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Three Decades of WASH Progress in South Asia: Evidence from Demographic and Health Surveys

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Abstract

Background: Access to improved sanitation, water and hygiene services has become a crucial aim in development agendas globally, including Sustainable Development Goals established by the United Nations. Sustainable Development Goals (SDG-6) target to ensure equitable and universal access to improved sanitation and safe drinking water to all by 2030. Although tremendous progress has been made by government globally and significant progress has been observed over recent decades still many countries in South Asia continue to face challenges in achieving universal access to WASH facilities.

Material and Method: This study examines the long-term trend in access to clean water, improved sanitation and the prevalence of open defecation in three South Asian countries- Bangladesh, India and Nepal from the early 1990s to 2022. This paper uses nationally representative household survey data from Demographic and Health Survey Program. It applies descriptive trend analysis to examine changes in WASH indicators across these three countries with graphical interpretation and a logistic growth model is used to project the likely level of WASH facilities by 2030 across rural-urban areas and the highest and lowest wealth groups.

Results: The findings show substantial improvement in WASH facilities across all countries. Bangladesh achieved mostly-universal access to improved drinking water and Nepal achieved the fastest growth in improves sanitation coverage and the sharpest reduction in open defecation practice. India also recorded significant progress though disparity exists across rural and lower income groups. Projection results indicate that only Nepal is among the three countries, which is likely to attain near-universal sanitation coverage by 2030.

Conclusion: It emphasises the need of continues efforts, policy support and targeted interventions to eradicate remaining inequalities and achieve sustainable WASH facilities specially in India and Bangladesh.

Keywords: Water, Sanitation and Hygiene (WASH), Open defecation, Demographic and Heath Survey (DHS), South Asia.

Introduction:

Access to safe water and sanitation is the most basic human need for health, well- being and an essential component of sustainable development. Water, Sanitation and Hygiene (WASH) are essential to sustainable development. Inadequate water and sanitation services is found major contributor to environmental degradation, diseases transmission, and unsafe

living conditions, particularly in developing areas. Access to improved sanitation, water and hygiene services has become a crucial aim in development agendas globally, including Sustainable Development Goals established by the United Nations. SDG-6 targets to ensure equitable and universal access to improved sanitation and safe drinking water to all by 2030. Although tremendous progress has been made by government globally and significant progress has been observed over recent decades still many countries in South Asia continue to face challenges in achieving universal access to WASH facilities. These countries have historically recorded limited sanitation infrastructure, high level of open defecation, and disparities between rural and urban region access to these WASH facilities. Various national programmes and policy initiatives have been implemented by these countries. Bangladesh, India and Nepal have contributed to achieve success in universal improved sanitation and clean drinking water access. These countries have implemented various missions and schemes, including massive campaigns, community led initiatives and infrastructure development related investment schemes aimed at improving WASH coverage.

Analysing long term trends in WASH indicators is important for evaluating progress and identifying remaining inequalities across socioeconomic and geographic groups. Data from Demographic and Health Surveys Programme (DHS) offers comparable data across countries and surveys rounds, making it a useful source for examine changes in WASH facilities over three decades.

Rapid population growth, increasing irrigation requirements, industrial and energy sector development increased water demand. Water scarcity is projected to increase with increasing global temperature. Although there has been positive progress in achieving the access to safely managed drinking water from 68% to 74% between 2015 and 2024, still the world will not be able to achieve sustainable water management goal until at least 2049. There are 2.2 billion people is still lacked managed drinking water and 3.4 billion people are not able to access safely managed sanitation the access to improved water sources and sanitation facilities remains uneven mostly prominent in Sub-Saharan Africa and south Asian countries and millions of deaths are attributed to unclean water and unsafe sanitation annually, particularly among children (Moe & Rheingans, 2006). Rural population in developing countries face sanitation, water and hygiene- related issues due to lack of awareness, education, knowledge and practices related to sanitation and drinking water facilities (Kuberan et al., 2015). There is disproportionately disadvantage in excess of WASH amenities for the poorest quintile in low and medium countries (Ohwo & Vivian Odubo, 2021). Religious belief and cultural notion of pollution and purity has their significant impact on the adoption of sanitation facilities along with the economic factors across South Asian countries (Vyas & Spears, 2018) along with the presence of social stratification, particularly caste hierarchy play an interacting and independent role at different income level in achieving the outcomes of improved sanitation facilities (Kumar & Kharb, 2024). WASH is directly associated with public health outcome so infrastructure alone is not sufficient, it needs behavioural change and proper implementation of hygiene practice which can reduce a knowledge- practice gap especially in rural area along with education and better economic conditions (Kuberan et al., 2015). Clean water access, improved sanitation and hygiene (WASH) has a significant impact of people heath but lack of financial combats developing nations to make investment in WASH facilities and achieving universal access (Kishore et al., 2023). Rural schools in South Asian countries such often lack adequate clean water access

