Title: Internal Migration and Unmet Need for Family Planning in 31 Low- and Middle-Income Countries

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Introduction

Around one billion people globally are migrants, with approximately 48% being women and the majority of them living in low to middle-income countries (LMICs) (Almonte & Lynch, 2019). Migration in LMICs commonly entails transitioning from rural to urban centres (Awoh & Plugge, 2016), reflecting the dynamic nature of urbanisation that encompasses both physical relocation and urban residence (Pheiffer, 2021). More than half of the global population resides in urban regions, which is projected to rise to 68% by 2050, particularly in slums (World Health Organisation). The rapid urban expansion in LMICs strains the ability of the healthcare system to meet the demands of the increasing urban population (Awoh & Plugge, 2016).

Migration is a significant demographic event with the potential to impact other demographic factors, including fertility and family planning. The concept of unmet family planning needs plays a crucial role in advocacy, shaping family planning policies, and guiding the execution and assessment of family planning programs globally (Bradley, Croft, Fishel, & Westoff, 2012). It's defined through survey data as the proportion of women who are not using contraception and desire to space or limit pregnancy (Almonte & Lynch, 2019; Bradley et al., 2012; Namukoko, Likwa, Hamoonga, & Phiri, 2022). An unmet need has attained significant attention, mainly since it was included as a Millennium Development Goal (MDG) indicator (indicator 5.6) in 2008. This indicator has now developed into SDG Target 3.7, emphasising universal access to sexual and reproductive healthcare services, including family planning and reproductive health integration into national strategies and programs (Bradley et al., 2012; World Health Organization, 2016). The consequences of unmet need for FP are closely linked to increased risks of both maternal and child mortality since it elevates rates of unintended pregnancies and unsafe abortions (Almonte & Lynch, 2019). Addressing unmet needs is thus crucial not only for women's well-being but also for the broader community.

Among young, unmarried, and less educated women, unmet family planning needs are most pronounced, and this group is also more inclined to engage in internal migration (Almonte & Lynch, 2019). The concepts of migrant disruption and adaptation elucidate the connection between female internal migration and unmet family planning needs. Migrant disruption suggests that migration disrupts the existing social support networks of migrant women, leading to social isolation and hindering their ability to seek advice or access relevant information (Almonte & Lynch, 2019; Awoh & Plugge, 2016; Namukoko et al., 2022). This impact can exert its influence on both migrations from urban to rural and from rural to urban. Migrant adaptation, on the other hand, suggests that the differences observed between migrants and natives may result from migrants' difficulty in conforming to sociocultural norms or utilising urban health services, as well as their livelihood insecurity (Almonte & Lynch, 2019; Namukoko et al., 2022). This emphasises the unintended adverse consequences of rural-to-urban migration. However, many studies have focused on Western settings, and the impact of internal migration of women on family planning in LMICs remains underexplored. Furthermore, of the few existing studies that have examined the association between internal migration and unmet needs for FP, the majority have focused on rural-to-urban migration rather

than comprehensively considering migration in both directions. Additionally, these studies have been limited to a single country, which restricts the generalisability of their findings.

The current study aims to pool nationally representative surveys from 31 LMICs to investigate the association between internal female migration and unmet needs for FP. In particular, we explored how this association differed based on various migration pathways. Finally, we aimed to determine whether the timing of migration was linked to different likelihood of unmet FP needs.

Methods

Data Source

This study used data from the Demographic and Health Survey (DHS) conducted between 2010 2023 to ensure consistency and comparability. The DHS are nationally representative cross-sectional surveys conducted in LMICs to collect data on key population, health, and nutrition indicators (Corsi, Neuman, Finlay, & Subramanian, 2012). In general, DHS follows a two-stage cluster sampling design, stratified by region and urban/rural residence, and details of the survey design are well-documented elsewhere (Corsi et al., 2012).

Study Population

A total of 31 LMICs in 5 regions (East Asia & Pacific; EAP, Europe & Central Asia; ECA, Latin America & Caribbean; LAC, South Asia; SA, and sub-Saharan Africa; SSA) were included in our analysis (**Supplementary Table 1**). To conduct cross-comparison between countries, 1) women fell outside the age range of 15 to 49, and 2) temporary visitors or those who previously resided abroad were excluded. Of the 531,666 women, 7,833 women (3.44%) did not fell into 15-49 age category. The final pooled sample consisted of 523,833 women from 21,594 primary sampling units (PSUs) across 31 countries.

Measures

Outcome Variable

The study's outcome variable was unmet need for FP, a binary classification of whether a woman experienced either unmet needs for birth limitation or birth spacing.

