

Timing and determinants of age at menarche in LMICs

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Abstract

Age at first period is influenced by a unique set of genetic, socioeconomic, and environmental factors. However, very little is known about changes in the timing and determinants of the age at menarche in low- and middle-income countries (LMICs). This has mainly been due to a lack of suitable data.

The aim of this study is to review the evidence on the determinants and timing of age at menarche in LMICs. Using a systematic mapping of the literature and the 16 Demographic and Health Surveys (DHS) that have included age at menarche, this study's objective is to investigate patterns and regional variations in the timing of the age at menarche. Results show a significant relationship with wealth changing across countries and over time. While richer women were more likely to have an early menarche, now poorer do. Urban areas report consistently a higher risk of an early age at menarche.

Extended abstract

Menarche (first menstrual bleeding) serves as a critical marker of puberty, and the associated physiological and social changes which collectively symbolize sexual maturation, adulthood and fertility. Average age at menarche has been recorded in some European countries and the United States since the mid-1800s. Evidence suggests a downward trend from >16 years in the mid-1800s to <13 years by the 1980s (Euling, Selevan et al. 2008). This trend has been observed worldwide, irrespective of socioeconomic status, race or ethnicity (Wyshak and Frisch 1982, M. Okasha 2001, Wronka 2010, Buttke, Sircar et al. 2012).

The downward trend in high-income countries (HICs) has been attributed mostly to better nutrition and increased wealth (Prentice, Fulford et al. 2010). Our understanding of the relationship in LMICs is very poor. Evidence from the Philippines suggests that earlier menarche could be characteristic of girls who live in urban, higher socioeconomic status households, as indicated by higher maternal education, better housing quality, and household asset ownership (Adair 2001). In addition, age at menarche is significantly associated with birth characteristics with low birth weight having an earlier age at menarche (Adair, 2001). This evidence base is quite dated and precludes generalisability.

Timing and determinants of the age at menarche need to be better understood because of the potential linkages with outcomes later on in life. Research in HICs shows that early menarche has been linked to an increased risk of a number of adverse reproductive health outcomes including breast cancer (Leung, Mak et al. 2008), endometrial cancer (Dossus, Allen et al. 2010), and spontaneous abortion [miscarriage] (Buttke, Sircar et al. 2012). Early puberty has also been associated with mental health problems in middle adolescence, with the longer-term impact unknown (Kaltiala-Heino, Kosunen et al. 2003). Eating disorders, lack of self-esteem and in general mental health problems are often associated with an early age at menarche. All of these factors have implications for health at older ages. To date the evidence derives almost exclusively from HICs. With the exception of breast cancer, it is unclear whether or not these patterns hold true elsewhere. The psychological issues are even less studied with the stigma and distress linked to periods being poorly understood. Finally, in a setting with high fertility, low contraceptive use and early age at first sexual intercourse, earlier menarche could potentially have implications for an increase in teenage fertility. This link has so far not been tested though.

This proposed research will highlight the major gaps in knowledge linking literature from social epidemiology, demography, population health, life course studies, reproductive and mental health as well as bio-demography.

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have asked the question on age at first period, this study's objective is to investigate patterns and regional variations in the timing of the age at menarche.

Methods

In this study we:

1. Conduct a systematic mapping of the literature on timing and determinants of the age of menarche in LMICs.
2. Review the data of the DHS from the 16 countries (Table 1) which have been found to have included the question on age at first period in previous DHS surveys in a review conducted in 2018. Some of these countries have asked the question in more than one data round.
3. Analyse patterns and changes (where possible) in median and mean age at menarche; patterns of missingness by women's characteristics including socio-demographic, regional and residence (urban vs rural) variations.
4. Conduct cross-sectional analyses of the determinants of the timing using multivariate statistical analysis. We look, among other things, at socio-economic status, education, and place of residence.
5. Based on the cross-sectional results, pool data across different rounds to create a pseudo-longitudinal dataset in order to identify cohort patterns of changes in the factors affecting timing. These analyses would be feasible, for example, for the Philippines where 5 different waves of data have been collected over 15 years.

Table 1 DHS surveys that included question: "How old were you when you had your first period?"

Country	Years question was included
Botswana	1988*
Cameroon	1991
Colombia	2015
Egypt	1988, 1992, 1995
Gabon	2000
Ghana	1998
India	1992-93, 2015-16 (NFHS4)
Indonesia	2002-03 (Special), 2007 (Special), 2012 (Special)
Kyrgyz Republic	1997
Morocco	2003-04
Philippines	1993, 1998, 2003, 2008, 2013
Senegal	1986
Turkey	2013**
Uganda	2000-01
Uzbekistan	1996
Yemen	1991-92, 1997*, 2013

*Restricted access dataset. **Dataset not yet available

In the preliminary analysis the variables used to control the statistical analysis are residence, education and wealth calculated as a quintile derived from a principle component analysis of the asset variables (eg: toilet facilities, water, electricity, wall material). We want to control for variations in changes in nutrition across socio-economic groups and residence. Education could be both cause and consequence. Ideally we would have liked to use the education of the parents as the final education achievement would have arrived most likely after the first period. However education achievement could also be influenced by the age at first

menarche in a low income setting. Early menarche is linked to early sexual initiation but it is also linked to stigma due to the challenge to control menstrual hygiene (Glynn et al., 2010). At the same time we would have liked to control for place of residence at birth. However most of the datasets considered do not include this variable.