and maintenance of toilets with the prevalence of gender disparities although School WASH practices reduce transmission of diseases, improve academic performance along with achieving educational equality and have broader community level effects (Jasper et al., 2012). The presence of any form of inequality in WASH services reduces the chance of the attainment of Sustainable Development Goals for Water, Sanitation and Hygiene facilities. These disparities are like threats which pause the success of achieving universal access to WASH services (Ohwo, 2019).

Bangladesh is recognized for reducing open defecation compared to other Asian countries still reginal disparities still exist in WASH practice adoption and difference in income level and lack of information have their influence which resulted in incomplete coverage of hygiene practices (Ahmed et al., 2021). Undernutrition which is measured through stunting, wasting and underweight remains a bigger challenge in public health for developing countries and Improved access to sanitation, water and hygiene practice is significantly associated with reduction chronic malnutrition among children under five years of age, however poverty, education and other household factors affects the outcomes of WASH practice adoption (Hasan et al., 2023). In Nepal, although coverage of improved water increases still safely managed water facility remain limited, especially in mountainous and rural areas. There is progress in basic sanitation particularly in reducing open defecation but challenges in safely managed sanitation still persistent which emphasis a transition from coverage to service sustainability (Budhathoki, 2019).

Government has implemented different institutional capacity programmes and infrastructural enhancement programmes to achieve SDG-6 (clean water and sanitation for all), still countries of South Asian are facing challenges to attain full success. As literature suggests various socio-economic factors such as household income, poverty levels, caste, class and gender inequality and behavioural norms such as cultural attitudes towards hygiene have their impact on the coverage of clean water and safely managed sanitation facilities in all south Asian countries. In South Asia India, Nepal and Bangladesh have made tremendous progress in expanding water and sanitation coverage over the last two decades. However, the quality, pace, equity of improvements in these facilities remain different across these countries. There are similarities in socio-economic conditions and geographical proximity, still clean water and safely managed sanitation outcomes differ due to variation in policy approach, governance structure, inequality pattern and institutional capacity.

A total of seven countries is found in Asian States (AS) which is based on United National groupings. This study focuses on India, Bangladesh and Nepal, whose data is available for the period from 1993-1994 to 2020-2021 for analysing the access of clean water and sanitation facilities. This study used the WHO/ UNICEF Joint Monitoring Programme, 2017 definition for improved and unimproved sanitation and water facilities. Improved water sources. are those which are accessible in premises, available whenever needed, free from contamination and packed water. Based on this definition this study considers improved water sources access when households use water piped into dwelling, public tap, tubewell, protected well and spring, using rainwater, tanker truck and bottle water. For sanitation, JMP defines three main criteria which define safely managed sanitation services. These are treated and disposed of in situ, temporarily stored and then transported, emptied and trade off-site, transported through waste water sewer and then treated off-site. This study considers access to improved sanitation facility when a flush or pour flush toilet to a pipe/septic/pit latrine

available in households or there are houses with pit latrine with slab/ improved pit latrine/ compositing latrine. This study also analysis the households using open access as they don't have the access to improves and unimproved sanitation services.

Objectives:

To address the disparities in access to clean water and sanitation, the Sustainable Development Goal (SDG) 6 strives to attain universal and equal access to clean drinking water and sanitation by 2030. As The Joint Monitoring Programme (JMP) reports highlight the inequalities between rural and urban areas, different income and other groups so it is imperative to examine inequalities in access to improved water and sanitation. This study sets three main objectives to examine the present status and possibilities of the access of sanitation and clean water facilities in South Asian countries:

