



Role of Education, Worker Population Ratio and Health in Reducing Gender Disparity: A Disaggregated Gender Analysis of India

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Abstract

One of the most speedy and substantial social shifts in human history has been the evolution of gender relations since the turn of the 20th century. Even though female health, literacy and women participation in workforce have significantly improved, the status of women in Indian society is not very satisfactory leading to gender disparities. It is in this background that this paper attempts to analyse the role of education, labour market and health in reducing gender disparities across the states over the period of time. To analyse the impact of these variables, Gender Disparity Index (GDI) has been constructed utilising the data from Periodic Labour Force Survey (PLFS) and Sample Registration System (SRS) to measure gender disparities in 20 major states and union territories (UTs) of India. For the construction of GDI, we have used three dimensions, namely health, empowerment and labour market participation. The index is prepared to make a decadal comparative study for the years 2011–12 and 2020–21. The statistical results indicate that there is a significant difference in mean of the GDI scores for 2020–21 and 2011–12. The paper concludes with certain policy implications suggesting that there is a need to put more effort into creating infrastructure and cutting-edge policies to improve the health and education systems. The focus should also be to create more employment opportunities for females, helping them to raise their standard of living so as to enhance their contribution towards economic growth.

Keywords Gender disparities · Education · Workforce participation · Health · Gender Disparity Index

JEL Classification J01

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1 Introduction

One of the most speedy and substantial social shifts in human history has been the evolution of gender relations since the turn of the twentieth century. Decades have passed when our society is still grappling with the issue of gender disparity. Gender disparities may be defined as statistical discrepancies (commonly referred to as “gaps”) between males and females, as well as across genders, that show some quantitative disparities. There are several indices like economic participation and opportunity, educational achievement, life expectancy and health, political empowerment and participation in the workforce to assess gender equality. But the country still lack measures to reduce the gender gap in many of these indices. Numerous other factors like discriminatory social norms, defined gender roles, laws and cultural practices add more in this gender gap. In many developing countries, conventional traditions and patriarchal mindsets limit women from stepping out of their home spaces, thus failing them to become part of workforce. Also many a times, they do not get opportunities or family approvals to enrol themselves in higher studies. Hence, many of the women choose to surrender to their circumstances and are compelled to fight with these patriarchal mindsets and orthodox social standards. Even though female literacy and women participation in workforce has significantly improved, the status of women in Indian society is not very satisfactory.

According to the European Institute of Gender Equality (EIGE), gender inequality is the discrimination between men and women based on their gender or sex, which further results in unequal access to resources and enjoyment of rights. According to the World Bank (2021), women contribute 49.58% of the world’s population globally, and in India, this contribution is 48.00%. Women are called the bedrock of the nation, and like men, they also contribute significantly to the economic growth, economic advancement and rapid recovery of the economy. Therefore, mainstreaming all the sections of society is critical for economic progress.

Improvement in education, health and labour markets are some of the major areas where government is trying to narrow the gender gaps. Human health has undergone growing developments in recent years, which has resulted in people living longer with more productive and healthy lifestyle. Improved health has significant effects on population structure and has also boosted the rates of economic growth globally. Furthermore, in a study by Peters et al. (2022), it was found that citizens of low-income countries are not much aware regarding their health. Additionally, studies demonstrate that countries with sound economic policies and good governance get more benefit from improved health. A study by Bloom et al. (2004) provides convincing evidence for a process in which health played a major role in developing a better framework for advantageous beneficial economic policies. Furthermore, it was noted that improved health has resulted in a sharp rise in the labour supply. More people in workforce participate due to declining mortality and fertility rates.

Different studies opine that the one important factor which connects different strands of life, including the employment, is education (Yabiku & Schlabach 2009). Through education, people can accomplish their objectives with variety of approaches (Nasir & Nazli 2000). Therefore, it is important for an individual to build learning abilities, through education to achieve lifelong empowerment. Education equips individuals with the knowledge they need to take advantage of their job prospects and serves as a foundation for better developmental governance of both the quality and quantity (Hussain 2005). The concept of human capital theory, put out by renowned researchers like Schultz (1961), Becker (1992) and Mincer (1982), posits that the decision to spend in higher education is advantageous for both governments and individuals. The main justification for public investment in education is in its potential to stimulate economic growth via increased productivity, fostering social cohesion and nurturing improved well-being. On the other hand, choosing to privately invest in education leads to increased lifetime earnings for persons with a greater number of years spent in school, enhanced options for higher-paying work, shorter periods of unemployment and accelerated advancement towards superior career prospects (Wahrenburg & Weldi 2007). Education is regarded as the most significant factor determining the working world and has a significant impact on higher status and fascinating working ideas. In the National Education Policy (NEP) 2020, education system is suggesting better alternatives to tackle the problem of growing unemployment as well as the disparities in the economy. Countries like India follow a U-shaped curve concerning female labour supply with education, which means that the women with no or low education tend to have more participation in workforce rather than women with primary or secondary education (Dasgupta & Goldar 2005; Kapsos et al. 2014). Despite massive improvements in the country's literacy, education, skill levels and vocational training, the problem of gender disparities has not lessened.

