoring family planning progress, it is imperative that more weight should be assigned in the construction of the composite progress index to that dimension of family planning need in which the progress lags behind compared to that dimension in which the progress is advanced.

The two problems associated with A_n can be addressed by using the positive square root of three indexes p_s, p_t and p_q. This modification gives more weight to that dimension of family planning need in which the progress lags behind comparative to other dimensions. With this transformation, the composite family planning progress index, based on indexes p_s, p_p, and p_q, may be defined as

$$p = \frac{(\sqrt{p_s}*\sqrt{p_p})+(\sqrt{p_p}*\sqrt{p_q})+(\sqrt{p_q}*\sqrt{p_s})}{3} = \frac{p_{sp}+p_{pq}+p_{qs}}{3};\ p_{sp} = \left(\sqrt{p_s}*\sqrt{p_p}\right), \text{ etc.} \quad (8)$$

Since the indexes p_s, p_p, and p_q range between 0 and 1, the index p also ranges between 0, and 1 and the lower the index p the slower is the family planning progress. It may be emphasised here that the upper limit 1 and the lower limit 0 of the index p are the technical limits of the progress scale based on the index p. It is rare that the index p will be either 0 or 1 in any country. The upper and lower theoretical limits of the index p actually serve as the goal posts to measure and monitor family planning progress.

The index p measures family planning progress on a scale through a multidimensional perspective. It takes into consideration the progress in meeting the demand of modern spacing methods, the progress in meeting the demand of permanent methods and in expanding the method choice and is not linear in its construct. When p_s=p_p=p_q=0, p=0. When p_s=p_p=p_q=1, p=1. When p_s=p_p=p_q=k for any k, p=k/3. In this case, the index p is equal to the simple arithmetic mean of the three indexes. On the other hand, when p_s≠p_p≠p_q, the index p is always less than the simple arithmetic mean of the three indexes. The difference between the simple arithmetic mean of the three indexes p_s, p_t and p_q and the composite index p reflets the imbalance or the inequality in the progress in the three dimensions of family planning needs of women and men and the higher the difference the higher the imbalance or the inequality in the progress in the three dimensions of family planning needs. The index p summarises the multi-dimensional perspective of family planning services delivery by taking into consideration the met need of modern family planning methods, met need of permanent methods and family planning method choice. In this sense, it is an improvement over CPR and the demand satisfied by modern family planning methods. The index enables judgement about the efficiency of the family planning services delivery system in meeting family planning needs of women and men and places family planning progress at the centre of policy arena.

Data

The analysis is based on the country level database on family planning use which is maintained by the United Nations Population Division (United Nations, 2020) and is updated regularly. This database includes country-specific survey-based estimates of the prevalence of different family planning methods and unmet need for spacing and limiting. The database contains 1,317 observations from 196 countries for the period 1950 through 2019. The present analysis is, however, limited to 113 countries which have been selected on the basis of the following criteria: 1) the latest survey should have been carried out sometimes during the period 2010-2019; 2) estimates of the prevalence of different modern family planning methods are available for currently married or in-union women aged 15-49 years; and 3) estimates of unmet need for family planning are available separately for spacing and for limiting. Out of the 113 countries selected on the basis of the above criteria, 47 are from Africa; 30 are from Asia; 20 are from Latin America and Caribbean; 11 are from Europe; and 5 are from the Pacific region of the world. The countries included in the present analysis also include 65 of the 69 lowest-income countries that have been identified as focus countries under the FP2020 Initiative. The FP2020 initiative aimed at achieving the target of reaching an additional 120 million users of modern family planning methods in these countries by the year 2020 (FP2020, 2018). This target, however, could not be achieved.

Details of the methods, definitions and data sources used in the construction of the database maintained by United Nations Population Division are described elsewhere and not repeated here (United Nations, 2020). The data for different countries available in the database maintained by the United Nations Population Division are, however, not strictly comparable because of the differences in the survey design and implementation, and in the representativeness of the sample over time and across countries. Estimates of the prevalence of different family planning methods, in some cases, are also affected by rounding and the small size of the sample. There are also other limitations of the data available through the United Nations database which have been discussed at length elsewhere (United Nations, 2020).

The database maintained by the United Nations Population Division provides survey-based estimates of the prevalence of the following 13 family planning methods: 1) female sterilization; 2) male sterilization; 3) intra-uterine devices (IUD); 4) implant; 5) injectable; 6) pill; 7) male condom; 8) female condom; 9) vaginal barrier methods; 10) lactational amenorrhea method (LAM); 11) emergency contraception; 12) other modern methods; and 13) any traditional method. Based on these method-specific prevalence, all methods prevalence (CPR) and modern methods prevalence (mCPR) have been calculated for each country. For the present analysis, we have grouped the 13 family planning methods into three categories: 1) permanent methods (female sterilization, male sterilization); 2) modern spacing methods (IUD, implant, injectable, pill, male condom, female condom, vaginal barrier methods, LAM, and emergency contraception; and 3) traditional method (any traditional method). Prevalence of all the 13 family planning methods is, however, not available for all the 113 countries included in the present analysis. In many countries, prevalence of a number of family planning methods is either not available or is not reported. In all such cases, the prevalence of the method concerned has been assumed to be zero.

The database maintained by the United Nations Population Division also provides estimates of unmet need of spacing and limiting birth. The unmet need of family planning is not consistent across countries, but it is broadly defined as the proportion of currently married or in-union women of reproductive age who want to stop or delay childbearing but are not using any modern family planning method. The unmet need of family planning is the sum of the unmet need of family planning for delaying the first birth and for spacing between successive births and the unmet need for limiting or stopping births. The context of the unmet need of family planning for delaying the first birth and for spacing between successive births is different from the context of the unmet need of family planning for limiting or stopping births. The use of traditional methods is assumed to reflect the unmet need for spacing between births.

Family Planning Progress

Appendix table 1 gives values of indexes p, p_s, p_p and p_q for 113 countries which fulfil the selection criteria for the present analysis and the inter-country variation in these indexes is summarized in table 1 and figure 2. The index p is the lowest in Sudan (2014) (p=0.100) but the highest in Nicaragua (2011-2012) (p=0.760). In 24 (21.2 per cent) countries, the index p is less than 0.250 while in 54 (47.8 per cent) countries, it ranges between 0.250-0.500. There is no country in which, the index is at least 0.900 whereas Nicaragua (2011-2012) is the only country where the index is more than 0.750. In almost 80 per cent countries, family planning progress, measured in terms of the index p, is below average (p<0.500).

The index p is the composite of indexes p_s, p_p and p_q. The index p_s ranges from 0.049 in Albania (2017-2018) to 0.939 in Democratic Republic of Korea (2017). There are, however, only 5 countries where p_s<0.250 whereas $p_s \geq$ 0.750 in 33 countries. On the other hand, there are 7 countries – Benin (2017), Burkina Faso (2018), Côte d'Ivoire (2018), Ethiopia (2018), Guinea-Bissau (2018-2019), Libya (2014), and Sudan (2014) – where p_p=0. In 90 or almost 80 per cent countries, the met demand of permanent methods is below average (p_p<0.500). which leaves only 13 countries where $p_p \geq$0.500. There are only 3 countries - Nicaragua (2011-2012); Colombia (2015-2016); and Dominican Republic (2014) - where $p_p \geq$0.900. In majority of the countries, $p_s > p_p$ but there are 20 countries where $p_s < p_p$. The most notable example is India where the met demand of permanent methods is more than 83 per cent but the met demand of modern spacing methods is only around 50 per cent.