Exposure Variable

Internal migration status among adult women was constructed based on three variables: 1) previous and 2) current place of residence, and 3) the number of years the respondent lived in the current place of residence. Responses to prior places of residence encompassed countryside, town, or city/capital regions. Town and city were categorised as urban, and countryside as rural. We considered individuals who had resided in their current location for over five years as non-migrants. Consequently, the migration status variable was structured with the following classifications: 1) Urban non-migrants (comprising urban residents, urban-to-urban migrants,

and rural-to-urban migrants residing in urban areas for six or more years), 2) Rural non-migrants (encompassing rural residents, rural-to-rural migrants, and urban-to-rural migrants who had been in rural areas for six or more years), 3) Rural-to-urban migrants with less than five years in urban areas, and 4) Urban-to-rural migrants with less than five years in urban areas.

Covariates

We identified factors that could influence unmet need for FP in accordance with previous literature (Assaf, Raj Thapa, Edmeades, & ICF, 2023) and included those that were consistently available across all countries. Women's age in categories (15-19, 20-24, 25-29, 30-34, 35-39, 40-44, 45-49), marital status (currently married, formerly married, and never married), education level (no education, primary, secondary, and higher), and working status (not working, working but not paid, working and paid) were included. Since household wealth status was found to be highly correlated with the migrant variable, it was not included in the analysis.

Statistical Analyses

We first assessed the distribution of internal migration status and covariates in relation to unmet need for FP status and then performed chi-square and ANOVA tests to see if there were significant differences in the distributions. To investigate the association between internal migrants and unmet need for FP, two stages of survey-weighted multivariable logistic regression models were applied. In the first stage, we adjusted for country-fixed effects only and added all covariates in the second stage. Heterogeneity in the relationship between PAHC and U5M was assessed in regional- and country-specific analyses. For the regional-level analysis, we used the World Bank classification (*World Bank Country and Lending Groups*). As a sensitivity analysis, we conducted stratification by women's age to investigate the association between migration during distinct life stages and unmet FP needs. We reclassified women's age into three categories (15-24, 25-34, 35-49).

R was used (4.2.2), and all survey data were extracted using the rdhs package (Watson, FitzJohn, & Eaton, 2019). Given the complex sampling design of DHS, sampling weights were applied to all analyses to obtain precise standard errors (Lumley, 2010). All results are presented as adjusted odds ratios (OR) with 95% confidence intervals (CI).

Results

Of 523,833 women, 74,577 (14.2%) women had unmet need for FP, with 8.6% women faced spacing problem while others had limiting issue. The most prevalent group was rural non-migrants (54.2%), followed by urban non-migrants (38.8%), rural-to-urban migrants (3.6%), and urban-to-rural migrants (3.4%). Among migrants, women who migrated from urban to rural had a higher prevalence of unmet need for FP (17.7%) compared to those who moved from rural to urban (13.0%). Substantial variation was found across all regions and countries, with unmet need for FP ranging from 10.2 in EAP to 15.9 in SSA. Among 31 LMICs considered, Gabon had the highest unmet need for FP of 26.9%.

In country-fixed effects model, we found that migration status had significant associations with unmet need for FP. The odds of unmet need for FP were higher among urban-to-rural migrants (OR: 1.06, 95% CI: 1.00, 1.11) and lower among urban non-migrants (OR: 0.84, 95% CI: 0.82, 0.86) and rural-to-urban migrants (OR: 0.84, 95% CI: 0.78, 0.89) compared with rural-to-rural migrants. After adjusting for covariates, migration status remained statistically significant despite some attenuation in the magnitude. Women who migrated from urban to rural areas living in the ECA region (OR: 0.70, 95% CI: 0.50, 0.98) were 30% less likely to experience unmet needs for FP than rural non-migrant women. In addition, rural-to-urban migrants had a significantly lower unmet need for FP in all regions except EAP.

In the country-specific analysis, we found substantial variation in the association between urban-to-rural migration and unmet need for FP, and statistically significant association was observed in five countries: Liberia (OR: 0.75, 95% CI: 0.59, 0.96), Gabon (OR: 0.77, 95% CI: 0.61, 0.98), Burundi (OR:0.83, 95% CI: 0.72, 0.95), Malawi (OR: 1.25, 95% CI: 1.01,1.55) and Indonesia (OR:1.38, 95% CI: 1.07, 1.78). On the other hand, the overall tendency for reduced risk of experiencing unmet need for FP was consistent across rural-urban migrants compared to rural non-migrants. In 27 of 31 countries, women who migrated from rural to urban had decreased odds of unmet need for FP, and this association was statistically significant in seven countries: Peru (OR: 0.51, 95% CI: 0.31-0.82), Bangladesh (OR:0.58, 95% CI: 0.45,0.75), Malawi (OR: 0.64, 95% CI:0.43-0.96), Mauritania (OR:0.65, 95% CI:0.42,1.00), Uganda(OR: 0.71, 95% CI: 0.57,0.88), Haiti (OR:0.72, 95% CI:0.55,0.95), and Zambia (OR:0.73, 95% CI:0.55,0.97).