Another important indicator to indicate gender disparities is the worker population ratio (WPR) which internationally gauges the supply of labour. It would not be incorrect to state that an increase in the percentage of graduates drives up the WPR for the economy because higher levels of education encourage people to shift themselves from the labour force to workforce. National Sample Survey (NSS) Report 2011–12 and Periodic Labour Force Survey (PLFS) 2020–21 help us to draw the inference that regardless of the indicators of education and employment, women in Indian context have historically fared badly and have been at a far distant level from their counterparts in the economy, when it comes to development. This further demonstrates discrimination in a straightforward manner and further points to the pervasive “gender gap” and “gender inequality”. Thus, one of the mechanisms to bridge gender gaps could be women's participation in the job market. This might lead to greater access to health care and education, as well as a further reduction in poverty. According to predictions from the International Monetary Fund (IMF), India, the largest democracy in the world, could have been 27 per cent richer, if women had entered the labour force at the same rate as men (Lagarde & Ostry 2018).

In this backdrop, the main aim of this paper is to analyse the role of education, labour market and health in reducing gender disparities across the states over the

period of time. The paper is organised in the following manner. Having briefly discussed the introduction and background of the study in the first section, the second section elaborates upon the objectives and hypotheses of the study. The third section deals with the data and methods followed by analysis and discussion of Gender Disparity Index (henceforth, GDI) in the fourth section. The fifth section highlights the statistical analysis on how education, labour market and health helps to reduce the gender disparity. The study in the sixth and concluding section further seeks to draw attention towards those states/union territories (UTs) which needs to embrace more developmental initiatives to promote gender equality.

2 Objectives and Hypotheses of the Study

1. To do a comparative analysis of the GDI scores for the years 2011–12 and 2020–21 at the national level.
2. To do a comparative analysis of the GDI scores of states and UTs for the years 2011–12 and 2020–21 at the state/UTs level.
3. To carry out an interstate/UTs comparative analysis between 2011–12 and 2020–21 on the basis of the range of GDI.
4. To study the dimension-wise comparative analysis between 2011–12 and 2020–21.

Hypothesis:

H_{01} : There is no significant change in the GDI scores of different states/UTs from 2011–12 to 2020–21.

H_{A1} : There is a significant change in the GDI scores of different states/UTs from 2011–12 to 2020–21.

3 Data and Methods

The study utilises the data from NSS Report, PLFS and Sample Registration System (SRS) to create GDI that helps to measure gender disparities in 20 major states and UTs of India. The methodology of the index is similar to the methodology adopted for the calculation of Human Development Index (HDI) and Gender Inequality Index (GII) internationally, providing a basis for robust cross-state analysis for the time period 2011–12 and 2020–21. For the construction GDI, we have used three dimensions, namely health, education and labour market participation, so as to analyse interstate gender disparities.

To indicate the health status of population, global GII uses maternal mortality ratio (MMR) and adolescent birth rate (ABR). As it is known that both these measures deal with women health only and exclude health of males. Therefore, to remove this bias we have used life expectancy at birth (LEB) as our first indicator

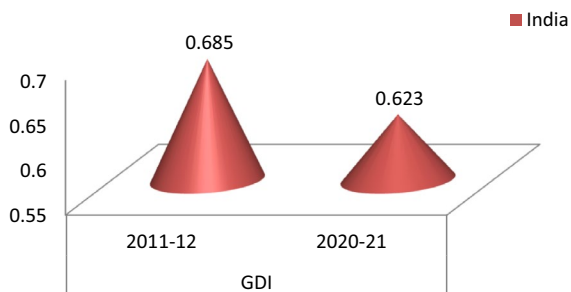
to measure gender disparity. It also captures the mortality throughout the course of life (Roser 2013). This indicator covers the mortality pattern affecting people of all ages and both the genders. Thus, for the construction of the health index for the year 2011–12, LEB of 2010–2014 from SRS has been considered, and for year 2020–21, data of LEB from SRS 2015–2019 has been taken. Also, along with better health, increasing student's educational attainment towards higher education has become the top most priority of the policymakers and better educational attainment is considered as one of the main indicators for economic prosperity and growth. ILOSTAT (2020) states that there is a positive correlation between a country's per capita income and the proportion of its workforce with a bachelor's or higher degree, but still in most of the countries working-age population lacks a bachelor's degree or above. Hence, for the calculation of education indices, the percentage distribution of the graduates (15 and above) has been taken from the NSS 68th round and PLFS report for the year 2020–21. Education at the level of graduates helps us to know the transition rate and vertical mobility of population in the education, and furthermore, it also helps to get the idea of the dropouts from the school education. Also educated population becomes a part of workforce rather than just being a part of labour force in the economy. Therefore, for the estimation of the labour market participation index, WPR aged 15 and above has been taken. The data have been taken from the NSS 68th round and PLFS report for the year 2020–21.

To calculate the GDI values, in the first step, dimension index has been determined using the minimum and maximum values of each parameter for each gender. In the second step, geometric mean has been calculated for both genders. To express the calculated index value, the ratio between female and male disparities shall be calculated and the final value of disparities, i.e., GDI, could be ascertained by subtracting 1 from the calculated index value. The values of GDI range from 0 to 1. In the state-wise analysis, the following groupings are created to categorise the index, and on the basis of this, they are placed in the following groups.