Lastly, the index p_q is the lowest in Democratic Republic of Korea (2017), where IUD alone accounts for more than 95 per cent of the total modern methods use. Other countries having very low p_q are Turkmenistan (2015), where the share of IUD is more than 93 per cent; Morocco (2018), where 82 per cent of all users of modern methods are Pill users; Sudan (2014) where Pill accounts for almost 77 per cent of modern methods use; and India (2015-16) where female sterilization accounts for more than 75 per cent of total use. On the other hand, p_q is the highest in Guinea-Bissau (2014). The index p_q is below average (<0.500) in 57 countries but above average ($\geq$0.500) in 56 countries.

There are four countries - Turkey (2018); Nepal (2016-2017); Sri Lanka (2018); and Pakistan (2017-2018) – where p_s, p_p and p_q are very nearly the same which means that family planning progress in these countries is nearly balanced. By contrast, progress inequality, p_i, is the highest in Ethiopia (2018) followed by Burkina Faso (2018-2019), and Côte d'Ivoire (2018). There are 68 (60.2 per cent) countries where the inequality in progress in different dimensions is very low (p_i <0.05) whereas in 13 countries, it is above average.

The ranking of countries in the index p is different from the ranking in mCPR and ranking in MDM. Among the 113 countries, Nicaragua (2011-2012) is the only country which has the same top rank in p, mCPR and MDM. On the other hand, Sudan (2014) ranks the lowest among the 113 countries in the index p, but it ranks 98 in MDM and 106 in mCPR. Similarly, South Sudan (2010) ranks the lowest in both mCPR and MDM but ranks 113 in the index p. The difference in the rank in index p and the rank in mCPR is the widest in Turkmenistan (2015-2016) which ranks 21 in MDM but 101 in the index p. Similarly, the difference in the rank in the index p and the rank in MDM is the widest in Democratic Republic of Korea (2017). The country ranks 6 in MDM but only 78 in the index p among the 114 countries. There are only five countries – Colombia (2015-2016), Costa Rica (2018), Nicaragua (2011-2012), North Macedonia (2011) and Uganda (2017) – where the rank in the index p is the same as the rank in mCPR. On the other hand, there are only two countries – Nicaragua (2011-2012) and Mali (2018) where the rank in the index p is the same as the rank in MDM. There are, however, 13 countries where the rank in mCPR is the same as the rank in MDM. Moreover, the maximum difference in the rank in mCPR and the rank in MDM is 25 in Qatar (2012).

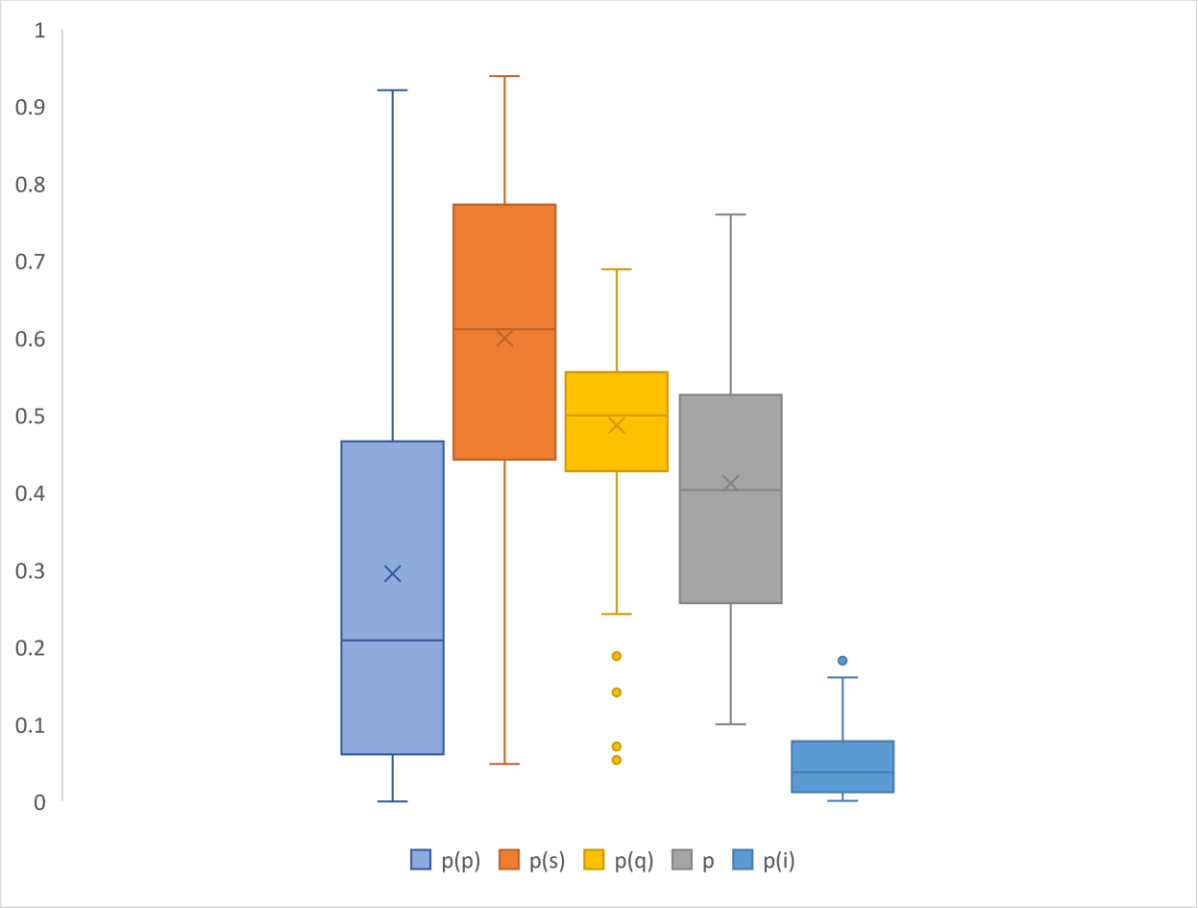

Figure 2: Variation in different indexes of family planning progress and progress inequality across 113 countries

Table 1: Inter-country distribution of different indicators of family planning progress and inequality in progress different dimensions of family planning services delivery in 113 countries, 2010-2019.