1. To analyse the trend in access to clean drinking water, improved sanitation facilities and reduction in open defecation in India, Bangladesh and Nepal from the 1990s to 2022 using Demographic and Health Survey (DHS) data.
2. To compare the progress and disparities in Water, Sanitation and Hygiene (WASH) facilities across rural-urban areas and different wealth groups in the selected South Asian countries.
3. To project the likely level of WASH facility coverage by the year 2030, which is the target year for achieving Sustainable Development Goal 6 (SDG-6)

Material And Methods:

Nationally representative household survey data from Demographic and Heath Survey (DHS) is used for south Asian countries specially Bangladesh, India and Nepal from 1993-94 to 2021-2022. Probability sampling is used for these surveys utilising existing sampling frames such as population censuses. It is secondary data related to population, education, health, and nutrition. It is open-source data and available on DHE website (www.dhsprogram.com) Access to improved and unimproved sanitation, improved water sources and open defecation practices are used as dependent variables and the determination of independent variable was based on the literature review, practical importance and theoretical significance. The independent variables were derived from literature review are type of residence (urban-rural), and wealth status (all households are divided into five statuses by DHS from poorer to richer). Descriptive trend analysis and graphical presentation are used to examine the changes in WASH indicators over these three decades. In addition, a logistic growth model is applied to project the likely level of access to improved sanitation by 2030, that is the targeting year to achieving Sustainable Development Goals. This model is appropriated for this analysis because it is clear from the given above trends that the growth for sanitation and water facilities stats slow in the beginning of 1990s, then accelerate rapidly in mid years from 2000s to 2015 and then slow near saturation in 2020s.

Logistic model formula $Y(t) = \frac{K}{1+Ae^{-Bt}}$

Where, Y(t) predicted level of WASH indicator at time t.

K = carrying capacity (maximum level, assumed ≈ 100%)

t= time (Years since 1996)

A = Constant determined from initial conditions

B = Parameters estimated from data

e = base of natural logarithm

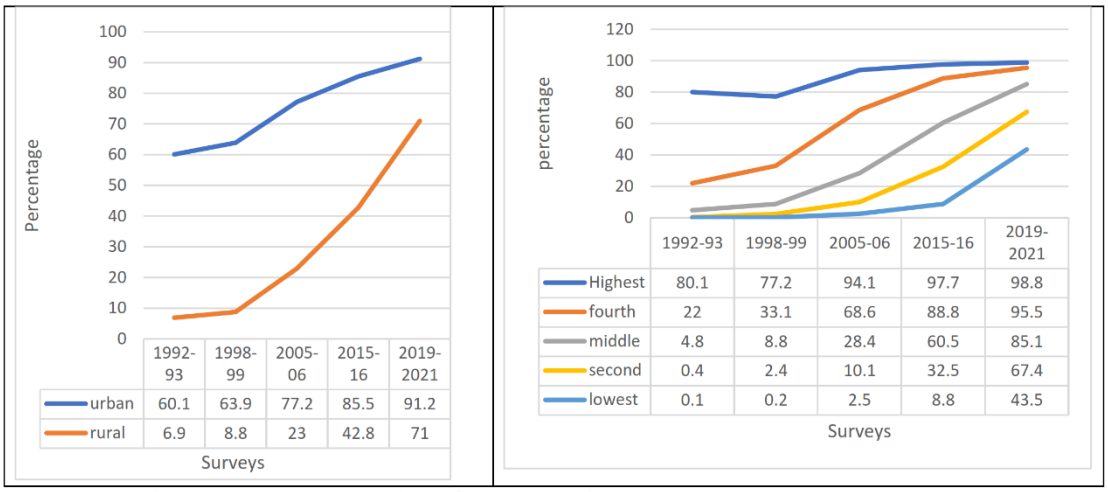
Results:

Figure 1 depicts a prominent growth in achieving access to improved sanitation facilities across India, Bangladesh and Nepal from 1990s to 2022. During 1990s, the proportion of household having access to improved sanitation was only 25%, 22% and 3% in Bangladesh, India and Nepal respectively. Bangladesh's household coverage with improved sanitation facilities expended significantly from 25% in 1993 to 80% in 2022. In India, the coverage of household access to improved sanitation has increase from 22% in the early 1990s to about 72% by 2021. Progress of improved sanitation facilities appears dramatic in Nepal. In Nepal, it improved from less than 3% in the 1996 to about 93% by 2022 showing the fastest expansion of sanitation coverage in Nepal. This trend shows that sanitation access has improved significantly across South Asian countries with Nepal made dramatic and most rapid growth in sanitation coverage.