Category	GDI range
Equality	0–0.250
Low equality	0.251–0.500
Inequality	0.501–0.750
High inequality	0.751–1

The index is prepared to make a comparative study for the years 2011–12 and 2020–21 so as to determine the decadal change in the disparities along with the factors responsible for the change. Further, rank correlation has also been calculated to analyse the changes in the ranks over the decade. To measure the mean difference of two sets of observation, paired *T*-Test has been used. Kendall's τ rank correlation coefficient provides the degree of correlation among the two variable used in the analysis, whereas paired *T*-Test is used to provide a comparison

Fig. 1 GDI of India for year 2011–12 and 2020–21. *Source:* Based on authors' calculation



of the population means for a group of random samples whose variances are almost normally distributed and examine the validity of the hypothesis.

3.1 Limitations of the Index

Like all composite measures, the constructed GDI also has some limitations. First, due to the lack of data available for LEB for all the states/UTs, we could consider 20 states/UTs of the country in the study. Secondly, due to non-availability of LEB data, for the years 2011–12 and 2021–22, we have used LEB data for the years 2010–2014 and 2014–2016 respectively. It is also in place to mention that due to the carving out of Telangana from Andhra Pradesh in 2014, the LEB of Telangana has been merged with Andhra Pradesh to make data symmetrical since the LEB data published by SRS for Telangana was available for the year 2014–2016.

4 Analysis and Discussion

The GDI is a schema of a nation's average performance to measure the presence of disparities among genders in terms of education, labour market participation and health. The interpretation of the index provides that the lower the value of the index, the lower will be the gender disparities in the states/UTs that ranges from value of 0 to 1. The results from GDI indicate that there has been a decrease in gender disparities in the country from 2011–12 to 2020–21.

Figure. 1 clearly shows that the GDI values for the country have decreased from 0.685 in 2011–12 to 0.623 in 2020–21 exhibiting that we are moving towards gender equality. The impact of gender budgeting (GB) introduced way back in 2005–06 could be the reason for the increase in the empowerment among the women that have led to lessening of gender gaps in the country. In recent years, the allocation of funds under women-centric and pro-women schemes has led to the increase in number of female beneficiaries under various schemes. GB has been a source for their empowerment, making them aware about their fundamental rights. Hence, gender disparity is not only an ethical and societal issue, but it is also a significant economic problem. However, with an effective emphasis on the development and empowerment of women in the fields of health, the gap of gender disparity in the country has narrowed down.

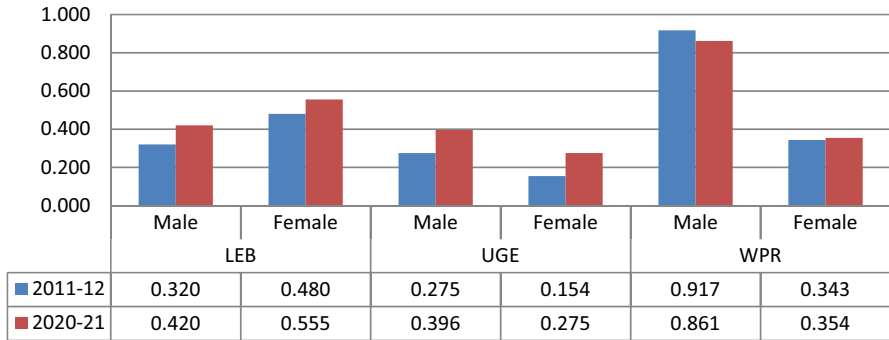


Fig. 2 Dimension-wise value of each indicator for the year 2011–12 and 2020–21. *Source:* Based on authors’ calculation

4.1 All India Comparative Analysis of GDI Between 2011–12 and 2020–21 on the Basis of GDI Scores

In the dimension-wise analysis, a positive increase has been recorded in each of the parameters. Figure 2 shows that LEB which is an indicator under health index shows the value of 0.320 in males and 0.480 in females in year 2011–12 that has been increased to 0.420 in males and 0.555 in females.

The education index using the percentage of graduates with the age of 15 and above has shown a growth in the number of graduates of females rather than males between the year 2011–12 to 2020–21. For males, the index is 0.275 and for females it stood at 0.154 in 2011–12 which has shown an increase of 0.396 for males and 0.275 for females in 2020–21. With the better implementation of education scheme like *Rashtriya Uchchar Shiksha Abhiyan (RUSA)*, Scheme of Apprenticeship Training, allocating more funds to universities, Indian Institute of Technologies (IITs) and Indian Institute of Managements (IIMs) along with the establishment of more new colleges and universities helped in the promotion of higher education. This results in an effective increase in the number of graduates. If more schemes and programmes are introduced, this dimension may further improve.