Progress	Index				Progress inequality	
	p_p	p_s	p_q	p	p_i	
	Frequency distribution					
Very slow (<0.250)	60	5	5	24	Very high (≥0.150)	3
Slow (0.250-0.500)	30	34	52	54	High (0.150-0.100)	13
Good (0.500-0.750)	10	41	56	34	Low (0.100-0.050)	29
Very good (≥0.750)	13	33	0	1	Very low (<0.050)	68
	Summary measures					
Minimum	0.000	0.049	0.054	0.100	0.001	
Q1	0.066	0.450	0.429	0.258	0.012	
Median	0.209	0.611	0.500	0.403	0.038	
Q3	0.465	0.767	0.552	0.525	0.078	
Maximum	0.921	0.939	0.689	0.760	0.187	
IQR	0.399	0.317	0.122	0.267	0.066	
CV	0.919	0.343	0.234	0.424	0.880	
N	113	113	113	113	113	

Source: Author's calculations.

Classification of Countries

Family planning progress in a country, as measured by the index p, is contingent upon indexes p_s, p_p and p_q. The contribution of the three indexes to the index p is, however, not additive. We have carried out the classification modelling exercise (Han et al, 2012; Tan et al, 2006) to classify countries in different groups based on indexes p_s, p_p and p_q and analysed how the index p varies across these groups of countries. The classification and regression tree (CRT) method (Brieman et al, 1984) was used for the purpose. CRT is a non-parametric recursive partitioning method that divides countries into mutually exclusive clusters in such a way that within-group homogeneity in the index p is the maximum. A cluster in which all countries have the same value of the index p is termed as 'pure'. If a cluster is not pure, the impurity in the cluster can be measured through the Gini index. If the dependent variable is a categorical one, the method provides cluster-specific distribution of the dependent variable. If the dependent variable is a scale variable, the method provides estimates of arithmetic mean and standard deviation of the dependent variable within the cluster (Chaurasia, 2018). In the present case, the dependent variable, the index p, is a scale variable and the three explanatory variables, p_s, p_p and p_q, are also scale variables. The classification modelling exercise, therefore, provided mean and standard deviation of inter-country distribution of the index p in each cluster. The TREE routine of the SPSS software package was used for the classification modelling exercise.

Results of the classification modelling exercise with the index p as the dependent variable and indexes p_s, p_p, and p_q as the classification or the independent variables are presented in table 2. The classification modelling exercise suggests that the 113 countries can be grouped into 7 mutually exclusive clusters or groups having distinct values of p_s, p_p, and p_q such that the variation in the index p across countries in each cluster is the minimum while the index p, on average, is different in different clusters. The mean value of the index p is the lowest in cluster 3 which implies that among the 7 clusters, family planning progress is the slowest on average in countries of this cluster. There are 20 countries in this cluster and all these countries are charaterised by $p_p \leq 0.108$ and $p_q \leq 0.460$ irrespective of the index p_s. The other cluster family planning progress is slow, on average, is cluster 7. This cluster also has 20 countries, in all these countries, $p_p \leq 0.108$ but $p_q > 0.460$ irrespective of index p_s. This means that there are 40 countries in which family planning progress is slow because of the slow progress in meeting the demand of permanent methods. On the other hand, the index p is relatively the highest in cluster 10 which means that family planning progress is relatively the most advanced in countries of this cluster. There are 17 countries in this cluster and in all these countries, $p_p > 0.550$ and $p_q > 0.460$ irrespective of the index p_s. This means that family planning progress in countries of this cluster is advanced because of the advanced progress in meeting the demand of permanent methods in countries of this cluster. It may, however, be noted that indexes p_s and p_q are not the highest, on average, in this cluster. The index p_s is the highest in cluster 12 while the index p_q is the highest in cluster 7.

The difference in the met demand of modern spacing methods accounts for the difference in family planning progress in clusters 11 and 12 as reflected by the mean value of the index p in the two clusters. In both clusters, the index p_p, ranges between 0.255 and 0.550 and the index $p_q > 0.460$. However, the index $p_s \leq 0.624$ in cluster 11 whereas the index $p_s > 0.624$ in cluster 12. As the result, the index p, on average is 0.479 in cluster 11 but 0.545 in cluster 12 indicating that family planning progress in countries of cluster 12 is, on average, more advanced than the family planning progress countries of cluster 12.

Table 3 also gives mean values of indicators mCPR and MDM for different clusters. Both indicators are the highest in cluster 10 but the lowest in cluster 7. The MDM is the second highest in cluster 4 whereas the mCPR is the second highest in cluster 12. The family planning progress reflected by the composite progress index p is different from the progress reflected by indicators mCPR and MDM because mCPR and MDM do not take into consideration the progress in method choice.

Table 2: Classification of countries based on p_s, p_p and p_q.

	Clusters (Node ID)						
	3	7	8	4	11	12	10
	Defining characteristics of the cluster						
p_s	*All*	*All*	*All*	*All*	*≤0.624*	*>0.624*	*All*
p_p	*≤0.108*	*≤0.113*	*>0.113, ≤0.255*	*>0.108*	*>0.255, ≤0.550*	*>0.255, ≤0.550*	*>0.550*
p_q	*≤0.460*	*>0.460*	*>0.460*	*≤0.460*	*>0.460*	*>0.460*	*>0.460*
	Mean values of progress indicators						
p	0.217	0.228	0.403	0.428	0.479	0.545	0.684
p_s	0.478	0.373	0.592	0.761	0.502	0.787	0.763
p_p	0.044	0.043	0.189	0.324	0.402	0.398	0.756
p_q	0.374	0.565	0.540	0.357	0.557	0.512	0.556
MDM	0.403	0.317	0.516	0.720	0.481	0.713	0.763
mCPR	0.228	0.154	0.333	0.513	0.317	0.517	0.614
N	20	20	18	11	13	14	17
Countries	Burundi	Angola	Ghana	Algeria	Mauritius	Eswatini	Malawi
	Ethiopia	Benin	Lesotho	Egypt	Tanzania UR	Kenya	Bhutan
	Gabon	Burkina Faso	Rwanda	Madagascar	Cambodia	Namibia	Iran IR
	Gambia	Cameroon	Uganda	Morocco	Iraq	South Africa	Nepal
	Liberia	Central African Republic	Zambia	Zimbabwe	Oman	Bangladesh	Sri Lanka
	Libya	Comoros	Afghanistan	Korea DPR	Pakistan	Indonesia	Thailand
	Mozambique	Congo	Maldives	India	Philippines	Qatar	Turkey
	Niger	Côte d'Ivoire	Timor-Leste	Jordan	Bolivia PS	Viet Nam	Belize
	Sierra Leone	Congo DR	Yemen	Kazakhstan	Papua New Guinea	Belarus	Colombia
	Sudan	Equatorial Guinea	Georgia	Kyrgyzstan	Samoa	Republic of Moldova	Costa Rica
	Tunisia	Eritrea	Guyana	Lao PDR	Solomon Islands	Barbados	Cuba
	Tajikistan	Guinea		Mongolia	Tonga	Panama	Guatemala
	Turkmenistan	Guinea-Bissau		Myanmar	Vanuatu	Saint Lucia	Honduras
	Armenia	Mali		State of Palestine		Trinidad & Tobago	Mexico
	Bosnia & Herzegovina	Nigeria		Ukraine			Nicaragua
	Montenegro	Sao Tome and Principe		Dominican Republic			Paraguay
	North Macedonia	Senegal		El Salvador			Peru
	Serbia	South Sudan		Suriname			
	Haiti	Togo					
	Mauritania	Albania					