Figure-1 Improved Sanitation Facility in South Asia

Figure 2 shows a continuous increase in improved sanitation access from 1992-93 to 2021 along with the existence of persistent inequality across rural-urban areas and different wealth groups. The percentage of urban household with improved sanitation was 60% in 1992-93, on the other side only 6.9% of rural households had access to improved sanitation for the same period. Although the gap between rural and urban households' access to improved sanitation reduces from 50% to 20% during this period showing remarkable progress in rural areas. still there is only 71% of the rural household has access to sanitation facilities in 2019-21. Wealth- based inequality is more severe as the highest wealth group have almost universal access on the other side only 43.5% of lowest group households have access to improved sanitation in 2021. It is evide4nt from the given figure that as the wealth status of households improves their ability to access the improved sanitation also increases.

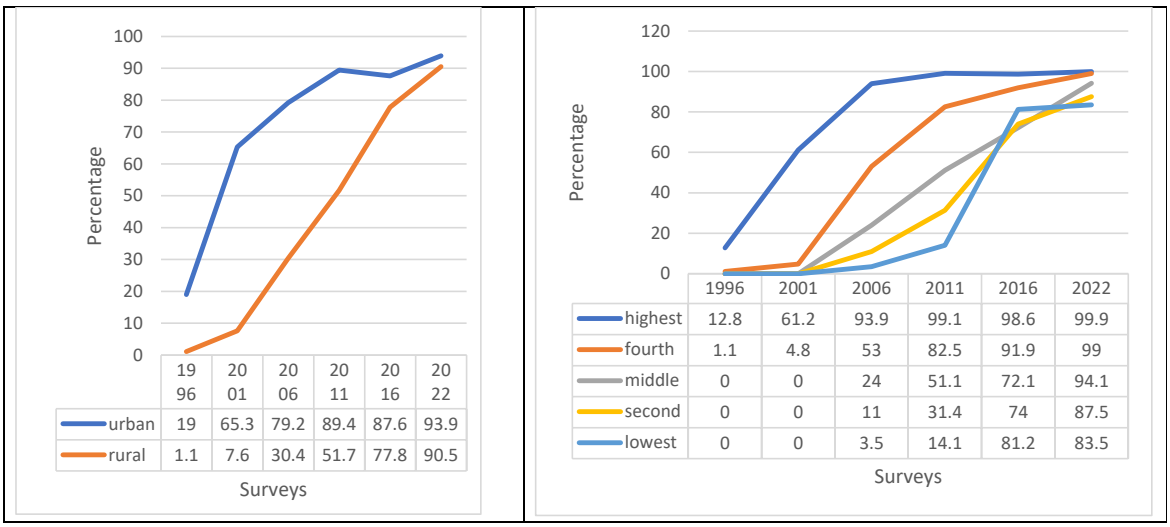
Figure-2. Access to improved sanitation across different income and residential groups in India



Source- Data from Demographic and Health Surveys from 1990s to 2021.

Figure 3 shows the percentage of rural and urban households with access to improved sanitation facilities in Nepal. Rural households showed progress towards achieving sanitation facilities from 1996 to 2021. Only 1.1% of rural households had access to improved sanitation in 1996 and this percentage increased to 90.5% in 2021. The rural-urban inequality reduced from 17.9% to just 3.4% in 2021. Although Nepal has made tremendous progress in attaining improved sanitation facilities but some level of inequality is still visible among the highest and lowest wealth groups. In 2021, almost all households belong to highest wealth group have access to improved sanitation facilities but the percentage of households was only 83.5% of lowest wealth groups.

Figure-3. Access to improved sanitation across different income and residential groups in Nepal

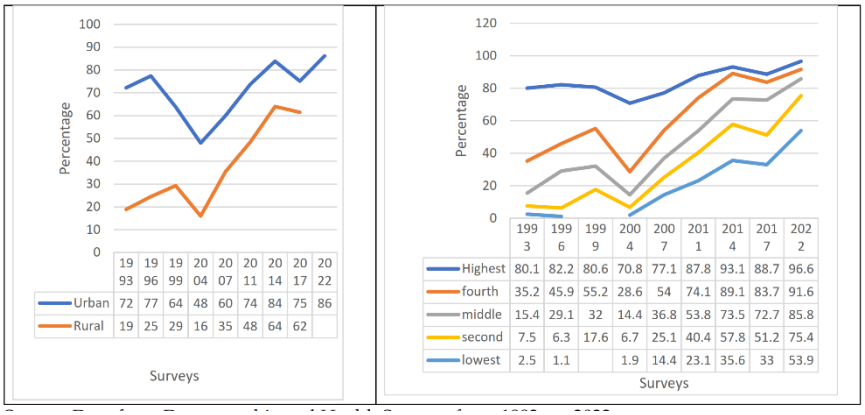


Source- Data from Demographic and Health Surveys from 1996s to 2021.