In the labour market participation dimension, the index for 2011–12 shows the male participation at 0.917 which decreased to 0.861 in 2020–21. For females, the index in 2010–11 has been 0.343 which improved to 0.354 in 2020–21 (refer Fig. 2). Thus, it shows that with time, female participations in the workforce have increased. As mentioned above, it could be the result of gender budgeting in which funds are allocated specifically on the basis of gender. This creates more opportunities for women and makes them more aware and empowered, resulting in increase in female workforce participation. Also, Fig. 2 shows that the gender gaps have decreased over the period of time, but still the differentials in the labour market are visible, implying that female participation in the labour market is still low when compared to males. This may be on account of the lack of availability of suitable job which may be compatible with family responsibilities, education level, career choices and household responsibilities. These are also significant factors contributing towards low

Table 1 GDI ranking of 21 major states/UTs on the basis of the scores

2011–12			2020–21		
State/UT	GDI score	Rank	State/UT	GDI score	Rank
Uttarakhand	0.330	1	Chhattisgarh	0.120	1
Kerala	0.428	2	Kerala	0.304	2
Tamil Nadu	0.524	3	Tamil Nadu	0.308	3
Madhya Pradesh	0.527	4	Uttarakhand	0.394	4
Andhra Pradesh	0.561	5	Rajasthan	0.483	5
Maharashtra	0.588	6	Karnataka	0.493	6
Rajasthan	0.592	7	Madhya Pradesh	0.521	7
Karnataka	0.611	8	Jammu and Kashmir	0.526	8
Chhattisgarh	0.620	9	Gujarat	0.557	9
Punjab	0.626	10	Andhra Pradesh	0.568	10
Gujarat	0.671	11	Maharashtra	0.630	11
Uttar Pradesh	0.702	12	Punjab	0.662	12
Jammu and Kashmir	0.704	13	Odisha	0.673	13
Haryana	0.712	14	Haryana	0.678	14
Odisha	0.751	15	Jharkhand	0.704	15
West Bengal	0.809	16	Uttar Pradesh	0.738	16
Delhi	0.823	17	West Bengal	0.765	17
Assam	0.850	18	Assam	0.821	18
Jharkhand	0.885	19	Delhi	0.824	19
Bihar	0.987	20	Bihar	0.956	20
All India	0.685		All India	0.623	

Source: Based on Authors' calculation for the GDI 2011–12 and 2020–21

Note: The higher the GII value, the higher will be the inequalities

female workforce participation and existing gender disparities (Deshpande & Kabeer 2021). Also women are more prone to stay at home and take care of the household when compared to men and this may explain why there is a disparity in the entry–exit rate between both genders. Gender bias in the workplace is another probable cause as women are paid less than males which creates dissatisfaction among them, and thus, they prefer to quit and stay at home (Deshpande 2021).

4.2 Inter-state Comparative Analysis of GDI Between 2011–12 and 2020–21 on the Basis of GDI Scores and Ranks

The overall scores at the all India level as well at the state level exhibit positive change in the economy as the scores have improved from 2011–12 to 2020–21 indicating narrowing of gender gaps. The exception to this improvement are Uttarakhand, Maharashtra, Punjab, Uttar Pradesh, Andhra Pradesh, and Delhi. These states

have shown an increase in the disparities in gender from 2011–12 to year 2020–21 (refer Table 1).

Table 1 exhibits the GDI scores as well as the ranks of the states and UTs. Looking at the scores, it can be inferred that among these states/UTs, the maximum decadal deterioration from 2011–12 (0.330) to 2020–21 (0.394) in the GDI score is in the case of Uttarakhand (0.064) and this is due to the decrease in female WPR. Following the same route, Maharashtra has deteriorated its score by difference of 0.042 from 2011–12 to 2020–21, whereas both Uttar Pradesh and Punjab have witnessed an increase in their scores by 0.036 during the same period. Moving ahead, with a nominal GDI score difference, Andhra Pradesh has not deteriorated much in its decadal GDI score (0.007); however, due to decline in female WPR, its decadal rank has moved down from 5th (2011–12) to 10th (2020–21). If we talk about the capital city of India, Delhi, then there has been a nominal decline in its GDI score (0.001), but due to decrease in female WPR, its rank has deteriorated from 17th to 19th between the two study periods. Despite improvements in the scores of Madhya Pradesh (0.005) and West Bengal (0.044) from 2011–12 to 2020–21, they have moved down in the GDI rankings due less female contribution in WPR. Madhya Pradesh has been ranked 7th in 2020–21 as compared to 4th in 2011–12, whereas West Bengal has moved down marginally from 16th in 2011–12 to 17th in 2020–21. This implies that to improve the GDI scores and to reduce gender disparities, it is important that more and more females should participate in workforce.

Looking at the better side of the story, Chhattisgarh have recorded the maximum improvement in GDI scores. In the year 2011–12, it was ranked 9th among all 20 states/UTs with GDI score of 0.620, and now in the year 2020–21, it has occupied 1st rank with the improved GDI score of 0.120. It made an improvement of 0.500 scores in GDI from 2011–12 to 2020–21 and this is due to the improvement in education, female WPR and LEB. According to NITI Aayog's Sustainable Development Goal (SDG) India Index report 2020–21, the improvement in Chhattisgarh ranking was seen due to an improvement in equal gender pay over the years and because of balanced life expectancy, which has helped it surpass past records of gender disparities. Along with Chhattisgarh, Tamil Nadu has also moved up in GDI with improved score of 0.308 in 2020–21 as against 0.524 in 2011–12. Similarly, Jharkhand has been positioned at 15th in 2020–21 from 19th in 2011–12 with an improvement of 0.181 scores, Jammu and Kashmir have moved from 13th in 2011–12 (0.704) to 8th (0.526) in 2020–21 and Karnataka by improving 0.118 points has moved to 6th rank in 2020–21 from 8th in 2011–12. On account of better female WPR and education, Odisha has also shown an improvement by attaining the score of 0.673 in 2020–21 from 0.751 in 2011–12 and has upgraded its decadal rank to 13th from 15th.