Trend in Composite Progress Index

The trend in the composite progress index p is measured in terms of annual proportionate change (*APC*) under the assumption that the *APC* is constant throughout the trend period. When *APC* is not constant, it may lead to erroneous conclusion about the trend. A segmented approach is, therefore, needed in which the trend period is divided into smaller time-segments, and it is assumed that *APC* in a time segment is constant but *APC* in different time-segments is different. The weighted average of *APC* in different time-segments with weights proportional to the length of the time-segment then gives average annual proportionate change (*AAPC*) during the trend period (Clegg et al, 2009). In this approach, the relative contribution of *APC* in a time-segment to *AAPC* is a function of the length of the time-segment. A high *APC* in a short time-segment has only a small contribution to *AAPC* whereas a moderate *APC* in a long time-segment has substantial contribution. If the time period t^b (beginning) to t^e (end) is divided into k time-segments such that $t^b<t^1<t^2<\ldots.<t^k<t^e$ and p^1 is the composite index in the year t^1 and p^2 is the composite index in the year t^2, then the *APC* in the time-segment (t^1, t^2) is calculated as

$$APC = \frac{(p^2-p^1)}{p^1\times(t^2-t^1)} \tag{9}$$

and the *AAPC* is calculated as

$$AAPC = \sum_{i=1}^{k} w_i * APC_i \tag{10}$$

where

$$w_i = \frac{t^{i+1}-t^i}{t^e-t^b};\ \sum w_i = 1 \tag{11}$$

An *AAPC*>0 indicates an increase in the index p while *AAPC*<0 indicates that the index p has decreased or the progress has reversed. When *AAPC*=0, there is no progress. We have carried out the trend analysis for 86 countries which have carried out least two surveys during 2000-2019. We calculated *APC* in indexes p, p_s, p_p and p_q for the period between two consecutive surveys and then calculated *AAPC* for the period between the first and the last survey. The *APC* and the *AAPC* in the index p are presented in figure 2 for each of the 86 countries, the period in which *APC*<0 is shown in red while the period in which *APC*>0 is shown in green and the period when *AAPC*=0 is shown in white. The *AAPC* was negative in 26 countries indicating a reversal in family planning progress. In Panama, the index p decreased by more than 12 per cent per year during 2013-2015. The index p also decreased substantially in Sierra Leone during 2013-2016; Tunisia during 2011-2018; and Serbia during 2010-2014 also. In other countries, *AAPC* in the index p was positive. By contrast, *AAPC* was at least 5 per cent per year in only five countries - Rwanda during 2000-2015; Togo during 2010-2017; Timor-Leste during 2009-2016; Ukraine during 2007-2012 and Oman during 2007-2014. In 31 countries, the trend in the index p was inconsistent as *APC* in one time segment was greater than 0 but less than 0 in other time-segments. There are only 37 countries where *APC* in the index p was greater than 0 in all time-segments. There are only five countries - Bolivia, Cambodia, Congo, India, and Zambia – where *APC* in the index p increased consistently.

The trend in indexes p_s, p_p and p_q also varies across countries (Table 3). The *AAPC* in the index p_s varies from the lowest in Albania (-6.196) to the highest in Rwanda (16.198). There are 19 countries where *AAPC* in p_s<0 while *APC* in index p_s increased with time in Cambodia, Congo, Mexico, Nicaragua, Turkey, and Zambia. Similarly, *AAPC* in p_p varies from Panama (-36.823) to Montenegro (98.295). There are 35 countries where *AAPC* in p_p<0 whereas *APC* in index p_p increased consistently in Guatemala, Togo, United Republic of Tanzania, and Zambia only. Finally, *AAPC* in p_q ranged from Sierra Leone (-4.431) to Timor-Leste (12.796). In 39 countries *AAPC* in p_q<0 but *APC* in index p_q increased consistently in Congo and Zimbabwe only. In most of the countries, the trend in the three indexes has been inconsistent. There is no country where all the three indexes improved consistently throughout the period 2000-2019.

Figure 2: Annual proportionate change (*APC*) and average annual proportionate change (*AAPC*) in the index *p* in 86 countries

Country	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	AAPC
Africa																					
Algeria							0.315														0.315
Benin		-0.937					-0.718					7.829									-1.266
Burkina Faso				5.429							-6.949						3.355	38.667			1.716
Burundi											1.183										1.183
Cameroon					-2.066							1.812									-0.903
Congo						2.604						9.470									4.893
Côte d'Ivoire												5.896					2.520	-30.451			0.221
DR Congo								12.175			-3.391										4.392
Egypt	-1.520			3.557		-0.961			1.712												0.710
Eritrea			0.188																		0.188
Eswatini							4.589				-2.611										0.989
Ethiopia	0.957					8.706					-3.366				31.009	-2.052	-1.678	-31.675			1.692
Gabon	-0.694																				-0.694
Gambia														-1.017							-1.017
Ghana				-2.259					6.701			-17.631		3.717	32.147	0.140	20.338				2.135
Guinea						-2.022							10.117								3.581
Kenya				0.543					1.936						2.452	2.959	-5.560				1.013
Lesotho					2.312					0.617					1.725						1.539
Liberia							0.182														0.182
Madagascar				2.861					1.954												2.278
Malawi	1.003				4.118						7.826			1.447							3.673
Mali		0.027											-0.234			7.520					2.248
Morocco				-2.051																	-2.051
Mozambique				-4.703								5.397									-1.336
Namibia	1.530						-0.533														0.419
Niger							-2.348						0.911				0.321				-0.920
Nigeria				2.508					-4.209			9.045		-1.856			6.648	-8.417			0.711
Rwanda	-0.524					18.188		8.674			6.559										6.144
Sao Tome & Principe							7.450			0.368											2.139
Senegal						-2.843					9.548		8.570		2.569		15.324	-6.377			2.795
Sierra Leone														-7.187							-7.187
South Africa				-0.435																	-0.435

Country	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	AAPC
Togo											2.946			9.195							6.517
Tunisia												-5.364									-5.364
Uganda	-1.838						4.651					-3.878			21.693	-1.488	4.168				1.469
UR Tanzania					2.660					1.878											2.233
Zambia		2.058						2.328													2.193
Zimbabwe						-1.072					2.664				1.218						0.651
Asia																					
Bangladesh					-1.690		3.000					-5.121									1.185
Cambodia	0.871					4.373					4.694										3.214
India						0.276		0.931													0.800
Indonesia			-1.682										1.111				-0.068				-0.224
Iraq												-1.751									-1.751
Jordan			1.432				-3.291			0.029			-2.718								-0.862
Kazakhstan											5.074					-6.596					0.698
Kyrgyzstan													0.169		0.454						0.359
Lao PDR	2.858					0.949						1.341									1.649
Maldives										-3.567											-3.567
Mongolia				3.005					-17.369		2.978			-2.664							-1.607
Myanmar		0.182																			0.182
Nepal		2.546					-0.610					1.998			-2.098						0.765
Oman								10.452													10.452
Pakistan	1.887						2.253						0.428								1.587
Philippines				-0.655					2.305			-1.267		0.525							0.229
Sri Lanka	3.391						0.508														1.589
S Palestine											-1.359										-1.359
Tajikistan													2.286								2.286
Timor-Leste										9.707											9.707
Turkey				2.039					1.809					-1.236							0.871
Turkmenistan	-2.184																				-2.184
Viet Nam			2.200								-4.202										0.454
Yemen							-0.033														-0.033
Europe																					
Albania									-4.310												-4.310
Armenia	-6.801					0.373					7.414										0.329