Figure 4 depicts the access of improved sanitation in Bangladesh households among different areas of living and wealth groups from 1993 to 2022. It is clear from the given trends that there is lack of access to improved sanitation facilities in Bangladesh along with the

persistence inequality existence. Only 86 % of urban households have access to improved sanitation in 2023. The lowest income group percentage of households with improved sanitation has increased during this period still 46% of lowest income group households have no access to improved sanitation facilities.

Figure-4 Access to improved sanitation across different income and residential groups in Bangladesh



Source- Data from Demographic and Health Surveys from 1993s to 2022.

The trends in figure-5 shows a consistent decline in the prevalence of open defecation practices across all these three countries. Nepal shows tremendous success in reducing open defecation practice as 77% of Nepali households practiced it in 1996 and there was just 1% of household left which practices open defecation by 2022. In India, the share of households practicing open defecation declined from 70% in 1990s to 19% by 2020 still it remains relatively high in comparison with other neighbouring countries. On the other side, Bangladesh showed dramatic progress and achieved fastest reduction from about 30% in mid-1990s to almost zero by 2021. Although all three countries have made remarkable progress in eliminate open defecation practice, Nepal and Bangladesh succeed to achieve near zero open defecation, while India showed a slower but substantial decline during these three decades.

Figure-5 Prevalence of Open Defecation

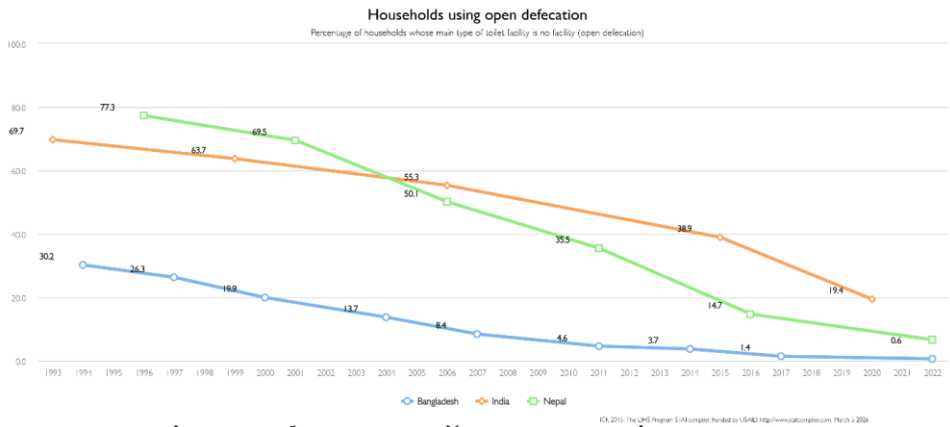
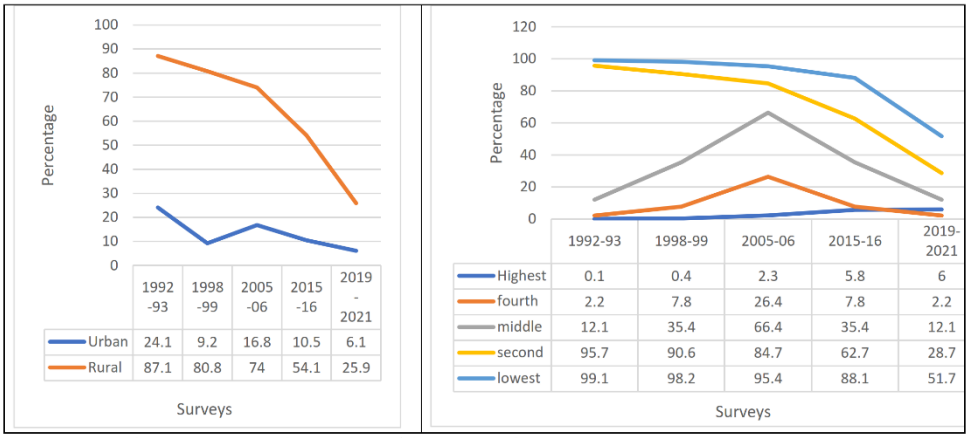