Sensitivity Analyses

Urban-to-rural migration among women aged 15 to 24 showed escalated risks of unmet needs (OR: 1.11, 95% CI: 1.02, 1.21). In contrast, rural-to-urban migration indicated a reduced likelihood of unmet needs in the 15-24 years (OR: 0.88, 95% CI: 0.80,0.98) and those in the 25-34 years (OR: 0.89, 95% CI: 0.80,0.98).

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Table 1. Distribution of internal migrant status and covariates of study sample by unmet need for family planning status across from 31 LMICs from DHS during 2010-2023.

Unmet need for family planning	Overall (N=475545)	Yes (N=66996)	No (N=408549)
Migrant Status			
Rural Non-migrants	265007 (55.7%)	39593 (59.1%)	225414 (55.2%)
Urban Non-migrants	174002 (36.6%)	21815 (32.6%)	152187 (37.3%)
Rural to Urban	18607 (3.9%)	2419 (3.6%)	16188 (4.0%)
Urban to Rural	17929 (3.8%)	3169 (4.7%)	14760 (3.6%)
Mother's education level			
No education	86198 (18.1%)	16942 (25.3%)	69256 (17.0%)
Primary	146563 (30.8%)	22854 (34.1%)	123709 (30.3%)
Secondary	190285 (40.0%)	22435 (33.5%)	167850 (41.1%)
Higher	52499 (11.0%)	4765 (7.1%)	47734 (11.7%)
Wealth			
Poorest	98787 (20.8%)	16353 (24.4%)	82434 (20.2%)
Poorer	91900 (19.3%)	13891 (20.7%)	78009 (19.1%)
Middle	92473 (19.4%)	13110 (19.6%)	79363 (19.4%)
Richer	95055 (20.0%)	12699 (19.0%)	82356 (20.2%)
Richest	97330 (20.5%)	10943 (16.3%)	86387 (21.1%)
Mother's age (in 5-year groups)			
15-19	101033 (21.2%)	7361 (11.0%)	93672 (22.9%)
20-24	84635 (17.8%)	12784 (19.1%)	71851 (17.6%)
25-29	75850 (16.0%)	12769 (19.1%)	63081 (15.4%)
30-34	65772 (13.8%)	11519 (17.2%)	54253 (13.3%)
35-39	58996 (12.4%)	10175 (15.2%)	48821 (11.9%)
40-44	48063 (10.1%)	7688 (11.5%)	40375 (9.9%)
45-49	41196 (8.7%)	4700 (7.0%)	36496 (8.9%)
Marital Status			
Never in Union	142486 (30.0%)	7784 (11.6%)	134702 (33.0%)
Currently in Union	296505 (62.4%)	56627 (84.5%)	239878 (58.7%)
Formerly in Union	36554 (7.7%)	2585 (3.9%)	33969 (8.3%)
Mother's Working Status			
Not working	218281 (45.9%)	29288 (43.7%)	188993 (46.3%)
Working but not paid	65622 (13.8%)	10477 (15.6%)	55145 (13.5%)
Working and paid	191546 (40.3%)	27226 (40.6%)	164320 (40.2%)

Table 2. Fully adjusted odds ratios and 95% confidence intervals of internal migration for unmet need for family planning among 523,833 women in 31 LMICs from DHS during 2010-2023.