Country	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	AAPC
Bolivia PS				0.058					1.980												1.241
Montenegro														4.532							4.532
R Moldova						2.169															2.169
Serbia											-5.075										-5.075
Ukraine								9.894													9.894
Latin America and Caribbean																					
Colombia	0.775					0.719				0.496											0.645
Costa Rica												-0.823									-0.823
Côte d'Ivoire												5.896					2.520	-30.451			0.221
Cuba											0.408										0.408
Dominican Republic			1.221					1.140						0.260							1.101
Guatemala			2.416						1.481												1.948
Guyana										-0.804											-0.804
Haiti	0.036					-1.157															-0.660
Honduras						1.466															1.466
Mauritania								10.050				-5.774									2.138
Mexico										1.981					0.931						1.806
Nicaragua		0.555					0.905														0.730
Panama														-12.971							-12.971
Peru	-0.670					-0.232		0.639		0.233	1.131	-0.223	2.161	0.963	4.146	0.941	-0.504	0.799			0.420
Suriname											-3.781										-3.781
Trinidad & Tobago							0.846														0.846
Pacific																					
Samoa										2.991											2.991
Solomon Islands							-2.561														-2.561

Source: Author's calculations

Table 3: Average annual per cent change (*AAPC*) in different indexes of family planning progress in 86 countries during 2000-2019

Trend	*AAPC* in			
	p_p	p_s	p_q	p
Progress reversed (*AAPC*<0)	33	19	37	26
Marginal progress (0≤*AAPC* <1.0)	10	17	21	23
Mild progress (1.0≤*AAPC* <2.0)	4	17	12	15
Moderate progress (2.0≤*AAPC* <3.0)	6	8	4	11
Substantial progress (*AAPC*≥3.0)	33	25	12	11
Minimum	-36.823	-6.196	-4.341	-12.971
Q1	-2.514	0.064	-0.750	-0.686
Median	0.996	1.364	0.154	0.721
Q3	5.282	3.168	1.385	2.088
Maximum	98.295	16.198	12.796	10.452
IQR	7.996	3.104	2.134	2.774
CV	4.099	1.704	4.349	4.378
N	86	86	86	86

Source: Author's calculations

The *APC* in the index p can be decomposed into three components, one each attributed to p_s, p_p and p_q. The difference $p^2–p^1$ may be decomposed as

$$p^2 - p^1 = \frac{p_{sp}^2+p_{pq}^2+p_{qs}^2}{3} - \frac{p_{sp}^1+p_{pq}^1+p_{qs}^1}{3} = \frac{1}{3}\left[\left(p_{sp}^2 - p_{sp}^1\right) + \left(p_{pq}^2 - p_{pq}^1\right) + \left(p_{qs}^2 - p_{qs}^1\right)\right] \quad (12)$$

We can write

$$\left(p_{sp}^2 - p_{sp}^1\right) = \frac{\left(p_{sp}^2-p_{sp}^1\right)}{ln\left(\frac{p_{sp}^2}{p_{sp}^1}\right)} * ln\left(\frac{p_{sp}^2}{p_{sp}^1}\right) = LM_{sp} * \ln\left(\frac{p_{sp}^2}{p_{sp}^1}\right) = LM_{sp} * \left[ln\left(\frac{\sqrt{p_s^2}}{\sqrt{p_s^1}}\right) + ln\left(\frac{\sqrt{p_p^2}}{\sqrt{p_p^1}}\right)\right] \quad (13)$$

where

$$LM_{sp} = \frac{\left(p_{sp}^2-p_{sp}^1\right)}{ln\left(\frac{p_{sp}^2}{p_{sp}^1}\right)} \quad (14)$$

is the logarithmic mean (Carlson, 1972). Similarly,

$$\left(p_{pq}^2 - p_{pq}^1\right) = LM_{pq} * \left[ln\left(\frac{\sqrt{p_p^2}}{\sqrt{p_p^1}}\right) + ln\left(\frac{\sqrt{p_q^2}}{\sqrt{p_q^1}}\right)\right] \quad (15)$$

$$\left(p_{qs}^2 - p_{qs}^1\right) = LM_{qs} * \left[ln\left(\frac{\sqrt{p_q^2}}{\sqrt{p_q^1}}\right) + ln\left(\frac{\sqrt{p_s^2}}{\sqrt{p_s^1}}\right)\right] \quad (16)$$

so that

$$p^2 - p^1 = \left\{\frac{\left(LM_{sp}+LM_{qs}\right)}{3} * \ln\left(\frac{\sqrt{p_s^2}}{\sqrt{p_s^1}}\right)\right\} + \left\{\frac{\left(LM_{sp}+LM_{pq}\right)}{3} * \ln\left(\frac{\sqrt{p_p^2}}{\sqrt{p_p^1}}\right)\right\} + \left\{\frac{\left(LM_{pq}+LM_{qs}\right)}{3} * \ln\left(\frac{\sqrt{p_q^2}}{\sqrt{p_q^1}}\right)\right\} \quad (17)$$

$$p^2 - p^1 = \partial p_s + \partial p_p + \partial p_q \quad (18)$$

Substituting from (18) into (9), we get

$$APC = \frac{\partial p_s}{p^1 \times (t^2 - t^1)} + \frac{\partial p_p}{p^1 \times (t^2 - t^1)} + \frac{\partial p_q}{p^1 \times (t^2 - t^1)} = S + P + Q \quad (19)$$

Where S is the contribution of the change in the index p_s; P is the contribution of the change in p_p; and Q is the contribution of the change in p_q. The *AAPC* in the index p is now decomposed as

$$AAPC = \sum_{i=1}^{k} w_i * S_i + \sum_{i=1}^{k} w_i * P_i + \sum_{i=1}^{k} w_i * Q_i = C_S + C_P + C_Q \quad (20)$$