4.3 Inter-state Comparative Analysis Between 2011–12 and 2020–21 on the Basis of the Range of GDI

On the basis of GDI scores, we have attempted to categorise the states in different categories ranging from equality to high inequality (refer Table 2).

Table 2 State-/UT-wise GDI category for the year 2011–12 and 2020–21

Category	2011–2012	2020–2021
Equality (0–0.250)	NIL	Chhattisgarh
Low equality (0.251–0.500)	Uttarakhand, Kerala,	Kerala, Tamil Nadu, Uttarakhand, Rajasthan, Karnataka
Inequality (0.500–0.750)	Tamil Nadu, Madhya Pradesh, Andhra Pradesh, Maharashtra, Rajasthan, Karnataka, Chhattisgarh, Punjab, Gujarat, Uttar Pradesh, Jammu and Kashmir, Haryana	Madhya Pradesh, Jammu and Kashmir, Gujarat, Andhra Pradesh, Maharashtra, Punjab, Odisha, Haryana, Jharkhand, Uttar Pradesh
High inequality (0.751–1)	Odisha, West Bengal, Delhi, Assam, Jharkhand, Bihar	West Bengal, Assam, Delhi, Bihar

Source: Authors' calculation from the GDI 2011–12 and 2020–21

Table 2 shows that in the highest range of equality (0–0.250) Chhattisgarh is the only state to enter this bracket in 2021–22, on account of improvement mainly in education dimension along with an improvement in female WPR as well as LEB also (refer Fig. 4), when in 2011–12 no state was placed in the equality range.

In the next range which signifies low equality (0.251–0.500), in 2011–12, two states, namely Tamil Nadu and Kerala, were placed. However, in 2020–21 additional three states, Rajasthan, Karnataka and Uttarakhand, have moved from range of inequality and have been placed in this bracket of low inequality in 2020–21. This improvement is due to their better performances in education dimension (refer Fig. 4).

In the inter-range comparison, the range of inequality (0.501–0.750) has the maximum number of states/UTs. It featured 12 states/UTs in 2011–12, but with their better performance, the number of states/UTs in this range got reduced to 10 in 2020–21. Tamil Nadu, Rajasthan and Karnataka performed better in education and health dimension and henceforth moved to the range of low equality (refer Figs. 3 and 4). Again due to improvement in education dimension, Odisha and Jharkhand moved to range of inequality from high inequality. On the other hand, Madhya Pradesh, Andhra Pradesh, Maharashtra, Punjab, Gujarat, Uttar Pradesh, Jammu and Kashmir and Haryana have remained in the same range in 2020–21 though with improved GDI scores from 2011 to 2012 (refer Table 2).

The range of high inequality (0.751–1), being the last in the range bracket, included six states/UTs in 2011–12, namely Odisha, West Bengal, Delhi, Assam, Jharkhand and Bihar, but with an improvement in education dimension, Odisha and Jharkhand have upgraded themselves and left this bracket (refer “Appendix 1”) to move to range of inequality in 2020–21. Bihar and Assam were the worst performing states among all other states/UTs and their ranks also did not show any improvement from 2011–12 to 2020–21. The reason is low WPR of females which has resulted in huge gender disparities in these two states (refer Fig. 5).

4.4 Dimension-Wise Comparative Analysis Between 2011–12 and 2020–21

4.4.1 Dimension I: Health: Life Expectancy at Birth

For the year 2011–12, Delhi (0.600) has scored the maximum on the “health” index for males along with Kerala (0.600), followed by Jammu and Kashmir (0.545) and Punjab (0.485). In the case of females, Kerala (0.890), Jammu and Kashmir (0.745), Delhi (0.735) and Uttarakhand (0.725) are placed in the highest bracket. In 2020–2021, Delhi (0.715) and Jammu and Kashmir (0.630) have the highest scores in the case of both males and females. In the disaggregated manner, Kerala (0.615), Maharashtra (0.580) and Punjab (0.555) were the top performers in the case of males and Tamil Nadu (0.745) and Punjab (0.735) were top performers in the case of females.

Table 5 shows that Jammu and Kashmir (J&K) surpassed Kerala in terms of life expectancy from 2011–12 to 2020–21, whereas Delhi retained its top most position in both the comparative years. With the emergence of “*Mohalla clinics*”, health care has become more accessible for the people, making the private health care in Delhi affordable, with typical treatment costs going down to roughly one tenth of what people pay at a hospital in Western India (Mya Care 2018). Further, as per the news reported in Rising Kashmir (17th October, 2022), *Ayushman Bharat-Pradhan Mantri Jan Arogya Yojana* (AB-PMJAY) *SEHAT* (Social Endeavour for Health and Telemedicine) programme was introduced in Jammu and Kashmir in 2020. The primary goal is to provide health insurance to all the citizens of Jammu and Kashmir. With a free insurance coverage up to ₹5 lakh per family on a floater basis to all inhabitants of the state, this has completely transformed the health sector in Jammu and Kashmir. With the help of this programme, thousands of low-income individuals who could not afford hospital care earlier can now receive cutting-edge care for their medical problems at any hospital in the state.