	Urban Non-migrants	Urban to Rural	Rural to Urban
Pooled	0.96 (0.93-0.98)	1.04 (0.98-1.10)	0.90 (0.85-0.97)
East Asia & Pacific	1.03 (0.96-1.10)	1.09 (0.87-1.35)	1.09 (0.87-1.37)
Cambodia	0.77 (0.63-0.93)	0.96 (0.55-1.70)	1.21 (0.76-1.95)
Indonesia	1.14 (1.02-1.26)	1.38 (1.07-1.78)	1.57 (1.07-2.30)
Papua New Guinea	0.80 (0.64-1.01)	0.92 (0.51-1.68)	0.80 (0.50-1.28)
Philippines	1.09 (0.94-1.26)	1.00 (0.59-1.72)	1.27 (0.76-2.14)
Timor-Leste	1.06 (0.87-1.29)	1.02 (0.70-1.49)	0.63 (0.38-1.05)
South Asia	0.83 (0.74-0.94)	1.20 (0.94-1.53)	0.80 (0.68-0.93)
Albania	1.11 (0.89-1.40)	0.86 (0.34-2.15)	0.76 (0.54-1.09)
Armenia	1.28 (1.02-1.62)	1.01 (0.48-2.16)	0.87 (0.34-2.20)
Tajikistan	0.93 (0.79-1.09)	0.70 (0.48-1.02)	0.96 (0.54-1.74)
Latin America & Caribbean	0.90 (0.81-0.99)	0.96 (0.79-1.17)	0.65 (0.52-0.82)
Haiti	0.93 (0.83-1.05)	0.90 (0.71-1.14)	0.72 (0.55-0.95)
Peru	0.82 (0.68-0.99)	1.10 (0.83-1.47)	0.51 (0.31-0.82)
Europe & Central Asia	1.03 (0.92-1.15)	0.70 (0.50-0.98)	0.66 (0.50-0.88)
Bangladesh	0.68 (0.56-0.82)	1.14 (0.83-1.57)	0.58 (0.45-0.75)
Nepal	1.03 (0.87-1.21)	1.34 (0.92-1.94)	1.08 (0.89-1.32)
Sub-Saharan Africa	0.95 (0.91-0.98)	1.04 (0.98-1.11)	0.91 (0.84-0.99)
Benin	1.02 (0.92-1.14)	1.00 (0.83-1.21)	1.19 (0.88-1.60)
Burundi	0.94 (0.80-1.10)	0.83 (0.72-0.95)	0.88 (0.60-1.31)
Cameroon	0.95 (0.80-1.12)	1.14 (0.93-1.41)	0.94 (0.70-1.26)
Gabon	0.77 (0.65-0.92)	0.77 (0.61-0.98)	0.57 (0.31-1.03)
Guinea	0.94 (0.81-1.10)	1.17 (0.87-1.57)	0.65 (0.35-1.19)
Kenya	0.82 (0.66-1.00)	1.03 (0.77-1.38)	0.99 (0.68-1.45)
Liberia	0.85 (0.70-1.04)	0.75 (0.59-0.96)	0.78 (0.40-1.51)
Madagascar	1.12 (0.96-1.30)	1.04 (0.81-1.33)	0.79 (0.50-1.26)
Malawi	0.89 (0.75-1.06)	1.25 (1.01-1.55)	0.64 (0.43-0.96)
Mali	0.92 (0.72-1.16)	0.97 (0.72-1.31)	0.87 (0.55-1.39)
Mauritania	0.82 (0.71-0.95)	0.87 (0.62-1.22)	0.65 (0.42-1.00)
Nigeria	0.95 (0.87-1.04)	1.14 (0.96-1.36)	1.12 (0.90-1.40)
Rwanda	1.27 (1.03-1.57)	1.31 (0.94-1.82)	1.05 (0.74-1.48)
Sierra Leone	1.10 (0.95-1.27)	1.17 (0.89-1.55)	1.11 (0.87-1.40)
South Africa	0.95 (0.78-1.16)	1.19 (0.63-2.25)	0.72 (0.47-1.11)
Tanzania	0.87 (0.72-1.04)	0.95 (0.71-1.26)	1.14 (0.87-1.50)
Uganda	0.75 (0.62-0.91)	0.86 (0.73-1.01)	0.71 (0.57-0.88)
Zambia	0.73 (0.61-0.88)	0.88 (0.70-1.09)	0.73 (0.55-0.97)
Zimbabwe	1.17 (0.90-1.53)	1.11 (0.70-1.77)	1.25 (0.72-2.18)

Supplementary Table 1. Regional classifications and sample size for the 31 LMICs from DHS during 2010-2023.

Region	Country	Sample Size
East Asia & Pacific	Cambodia	17968
	Indonesia	43612
	Papua New Guinea	13948
	Philippines	24609
	Timor-Leste	11962
Europe & Central Asia	Albania	8882
	Armenia	5536
	Tajikistan	10149
Latin America &	Haiti	12918
	Peru	20534
South Asia	Bangladesh	15377
	Nepal	10927
Sub-Saharan Africa	Benin	13360
	Burundi	12293
	Cameroon	11710
	Gabon	8367
	Guinea	10111
	Kenya	28644
	Liberia	6989
	Madagascar	17807
	Malawi	22892
	Mali	9575
	Mauritania	14267
	Nigeria	38425
	Rwanda	13405
	Sierra Leone	14050
	South Africa	7221
	Tanzania	12151
	Uganda	16901
	Zambia	12521
	Zimbabwe	8434

Supplementary Table 2 Fully adjusted odds ratios and 95% confidence intervals of internal migration for unmet need for family planning among 523,833 women after age stratification in 31 LMICs from DHS during 2010-2023.

Women's age	**Urban Non-migrants**	**Urban-to-Rural**	**Rural-to-Urban**
15-24	0.96 (0.92,1.01)	1.11 (1.02,1.21)	0.88 (0.80,0.98)
25-34	0.96 (0.92,1.01)	0.95 (0.88,1.04)	0.89 (0.80,0.98)
35-49	0.94 (0.90,0.99)	1.03 (0.89,1.18)	0.89 (0.76,1.03)