The term C_S gives the contribution of the change in the index p_s to the *AAPC* in the index p. Similarly, C_P gives the contribution of the change in the index p_p while C_Q gives the contribution of the change in the index p_q. Results of the decomposition exercise are presented in table 4 while the decomposition result for different countries are presented in appendix table 2. There are only 27 countries where the contribution of the change in all the three indexes to *AAPC* in the index $p>0$. In these countries, progress in all the three dimensions of the family planning services delivery has contributed to family planning progress. On the other hand, there are 6 countries where contribution of the change in all the three indexes to *AAPC* in the index $p<0$. In these countries, there has been reversal in progress in all the three dimensions so that *AAPC* in the index $p<0$. In these countries, the overall family planning progress appears to have reversed during 2010-2019. In the remaining 53 countries, the contribution of the change in the three indexes to *AAPC* in the index p has been mixed so that the *AAPC* in the index p is the algebraic sum of change in the three indexes. Family planning progress in these countries has been inconsistent as there has been progress in some dimensions but reversal in progress in other dimensions leading to progress inequality in different dimensions of the family planning services delivery system. In 14 countries, *AAPC* in the index p has been positive despite reversal in progress in the dimension of method choice as the progress reversed in meeting the demand of both modern spacing methods and permanent methods. On the other hand, in 10 countries, *AAPC* in the index p has been negative despite progress in meeting the demand of permanent methods because the progress reversed in meeting the demand of modern spacing methods and in expanding the method choice. There is no country where the *AAPC* in the index p has remained unchanged during the period under reference.

Table 4: Distribution of countries according to the contribution of the change in indexes p_s, p_p and p_q to the *AAPC* in the index p.

Contribution of			*AAPC*		
p_s	p_p	p_q	Positive	Negative	Total
Negative	Negative	Negative	0	6	6
Negative	Negative	Positive	1	5	6
Negative	Positive	Negative	6	10	16
Negative	Positive	Positive	6	4	10
Positive	Negative	Negative	3	0	3
Positive	Negative	Positive	3	1	4
Positive	Positive	Negative	14	0	14
Positive	Positive	Positive	27	0	27
Total			60	26	86

Source: Author's calculations

Equation (20) holds for every country. This means that inter-country variation in *AAPC* in the index p can be decomposed as

$$Var(AAPC) = \sum Var(C_i) + 2\sum_{i \neq j} Cov(C_i, C_j),\ i, j = S, P, Q \quad (21)$$

Equation (21) suggests that the contribution of inter-country variation in C_i to the inter-country variation in *AAPC* may be small because either $Var(C_i)$ is small or covariance terms $Cov(C_i, C_j)$ are negative so that equation (21) may not reflect the true importance of inter-country variation in the change in the three indexes to the change in the index *p*. This problem can be circumvented by using absolute values of covariance terms in equation (21). Thus, the relative importance of the inter-country variation in the change in the indexes p_s to the inter-country variation in the change in the index *p* can be calculated as (Chaurasia, 2020; Horvitz et al, 1997; Rees et al, 2010: Rees et al, 1996)

$$I(p_s) = \frac{Y(p_s)}{Y(p)} \quad (22)$$

where

$$Y(p_s) = Var(C_S) + |Cov(C_S, C_P)| + \left|Cov(C_S, C_Q)\right|, \text{ etc.} \quad (23)$$

and

$$Y(p) = Y(p_s) + Y(p_p) + Y(p_q) \quad (24)$$

This exercise suggests that almost three fourth (73.9 per cent) of the inter-country variation in *AAPC* in the index *p* is attributed to the inter-country variation in the change in the index p_p whereas the inter-country variation in the change in the index p_s accounts for around 15 per cent of the inter-country variation in *AAPC* in the index *p*. Finally, the inter-country variation in the change in the index p_q accounts for around 11 per cent of the inter-country variation in *AAPC* in the index *p*. This means that overall progress in family planning in these countries has largely been driven by the progress in meeting the demand of permanent methods. Progress in meeting the demand of modern spacing methods and the progress in expanding the method choice

Discussions and Conclusions

This paper has attempted to construct a composite family planning progress index that reflects the agility of the family welfare services delivery system in meeting the need of modern spacing method, in meeting the need of permanent methods, and in expanding the method choice. The index offers wholistic assessment of overall family planning progress by considering both the quantitative and the qualitative aspects of family planning use. It can serve as the basis for monitoring the family planning progress and for spatio-temporal comparisons. The index can be constructed from the already available data and does not require any new data collection exercise. An advantage of the index is that the overall family planning progress reflected through the indexed can be attributed to the change in different dimensions of family planning services delivery to identify which dimension of family planning services delivery is not progressing satisfactorily so that appropriate policy and programme level actions can be taken. The composite family planning progress index presents a different perspective of family planning progress than the perspective presented by contraceptive prevalence or the demand satisfied by modern methods.

Application of the proposed composite family planning progress index to 113 countries suggests that, in most of the countries, family planning progress has remained far from satisfactory as far as the agility of the family planning services delivery system towards the diverse family planning needs of women and men is concerned. This unsatisfactory progress appears to be the reason why the ambitious target of recruiting 120 million new acceptors of family planning by 2020 (120 by 2020) set under The FP2020 Initiative could not be achieved (FP2020, 2020). What is even more concerned is that, in many countries, the family planning progress has reversed in some or in all the three dimensions of family planning services delivery indicating that the agility of the family planning services delivery system in meeting family planning needs of women men has waned. Family planning services delivery in most of the countries is essentially a prerogative

of government initiative and support. The waning of the agility of the family planning services delivery system, therefore, calls for reinvigorating official family planning efforts. Family planning is now an integral component of any strategy directed towards meeting the reproductive health needs of the people, especially women and is valued as a reproductive right. It is also an important development intervention that has implications for United Nations Sustainable Development Agenda.

The analysis also reveals that, in majority of the countries, the method choice is getting increasingly limited because of the increased dependence of family planning services delivery system on only one family planning method. The is not a welcome feature of family planning services as it indicates that family planning needs of a substantial proportion of women and men remain neglected. Similarly, family planning progress in meeting the demand for modern spacing methods and in meeting the demand for permanent methods has also been different in most of the countries suggesting that the family planning progress is not balanced and the inequality in progress across different dimensions of family planning services delivery is quite substantial in many countries. There are only a small number of countries where family planning progress may be termed as satisfactory, to some extent, in meeting the diverse family planning needs of women and men.

The global family planning movement is now almost seven decades old. The launch of the first official family planning program by India way back in 1952 may be taken as the beginning of this movement. The genesis of the movement was grounded in the proposition that regulating fertility and curtailing population growth through family planning would contribute significantly towards addressing a range of development concerns facing the developing countries of the world. Following this premise, substantial efforts were put in place, resources mobilized, and commitments made to main-stream family planning in the development discourse of almost all developing countries of the world. The present analysis, however, suggests that international, national, local, and individual commitments have somewhere lacked in realizing the goal of planned family that is regarded as critical to sustainable development and human well-being.

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Appendix table 1: Indicators of family planning progress in 113 countries, latest available data.