4.4.2 Dimension II: Education: Percentage Distribution of the Graduates (15 and Above)

In the “education” index for the year 2011–12, highest scores in the case of male have been observed in the case of Delhi (0.904) followed by Maharashtra (0.358), Haryana (0.338) and Karnataka (0.333). Regarding females, Delhi (0.763), Kerala (0.275), Uttarakhand (0.242) and Haryana (0.225) scored the highest. For the year 2020–2022, in the male category, again, Delhi (0.638), Andhra Pradesh (0.463), Tamil Nadu (0.454), Kerala (0.425) and Haryana (0.425) have achieved high scores, and in female category, Andhra Pradesh (0.258) has been replaced by Maharashtra (0.321) in 2020–2011 and Delhi (0.554), Kerala (0.500), Tamil Nadu (0.417), Haryana (0.342) also have got high scores (refer Table 5).

The reason for interstate disparities in the context of education is that despite the expansion of higher education facilities throughout the country, students have to migrate to Delhi, Maharashtra, Kerala, Rajasthan and Karnataka for pursuing better higher education. Migration could be a reason for low female education index in

the states like Andhra Pradesh, as male students from this state are in better situation to migrate to neighbouring states like Tamil Nadu, Kerala and Karnataka, while migration seems to be difficult for their counterparts. Delhi, due to its highly ranked colleges and universities, continues to attract students for its postgraduate and graduation programmes which clarifies the reason for achieving high education index in the disaggregated category during the study period.

4.4.3 Dimension III: Labour Market Participation: Worker Population Ratio (15 and Above)

Odisha (0.972), Chhattisgarh (0.946), Jharkhand (0.946) and West Bengal (0.943) have highest score in male labour market participation index in 2011–12, whereas Chhattisgarh (0.636), Andhra Pradesh (0.535), Rajasthan (0.489) and Tamil Nadu (0.445) are better performers in female labour market participation index for the same year.

For the year 2020–21, Madhya Pradesh (0.933), Gujarat (0.899), Assam (0.899) and Karnataka (0.896) have scored better in male labour market participation index. Chhattisgarh (0.617), Andhra Pradesh (0.505), Jharkhand (0.501) and Madhya Pradesh (0.459) have gained the top positions under female labour market participation index (refer Table 5).

Though WPR has increased from 2011–12 to 2020–21, the female WPR is much less when compared to male WPR. This decline in the female WPR is usually among those women who have low level of education. Even if some of the females are equipped with better education and have better employment opportunities, still they fail to convert these opportunities into an advantage, reasons being patriarchal societal restrictions. Human capital theorists have argued that the production of human capital is contingent upon the accumulation of years of education, on-the-job training and work experience. The exclusion of graduates results in the exclusion of a significant chunk of human capital that has the potential to contribute to the labour force, but is not accounted for in the measurement. It is noticed that gender disparities have increased due to the focus of women in fulfilling the expectations of their family and relatives rather than grabbing the opportunity for better growth and success. This can be corroborated by the study by Claudia Goldin (1994) that women leave the workforce during child birth or during the process of raising their children. Further women have to join at lower positions when they re-enter into the workforce and are paid less as a result than men into their age group. This is famed as “penalty for motherhood”. Additionally, there is very limited scope for educated women to participate in the workforce due to the lack of official positions, glass ceilings, excessively long hours and lack of job security in informal jobs which further increases the “gender gap” in the labour market. According to the PLFS (2018–19), there was a 2.6 percentage point drop in women’s written job contracts from 2011–12 to 2018–19. In 2018–19, 74.3% of women did not have a written employment job contract, and only 25.7% had any kind of written job contracts.

4.4.4 Statistical Analysis

From the preceding paragraphs, it is obvious that many states have improved their decadal ranks as well as scores. To prove this statistically, Kendall’s τ rank correlation coefficient has been applied because it is more sensitive towards the inverse distribution of the index and it is also taking into account of the change in the ranks which are much visible in the case of state/UTs like Chhattisgarh, Uttarakhand, Jammu and Kashmir, etc. and further paired *T*-Test has been used to provide a comparison of the population means on the GDI scores of state/UTs for the year 2011–12 and 2020–21 (refer Tables 3 and 4).

Statistical analysis explains that the value of Kendall’s τ correlation coefficient has come out to be 0.663 as the probability is less than 0.05 (i.e. $p < 0.05$), which indicates that there is moderately strong positive correlation in the ranks of the states/UTs between 2020–21 and 2011–12. This rank correlation coefficient makes it evident that practically most of the states have maintained their places and that the changes in rank are not much noticeable barring few states/UTs. Much difference in the ranks is witnessed in Jharkhand, Odisha, Jammu and Kashmir and majorly in the case of Chhattisgarh which is mainly due to increase in its female education along with improvement in female WPR and LEB. Further to test the significant difference in mean of the comparative GDI scores between 2011–12 and 2020–21, paired *T*-Test has been applied. The results (refer Table 4) indicate that our null hypothesis

Table 3 Kendall’s τ rank correlation on ranks of states/UTs in 2011–12 and 2020–21

Correlations		
Rank 2011–12 (R1) and Rank 2020–21 (R2)		
Kendall’s τ rank correlation	Correlation coefficient	0.663
	Sig. (two-tailed)	0.000
	<i>N</i>	20