Figure 6 rev major problem in rural and lowest income groups. Although the urban households and highest wealth groups are in better situation still there is existence of open defecation practice. The inequality between highest to lowest group households declined from 99% in 1992 to 55.7%

in 2021. It reflects the need to build infrastructure and spread awareness to reduce the open fefecation facilities specially in targeted population. It reflects the need of strengthening economic conditions of people as wealth status has negative impact to this practice.

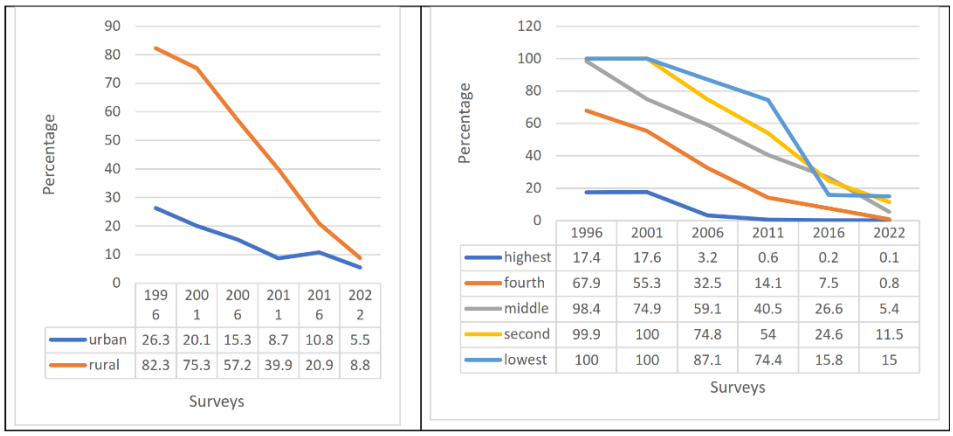
Figure-6 Prevalence of open defecation among different wealth and residential groups in India



Source- Data from Demographic and Health Surveys from 1993s to 2021.

Figure 7 depicts the prevalence of open defecation practice in Nepal. It is evident from the figure that Nepal has achieved tremendous progress in reducing open defecation practice across all wealth groups and area of residences. The percentage of open defecation practice has reduced from 82.3% in 1996 to only 8% in 2022 of rural households. The households residing in rural area (8.8%) and belong to lowest group (15%) still have to adopt open defecation practice in 2022. The prevalence of inequality among rural-urban and different wealth groups is lower when we compare it with its neighbouring countries.

Figure-7 Prevalence of open defecation among different wealth and residential groups in Nepal

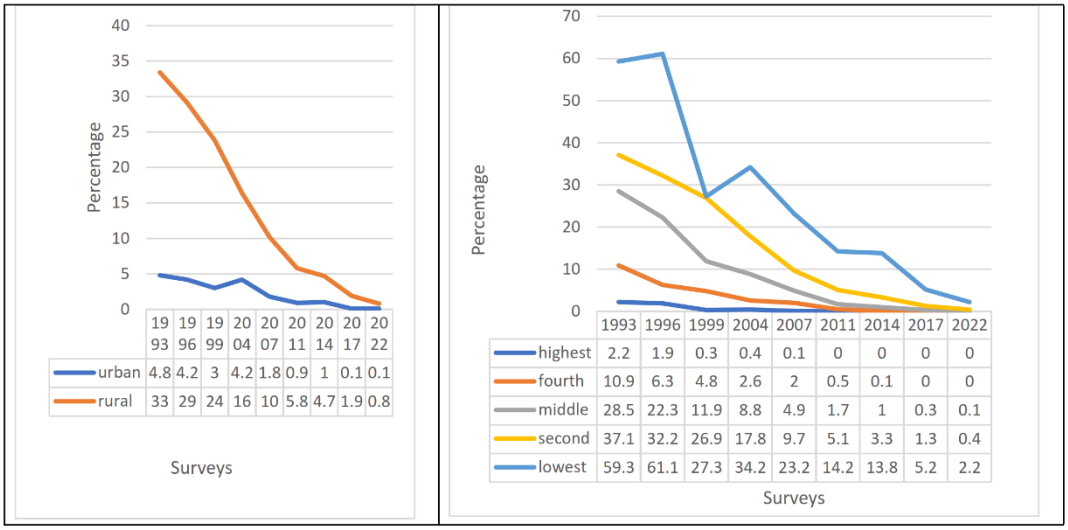


Source- Data from Demographic and Health Surveys from 1996s to 2022.