Country	Period	p_p	p_s	p_q	p
Africa					
Algeria	2012-2013	0.185	0.798	0.141	0.294
Angola	2015-2016	0.008	0.315	0.531	0.176
Benin	2017-2018	0.000	0.313	0.541	0.137
Burkina Faso	2018-2019	0.000	0.595	0.494	0.181
Burundi	2016-2017	0.042	0.494	0.460	0.254
Cameroon	2014	0.027	0.464	0.590	0.253
Central African Republic	2010-2011	0.029	0.337	0.481	0.207
Comoros	2012	0.090	0.316	0.581	0.275
Congo	2014-2015	0.041	0.424	0.488	0.242
Côte d'Ivoire	2018	0.000	0.434	0.524	0.159
Democratic Republic of the Congo	2013-2014	0.104	0.164	0.560	0.225
Egypt	2014	0.129	0.901	0.429	0.399
Equatorial Guinea	2011	0.077	0.254	0.657	0.258
Eritrea	2010	0.029	0.237	0.584	0.194
Eswatini	2014	0.282	0.906	0.540	0.532
Ethiopia	2018	0.000	0.709	0.348	0.166
Gabon	2012	0.072	0.383	0.349	0.230
Gambia	2018	0.046	0.434	0.446	0.242
Ghana	2017	0.123	0.547	0.617	0.372
Guinea	2018	0.039	0.428	0.602	0.264
Guinea-Bissau	2014	0.029	0.454	0.689	0.272
Kenya	2017	0.269	0.850	0.463	0.486
Lesotho	2018	0.181	0.901	0.531	0.468
Liberia	2013	0.032	0.450	0.389	0.217
Libya	2014	0.000	0.276	0.434	0.115
Madagascar	2017	0.182	0.668	0.382	0.372
Malawi	2015-2016	0.582	0.798	0.467	0.604
Mali	2018	0.053	0.475	0.498	0.269
Mauritius	2014	0.465	0.399	0.580	0.477
Morocco	2018	0.120	0.788	0.188	0.281
Mozambique	2015	0.029	0.580	0.455	0.253
Namibia	2013	0.444	0.831	0.500	0.574
Niger	2017	0.042	0.467	0.456	0.246
Nigeria	2018	0.029	0.416	0.652	0.255
Rwanda	2014-2015	0.144	0.733	0.491	0.397
Sao Tome and Principe	2014	0.037	0.662	0.537	0.298
Senegal	2017	0.068	0.589	0.529	0.316
Sierra Leone	2016	0.011	0.545	0.426	0.210
South Africa	2016	0.485	0.872	0.547	0.619
South Sudan	2010	0.014	0.070	0.598	0.108
Sudan	2014	0.000	0.370	0.243	0.100
Togo	2017	0.083	0.457	0.594	0.313
Tunisia	2018	0.089	0.786	0.398	0.338
Uganda	2017	0.202	0.572	0.479	0.392
United Republic of Tanzania	2015-2016	0.347	0.566	0.578	0.488
Zambia	2013-2014	0.209	0.700	0.534	0.443
Zimbabwe	2015	0.154	0.903	0.383	0.401

Country	Period	p_p	p_s	p_q	p
Asia					
Afghanistan	2015-2016	0.205	0.470	0.607	0.399
Bangladesh	2014	0.468	0.778	0.485	0.565
Bhutan	2010	0.741	0.903	0.552	0.721
Cambodia	2014	0.307	0.609	0.525	0.466
Democratic People's Republic of Korea	2017	0.265	0.939	0.054	0.281
India	2015-2016	0.834	0.502	0.257	0.490
Indonesia	2016-2017	0.311	0.864	0.461	0.510
Iran (Islamic Republic of)	2010-2011	0.890	0.616	0.619	0.700
Iraq	2018	0.270	0.594	0.533	0.448
Jordan	2017-2018	0.161	0.632	0.437	0.370
Kazakhstan	2018	0.117	0.855	0.416	0.378
Kyrgyzstan	2018	0.173	0.724	0.407	0.387
Lao People's Democratic Republic	2017	0.331	0.811	0.424	0.493
Maldives	2016-2017	0.242	0.325	0.501	0.344
Mongolia	2018	0.191	0.762	0.426	0.412
Myanmar	2015-2016	0.309	0.888	0.437	0.505
Nepal	2016-2017	0.564	0.557	0.634	0.584
Oman	2014	0.444	0.371	0.653	0.479
Pakistan	2017-2018	0.533	0.463	0.535	0.509
Philippines	2017	0.404	0.623	0.480	0.496
Qatar	2012	0.271	0.758	0.546	0.494
Sri Lanka	2016	0.758	0.735	0.667	0.719
State of Palestine	2014	0.281	0.686	0.408	0.436
Tajikistan	2017	0.066	0.659	0.338	0.276
Thailand	2015-2016	0.895	0.893	0.483	0.736
Timor-Leste	2016	0.189	0.507	0.480	0.368
Turkey	2018	0.578	0.607	0.531	0.571
Turkmenistan	2015-2016	0.078	0.817	0.071	0.190
Viet Nam	2013-2014	0.446	0.717	0.477	0.537
Yemen	2013	0.148	0.495	0.510	0.349
Europe					
Albania	2017-2018	0.103	0.049	0.571	0.160
Armenia	2015-2016	0.099	0.435	0.425	0.281
Belarus	2012	0.500	0.766	0.501	0.580
Bolivia (Plurinational State of)	2016	0.370	0.561	0.677	0.524
Bosnia and Herzegovina	2011-2012	0.034	0.241	0.426	0.177
Georgia	2018	0.221	0.638	0.545	0.437
Montenegro	2018	0.054	0.376	0.440	0.235
North Macedonia	2011	0.056	0.270	0.356	0.191
Republic of Moldova	2012	0.484	0.624	0.477	0.525
Serbia	2014	0.036	0.289	0.325	0.172
Ukraine	2012	0.333	0.692	0.451	0.475
Latin America and Caribbean					
Barbados	2012	0.316	0.792	0.526	0.518
Belize	2011	0.735	0.729	0.543	0.664
Colombia	2015-2016	0.919	0.820	0.545	0.748
Costa Rica	2018	0.751	0.864	0.594	0.730
Cuba	2014	0.845	0.903	0.537	0.748

Country	Period	p_p	p_s	p_q	p
Dominican Republic	2014	0.907	0.757	0.383	0.652
El Salvador	2014	0.894	0.735	0.421	0.660
Country	Period	p_p	p_s	p_q	p
Guatemala	2014-2015	0.797	0.576	0.500	0.615
Guyana	2014	0.218	0.630	0.645	0.461
Haiti	2012	0.075	0.611	0.390	0.291
Honduras	2011-2012	0.834	0.725	0.569	0.703
Mauritania	2015	0.010	0.374	0.304	0.152
Mexico	2015	0.814	0.812	0.492	0.693
Nicaragua	2011-2012	0.921	0.884	0.526	0.760
Panama	2014-2015	0.474	0.767	0.548	0.587
Paraguay	2016	0.563	0.890	0.594	0.671
Peru	2018	0.709	0.657	0.602	0.655
Saint Lucia	2011-2012	0.447	0.802	0.542	0.583
Suriname	2018	0.272	0.655	0.385	0.416
Trinidad and Tobago	2011	0.372	0.687	0.560	0.528
Pacific					
Papua New Guinea	2016-2018	0.395	0.538	0.574	0.498
Samoa	2014	0.280	0.473	0.483	0.403
Solomon Islands	2015	0.395	0.370	0.546	0.432
Tonga	2012	0.537	0.434	0.491	0.486
Vanuatu	2013	0.477	0.522	0.581	0.525

Source: Author's calculations

Appendix table 2: Decomposition of *AAPC* in the index *p*.