Source: Authors’ calculation from the GDI 2011–12 and 2020–21

Table 4 Results of paired *T*-test

Variable	Obs	Mean	SE	SD	[95% Conf. interval]	
G~202,021	20	.5862152	.0453388	.2027613	.49132	.6811104
G~201,112	20	.6650019	.0355837	.1591351	.5905243	.7394794
Diff	20	-.0787867	.0285971	.12789	-.138641	-.0189323

Mean (diff) = mean (GDI202021–GDI201112) $t = - 2.7551$

H_0 : mean (diff) = 0 degrees of freedom = 20

H_a : mean (diff) < 0 H_a : mean (diff) != 0 H_a : mean (diff) > 0

Pr ($T < t$) = 0.0063 Pr ($|T| < |t|$) = 0.0126 Pr ($T > t$) = 0.9937

Source: Based on authors’ calculation

(H_0) has been rejected. Thus, it can be inferred that there is a significant difference in mean of the GDI scores for 2020–21 and 2011–12 as the probability is less than 0.05 (i.e. $p < 0.05$). The value of mean difference is -0.0787 and the t-value is -2.755 , where the alternate hypothesis mean difference is less than zero (H_a : mean (diff) < 0) and significant at 5 per cent probability level which implies that there has been fall in the gender disparities over the study period (refer Table 4).

5 Conclusion

It is evident from the above analysis that, between the years 2011–12 and 2020–21, there has been a significant decline in gender disparities, at the national level as well as at the state/UTs level. This reduction has been due to the improved performance of the states/UTs in all the three dimensions of the constructed GDI, but mainly on account of increased participation of women in workforce and their better educational levels. The study also concludes that there is a high correlation among the ranks of the states/UTs between 2011–12 and 2020–21. Further the parametric statistical analysis explained through paired *T*-Test shows that there is a significant difference in the scores of the GDI from 2011–12 to 2020–21. These results indicate that although the decadal ranks of some states/UTs remained unchanged, the decadal scores of almost all the states/UTs have improved indicating reduction in gender disparities.

The scaling up of the health index, particularly in health dimension, has significantly improved in all states/UTs as a result of numerous health programmes including *Pradhan Mantri Matru Vandana Yojana* (PMMVY), *Ayushman Bharat*, Integrated Child Development Service (ICDS) and many more, Uttarakhand being the only exception. According to Comptroller and Auditor General of India (CAG) report 2019–20, Uttarakhand has the worst health facilities. Numerous women lose their lives during the first trimester of pregnancy due to poor medical facilities. Along with this, there are extremely few ambulances available; therefore, “*Dandi Kandis*” are utilised to transport patients to hospitals, where they frequently pass away before arriving which causes the decline in their LEB.

It is said that “Educating a man means educating an individual but educating a female means educating a generation”. This quote explains itself very well in context of Kerala and Tamil Nadu which have outperformed all other states and UTs when it comes to educating their females. Also they have been successful in improving upon health and labour. With the better implementation of education scheme like *Rashtriya Uchatar Shiksha Abhiyan* (RUSA) and establishment of new colleges and universities, there has been an increase the proportions of graduates in these two states. Enhancement of the education level further results in the shift of population especially females from the labour force to workforce that led to reduction in gender disparities.

However, India's education has improved from previous years, but still the female labour workforce participation is low when compared to other indicators of development. It is in place to mention that women are discouraged from finding employment outside of the home due to cultural and societal traditions as well as fear of mistreatment and mobility constraints is the main cause for low female workforce in India (Banerjee 2019). Therefore, increasing the number of women in the workforce is also crucial for promoting gender equality in the context of development. Though some states have flared well on account of increased female WPR, the need of the hour is to concentrate more on increasing the workforce rather than the only the labour force. Similar to Mahatma Gandhi National Rural Employment Guarantee Act (MGNREGA), Skill India, Make in India and other employment creation programmes must be introduced specifically for women in order to improve their participation in workforce, making them financially independent and thus improving gender equality.

Gender-based discrimination at employment or education not only is regressive for women, but imposes a cost for the entire society. According to Global Gender Gap Index Report (2021), the educational attainments, economic participation and health are the main drivers to close the gender gaps which have resulted in reduced gender disparities in India. Therefore, the government needs to put more effort in creating infrastructure and designing cutting-edge policies to improve the health and education system, as also to focus on creating more employment opportunities for females. This will help them to raise their standard of living and contribute towards economic growth. Klasen (2008) pointed that there is an urgent need to increase the female participation in workforce as well as in the field of education to have a better economic growth. The development of an employment-intensive growth strategy that prioritises women should be more practical. Along with it, there should be a change in the labour market composition where females should be given more opportunities for being included in workforce. Furthermore, the findings of this paper imply that the country's economic growth may be hampered by the current impediments to women's employment, which may slow the pace of economic development and lower economic growth. Therefore, in order to lessen gender discrepancies and the imbalance in the society, the government should concentrate more on providing better health, education and employment opportunities for women.

Appendix 1

See Figs. 3, 4 and 5.