Figure-8 shows the prevalence of open defecation in Bangladesh. Although percentage of urban households experiencing open defecation remained low in initial time of survey and reached to zero defecation in 2017. On the other side 1% or rural households still facing the problem in 2022 although the percentage of households was 33% in 1993. The households belong to highest income level succeed to get complete rid from open defecation in 2011 but

2.2% households belong to poorest groups have to face open defecation in 2022. This reflects that growing income level and urban facilities can sharply reduce this practice of open defecation.

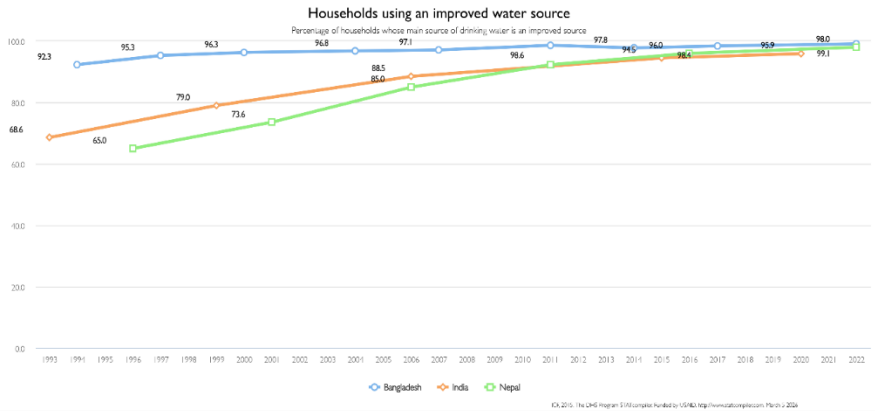
Figure-8 Prevalence of open defecation among different wealth and residential groups in Bangladesh.



Source- Data from Demographic and Health Surveys from 1996s to 2022.

The graph 9 indicates that all three countries have already achieved universal access to improved water sources, resulted improvement in public health. Bangladesh consistently tried to maintain the access to clean drinking water throughout the period and succeed to achieve near- universal access relatively earlier compared to other neighbouring countries. The percentage of household with improved water access was 92.3% in 1993 and it reached to 98% by 2022. Although Nepal and India started access was lower than Bangladesh, but these countries put continuous efforts over time and they have successfully achieved universal access by 2022. The percentage of Indian household with access to improved water was only 68.6% in 1993 and it has reached to 99% by 2020. Nepal was at the worst level where only 65% of its households had access to improved water in 1993 and it has achieved universal access to clean water by 2022.

Figure-9 Access to Improved Water Resources



Although SDG-6 emphasised to achieve universal access to clean water and improved sanitation by 2030. We found that all these three countries have achieved near universal access to clean water by 2022 but there is persistent inequality and lack in access to improved sanitation. This paper tried to predicate the achievement of SDG-6 for the year 2030 by using logit growth model for all three countries across different areas of living and highest and lowest wealth groups.

Table-1 Projection of improved sanitation in Nepal for 2030 (in percentage)

Category	1996	2022	2030(Logistic Projection)	Status by 2030
Rural	1.1	90.5	98.5	Almost-universal
Urban	19	93.9	98.2	Almost-universal
Lowest	01	83.5	98.6	Rapid convergence
Highest	28	99.9	99.9	Fully achieved

Source- Estimated from data given in demographic and Heath Survey

The model projections indicate that universal coverage can be achieved by 2030 if current structural, institutional and infrastructural growth remains continue in Nepal. The households belong to lowest wealth group showed dramatic transformation as the percentage of households' access to improved sanitation was zero in 1996 and now it is rising to nearly universal access by 2030. The rural urban gap which was 18% in 1996 reduced to .3 percent in 2022 and projected to complete elimination of disparity by 2030. The structural transformation of Nepal is projected to achieve SDG-6 by 2030.