Country	Period		*AAPC* in index *p*	*AAPC* attributed to the change in		
				pp	*ps*	*pq*
Africa						
Algeria	2006	2012	0.315	1.043	-0.130	-0.598
Benin	2001	2017	-1.266	-2.307	1.448	-0.407
Burkina Faso	2003	2017	1.716	-0.833	3.154	-0.604
Burundi	2010	2016	1.183	-1.077	1.625	0.635
Cameroon	2004	2014	-0.903	-3.735	1.605	1.228
Congo	2005	2014	4.893	0.356	2.957	1.579
Côte d'Ivoire	2011	2018	0.221	-2.788	1.582	1.427
Democratic Republic of the Congo	2007	2013	4.392	0.132	1.809	2.450
Egypt	2000	2014	0.710	0.109	0.014	0.587
Eritrea	2002	2010	0.188	0.000	-0.077	0.265
Eswatini	2006	2014	0.989	0.692	0.529	-0.232
Ethiopia	2000	2018	1.692	-0.890	3.038	-0.457
Gabon	2000	2012	-0.694	-0.835	1.364	-1.223
Gambia	2013	2018	-1.017	-3.824	3.615	-0.808
Ghana	2003	2017	2.135	0.812	1.302	0.021
Guinea	2005	2018	3.581	1.080	2.402	0.098
Kenya	2003	2017	1.013	0.080	1.220	-0.288
Lesotho	2004	2018	1.539	0.880	0.583	0.076
Liberia	2006	2013	0.182	-1.256	2.775	-1.337
Madagascar	2003	2017	2.278	1.597	1.145	-0.464
Malawi	2000	2015	3.673	2.047	1.124	0.502
Mali	2001	2018	2.248	0.582	1.796	-0.129
Morocco	2003	2018	-2.051	-1.281	-0.046	-0.723
Mozambique	2003	2015	-1.336	-1.560	0.472	-0.247
Namibia	2000	2013	0.419	0.272	0.284	-0.136
Niger	2006	2017	-0.920	-1.563	0.647	-0.005
Nigeria	2003	2018	0.711	0.029	0.615	0.068
Rwanda	2000	2014	6.144	1.735	5.075	-0.666
Sao Tome and Principe	2006	2014	2.139	0.316	-0.326	2.149
Senegal	2005	2017	2.795	0.439	2.578	-0.222
Sierra Leone	2013	2016	-7.187	-7.603	2.123	-1.707
South Africa	2003	2016	-0.435	-0.599	-0.100	0.264
Togo	2010	2017	6.517	4.236	1.678	0.603
Tunisia	2011	2018	-5.364	-5.315	0.157	-0.205
Uganda	2000	2017	1.469	0.945	0.918	-0.394
United Republic of Tanzania	2004	2015	2.233	1.040	0.876	0.317
Zambia	2001	2013	2.193	0.958	1.150	0.086
Zimbabwe	2005	2015	0.651	-0.753	0.200	1.204
Asia						
Bangladesh	2004	2014	1.185	0.476	0.331	0.378
Cambodia	2000	2014	3.214	2.404	1.218	-0.408
India	2005	2015	0.800	0.030	0.612	0.158
Indonesia	2002	2016	-0.224	-0.070	0.004	-0.158
Iraq	2011	2018	-1.751	-2.294	0.216	0.327
Jordan	2002	2017	-0.862	-0.868	-0.026	0.032

Country	Period		*AAPC* in index	*AAPC* attributed to the change in		
			p	*pp*	*ps*	*pq*
Kazakhstan	2010	2018	0.698	-0.112	-0.210	1.020
Kyrgyzstan	2012	2018	0.359	-1.102	0.389	1.072
Lao People's Democratic Republic	2000	2017	1.649	1.475	0.551	-0.377
Maldives	2009	2016	-3.567	-2.340	-1.030	-0.197
Mongolia	2003	2018	-1.607	-1.296	-0.255	-0.055
Myanmar	2001	2015	0.182	-0.093	0.573	-0.298
Nepal	2001	2016	0.765	0.038	0.377	0.350
Oman	2007	2014	10.452	7.210	3.098	0.144
Pakistan	2000	2017	1.587	1.487	0.262	-0.161
Philippines	2003	2017	0.229	-0.171	0.662	-0.262
Sri Lanka	2000	2016	1.589	0.351	0.851	0.387
State of Palestine	2010	2014	-1.359	-1.154	-0.056	-0.149
Tajikistan	2012	2017	2.286	1.056	0.209	1.022
Timor-Leste	2009	2016	9.707	4.800	0.600	4.307
Turkey	2003	2018	0.871	0.498	0.235	0.138
Turkmenistan	2000	2015	-2.184	-1.355	0.071	-0.900
Viet Nam	2002	2013	0.454	-0.728	0.225	0.957
Yemen	2006	2013	-0.033	-0.709	0.591	0.084
Europe						
Albania	2008	2018	-4.310	-2.495	-1.827	0.012
Armenia	2000	2015	0.329	-0.126	0.805	-0.351
Bolivia (Plurinational State of)	2003	2016	1.241	0.690	0.381	0.170
Montenegro	2013	2018	4.532	6.218	-1.547	-0.140
Republic of Moldova	2005	2012	2.169	1.394	0.285	0.490
Serbia	2010	2014	-5.075	-1.909	-1.603	-1.563
Ukraine	2007	2012	9.894	8.855	0.265	0.773
Latin America and Caribbean						
Colombia	2000	2015	0.645	0.238	0.448	-0.042
Costa Rica	2011	2018	-0.823	-0.798	-0.172	0.147
Cuba	2010	2014	0.408	0.585	-0.224	0.046
Dominican Republic	2002	2014	1.101	0.050	0.478	0.573
Guatemala	2002	2014	1.948	0.937	0.944	0.067
Guyana	2009	2014	-0.804	0.018	-1.205	0.384
Haiti	2000	2012	-0.660	-0.612	0.682	-0.730
Honduras	2005	2011	1.466	0.968	0.434	0.064
Mauritania	2007	2015	2.138	0.666	0.928	0.544
Mexico	2009	2015	1.806	-0.563	0.570	1.799
Nicaragua	2001	2011	0.730	0.760	0.210	-0.240
Panama	2013	2014	-12.971	-14.128	0.014	1.143
Peru	2000	2018	0.420	0.393	0.117	-0.091
Suriname	2010	2018	-3.781	-2.338	-0.839	-0.604
Trinidad and Tobago	2006	2011	0.846	1.420	-0.494	-0.080
Pacific						
Samoa	2009	2014	2.991	2.184	0.049	0.758
Solomon Islands	2006	2015	-2.561	-2.209	-0.910	0.557

Source: Author's calculations