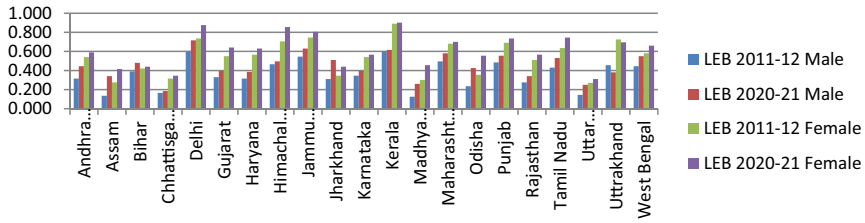


Fig. 3 Health index across the states. *Source:* Authors’ calculation from the GDI 2011–12 and 2020–21

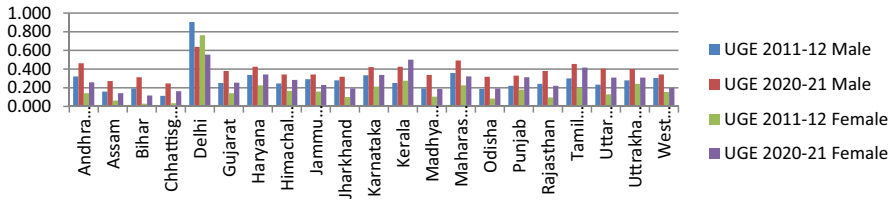


Fig. 4 Education index across the states. *Source:* Authors’ calculation from the GDI 2011–12 and 2020–21

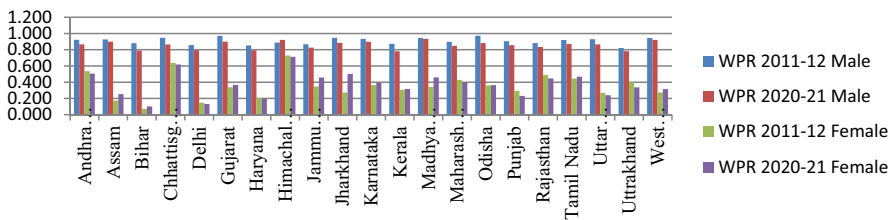


Fig. 5 Labour market participation index across the states. *Source:* Authors calculation from the GDI 2011–12 and 2020–21

Appendix 2

See Table 5.

Table 5 Dimension-wise index for year 2011–12 and 2020–21

S. No	State/UT	Dimension index (2011–12)						Dimension index (2020–21)					
		LEB		UGE		WPR		LEB		UGE		WPR	
		Male	Female	Male	Female	Male	Female	Male	Female	Male	Female	Male	Female
1	Andhra Pradesh	0.315	0.540	0.321	0.142	0.922	0.535	0.445	0.590	0.463	0.258	0.865	0.505
2	Assam	0.135	0.275	0.158	0.063	0.925	0.172	0.340	0.415	0.271	0.142	0.899	0.252
3	Bihar	0.390	0.420	0.192	0.029	0.880	0.072	0.480	0.440	0.313	0.117	0.789	0.101
4	Chhattisgarh	0.165	0.315	0.113	0.033	0.946	0.636	0.185	0.345	0.246	0.163	0.864	0.617
5	Delhi	0.600	0.735	0.904	0.763	0.857	0.147	0.715	0.875	0.638	0.554	0.793	0.131
6	Gujarat	0.330	0.550	0.250	0.142	0.970	0.337	0.395	0.640	0.379	0.254	0.899	0.366
7	Haryana	0.315	0.565	0.338	0.225	0.852	0.205	0.385	0.630	0.425	0.342	0.792	0.194
8	Jammu and Kashmir	0.545	0.745	0.292	0.158	0.867	0.346	0.630	0.805	0.342	0.229	0.825	0.457
9	Jharkhand	0.310	0.345	0.279	0.100	0.946	0.272	0.510	0.440	0.317	0.192	0.884	0.501
10	Karnataka	0.345	0.540	0.333	0.213	0.934	0.364	0.395	0.565	0.421	0.338	0.896	0.396
11	Kerala	0.600	0.890	0.250	0.275	0.872	0.306	0.615	0.900	0.425	0.500	0.781	0.316
12	Madhya Pradesh	0.125	0.300	0.192	0.104	0.943	0.342	0.260	0.455	0.338	0.188	0.933	0.459
13	Maharashtra	0.495	0.680	0.358	0.225	0.898	0.429	0.580	0.700	0.492	0.321	0.847	0.398
14	Odisha	0.235	0.355	0.188	0.083	0.972	0.360	0.425	0.555	0.317	0.192	0.881	0.364
15	Punjab	0.485	0.690	0.221	0.179	0.904	0.293	0.555	0.735	0.329	0.313	0.855	0.230
16	Rajasthan	0.275	0.510	0.242	0.096	0.881	0.489	0.340	0.565	0.379	0.221	0.834	0.446
17	Tamil Nadu	0.430	0.635	0.300	0.200	0.919	0.445	0.530	0.745	0.454	0.417	0.871	0.467
18	Uttar Pradesh	0.145	0.270	0.233	0.129	0.929	0.269	0.250	0.310	0.404	0.308	0.865	0.240
19	Uttarakhand	0.455	0.725	0.279	0.242	0.820	0.399	0.380	0.695	0.400	0.308	0.782	0.336
20	West Bengal	0.445	0.580	0.304	0.154	0.943	0.272	0.550	0.660	0.342	0.196	0.920	0.314
	All India	0.320	0.480	0.275	0.154	0.917	0.343	0.420	0.555	0.396	0.275	0.861	0.354

Source: Authors' calculation from the GDI 2011–12 and 2020–21

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