Table-2 Projection of improved sanitation in India for 2030 (in percentage)

Category	1993	2021	2030 (Logistic Projection)	Status by 2030
Rural	6.9	71	95-96	Strongly pick up
Urban	60.1	91.2	98.5	almost-universal
Lowest	0.1	43.5	90-92	Need major structural improvement
Highest	80.1	98.8	99.9	Fully saturated

Source- Estimated from data given in demographic and Heath Survey

Logistic growth model indicates that India is projected to attain almost-universal coverage across all urban households and highest income group by 2030 but the almost 2% households in rural area and 8% households in lowest income group need major institutional and structural improvement to pick up universal coverage by 2030. Although

remarkable progress towards universal access to improved sanitation have been made in India still national coverage is expected to reach only 95% of universal coverage with the prevailing current trends. The rural-urban gap which was 20.2 percentage points in 2019-2021 was projected 2-3 percentage points in 2030. It shows continuous progress in rural area during these years to eliminate rural-urban disparity.

Table-2 Projection of improved sanitation in Bangladesh for 2030 (in percentage)

Category	1993	2022	2030(Logistic Projection)	Status by 2030
Rural	18.9	61.5*	94-95 (trend-based estimate)	Strong catch up
Urban	72.2	86.2	97-98	Mostly universal
Lowest	2.5	53.9	90-92	Required major structural improvement
Highest	80.1	96.6	99.2	Near universal

(* Rural 2022 value not provided; estimated using 2017-18 trend)

Source- Estimated from data given in demographic and Heath Survey

Rural area showed continuous progress from 1993 to 2022. Households of higher income group and urban areas are projected to achieve near universal coverage by 2030. Only 90-92 % household of the lowest quintiles and 95% households of rural areas would be able to access improved sanitation access by 2030. The disparity between highest and lowest wealth quintiles was estimated 42.7 percentage points in 2022 and it is projected to remain 7-9 percentage by 2030. It reflects the need of strong convergence strategies and efforts so that the gap between the highest and lowest quintiles is projected to narrow substantially.

Discussion:

This paper reveals major progress in access to water and sanitation facilities and reduction in open defecation practice in South Asian countries specially in Bangladesh, India and Nepal. Bangladesh showed success in improved drinking water access and rapidly reduction in open defecation, Nepal experienced the most dramatic improvement in open defecation reduction and improved sanitation facility coverage. India showed continuous progress in both clean water and sanitation coverage but rural urban gaps remain high although it has started from the lower baseline levels and therefore required more time to achieve comparable coverage. Sanitation is not only linked to income but cultural notion of different religions of purity and pollution has their significance impact. Such cultural notions are more prevalent in rural areas which has set boundaries to adopt new notions and leave old customs and practices. Across South Asian countries, differences in sanitation outcomes cannot explained by poverty alone although cultural and religion notions of pollution and purity along with social acceptability has significant impact on open dedication toilets adoption practices(Vyas & Spears, 2018). In India, improved sanitation coverage is relatively slow in comparison to other neighbouring South Asian countries (Hossain & Howard, 2014). Overall sanitation access in Bangladesh, Nepal and India has improved significantly over the past three decades. Although recent trends show strong convergence, still disparities across rural-urban and different income groups still exist. Bangladesh shows stronger WASH performance despite lower GDP as it follows community engagement model which are differ from India's subsidy driven approach. It is found that continued policy support for targeted population and infrastructure investment remain crucial for achieving universal

sanitation coverage by 2030. This paper emphasises that social mobilization, awareness programmes and governance are needed along with the economic development to achieve this target. There is need to collaborate by private sector, government and civil society organizations to invest in technology and infrastructure development, to promote hygiene practices, to implement education and awareness spreading programmes to ensure that everyone can have access to clean drinkable water and sanitation facilities.

Conclusion:

These finding highlights that infrastructure development; sanitation campaigns and sustained policy intervention have played important role in improving sanitation access and clean water availability across these countries. There is still need of continuous efforts to ensure equitable access and long-term sustainability of WASH services in both rural and urban areas across these countries. It emphasises the need of certain WASH policies that reduce inequality to WASH facilities, alleviate poverty and promote education, develop the capacity of institution with funding and accountability that reduce corruption in WASH services.

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