The data analysed so far refers to all rounds of the Philippines, India and Indonesia.

Results so far:

Table 2 Mean age at menarche selected DHS datasets

Country	Year	Mean age at menarche	CI
India	1992-93	13.70	(13.69 13.72)
India	2015-16	13.31	(13.15 13.45)
Indonesia	2002-03	13.48	(13.36 13.61)
Indonesia	2007	13.40	(13.35 13.46)
Indonesia	2012	13.24	(13.20 13.29)
Philippines	1993	13.64	(13.60 13.67)
Philippines	1998	13.66	(13.62 13.71)
Philippines	2003	13.28	(13.25 13.33)
Philippines	2008	13.21	(13.18 13.24)
Philippines	2013	13.13	(13.10 13.17)

The mean age at menarche distribution DHS shows a significant decrease over time with the Philippines having data across five DHS rounds (Table 2).

Using 13 as the cut-off date for age at menarche, we see that those in the poor and poorest strata are more likely to be in the below 13 cut off while the richest are more likely in the 13+ category. This is true for all the datasets post 1998. Previously the direction was either not significant (India) or reversed showing a possible change in eating and health habits.

The logistic regression results confirm the descriptive trends. We control at this stage for wealth, education and residence only. We would expect public health, nutrition and physical development to follow similar patterns across the same groups, for example better nutrition in urban areas and among wealthier groups. However, as the results for the Philippines show (Table 3) the relationship between wealth and reverses from 2003. Possibly as a change in nutrition habits and more sedentary life among wealthier groups.

Discussion and preliminary conclusions

The data shows a significant decline in the age at menarche within a rather short period. Preliminary results show a clear change in the relationship between wealth and age at menarche in the Philippines and a possible pattern when comparing to Indian and Indonesia when considering comparable temporal proximities. These results need to be further investigated in light of possible increases in obesity and changes in nutrition.

We plan on finalising the systematic literature mapping and the data analysis for all the countries. In addition we will include all countries in Table 1 to the analysis to make sure the trend patterns replicate elsewhere. The pseudo-longitudinal analysis will also allow us to control for time within the same country.

Table 3 Logistic regression odds of having menarche before age 13, selected countries 1992-2012. DHS data

	Indonesia			India		Philippines				
	2002-03	2007	2012	1992-93	2015-16	1993	1998	2003	2008	2013
Education										
No education	.	1.018	1.043***	1.046	0.210***	0.946	1.265*	0.775	0.818	0.557***
Incomplete primary	1.130	0.900	1.177*	1.194*	0.486***	1.150	0.903	0.713***	0.689***	0.601***
Complete primary	1.164	0.980	1.366*	1.262**	0.460***	1.040	0.950	0.637***	0.669***	0.627***
Incomplete secondary	1.763	1.037	1.436***	0.960	1.193***	0.761***	0.585***	0.986	0.949	0.825***
Complete secondary ¹	1.000	1.000	1.000	3.407**	1.212***	0.886*	0.853**	0.856**	0.842***	0.836***
Higher				1.000	1.000	1.000	1.000	1.000	1.000	1.000
Wealth										
Poorest	0.543*	0.489***	0.589**	1.325***	3.087***	1.251**	1.332***	0.669***	0.665***	0.493***
Poor	0.656*	0.509***	0.773*	1.446***	2.589***	1.376***	1.410***	0.764***	0.699***	0.637***
Average	0.713	0.582***	0.835	1.191**	1.869***	1.261**	1.125*	0.86**	0.830***	0.694***
Rich	0.895	0.882	0.881	1.061	1.392***	1.376***	1.237**	0.872**	0.900*	0.867**
Richest	1.000	1.000	1.000	1.000	1.00	1.000	1.000	1.000	1.000	1.000
Residence										
Urban	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
Rural	0.615*	0.735**	0.719***	0.802***	0.905***	0.909*	0.972	0.905*	0.966	1.008
Constant	0.126***	0.190***	0.459***	0.127***	0.051***	0.194***	0.449***	0.762***	0.784***	0.970

* $p < .05$; ** $p < .01$; *** $p < .001$. ¹ Educational attainment coded differently in Indonesian datasets, with highest category being secondary+.

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