Title
Contraceptive practices in Honduras and Nicaragua: age, period and cohort differences over the past 15 years

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Abstract
This analysis examines life-cycle (age) patterns, time (period) and generational (cohort) effects in contraceptive practices in two Central American countries: Honduras and Nicaragua. We use data from four rounds of nationally-representative cross-sectional surveys conducted in Honduras (1991/92, 1996, 2001, 2006) and Nicaragua (1992/93, 1998, 2001, 2006/07). We construct synthetic birth-cohorts (1942-1991) of women of reproductive age using pooled data collected in each country (N=43,888 for Honduras; N=47,740 for Nicaragua). To assess age, period, and cohort effects on contraceptive practices, we fit logistic regression models adjusting for survey-round, birth-cohort, women's residence, education, parity and wealth. We find that the birth-cohort is the most important positive predictor of contraceptive use in both countries. The likelihood of women in the same birth-cohort practicing a modern contraceptive method increases by 10-13% between survey rounds in the two countries.

Extended Abstract

Study objectives
Central America is one of the last regions in Latin America to experience fertility decline and much of the decline is attributable to greater contraceptive use. This study aims to disentangle generational (cohort) effects from life-cycle (age) patterns and time (period) effects in contraceptive practices in two Central American countries: Honduras and Nicaragua.

Data and methods
We use data from four rounds of nationally-representative cross-sectional surveys conducted in Honduras and 1991/92, 1996, 2001, 2006, and Nicaragua in1992/93, 1998, 2001, 2006/07. The surveys are either Demographic and Health Surveys (DHS) or Reproductive Health Surveys (RHS) as follows: the 1991/92, 1996 and 2001 RHSs and the 2005/06 DHS in Honduras; the 1992/93 and 2006/07 RHSs, and the 1998 and 2001 DHSs in Nicaragua. The RHSs were provided technical assistance by the Division of Reproductive Health of CDC as part of the MEASURE/CDC project and the DHSs were provided technical assistance by Macro International as part of the MEASURE/DHS project. The Honduras 1991/92 survey was provided technical assistance by FHI and MSH. The data sources are described in greater detail in a recent report on health equity trends in Central America (Stupp, Daniels and Ruiz, 2007). For most of the characteristics, a common definition has been used for all of the surveys. Education is

defined in terms of completed years of education at the time of interview in each survey, without differentiating between women who are still attending school and those who have completed schooling. Residence has been defined as urban or rural based on the classification used by the statistics office of the country. Parity is the number of live births that occurred to the woman prior to the survey.

DHSs and RHSs do not collect data on household income but measure wealth based on household-level reports of owning various assets and housing characteristics. Assets and amenities in the index include possession of items such as bicycles, cars, radios, sofas, and televisions; dwelling characteristics include type of flooring material or the existence of overcrowding; and household facilities include source of drinking water, type of toilet facility, and type of cooking fuel. The asset index uses principal-components analysis to divide the population into quintiles, from the poorest 20% to the richest 20%, on the basis of wealth. Each household asset is assigned a weight or factor score, and the resulting asset scores are standardized in relation to a standard normal distribution with a mean of zero and a standard deviation of one. In our analysis, wealth quintiles are expressed in terms of quintiles of all individuals in the population in each survey.

We create synthetic cohorts of women in the two countries. Synthetic cohort (quasipanel) methods are employed to disentangle life-cycle (or age) patterns from generational (or cohort) and time (period) differences. This type of cohort analysis does not suffer from the data availability, attrition, and small sample problems that often limit longitudinal approaches (approaches using genuine panel data). The resulting quasi-panel consists of four annual surveys and spans a 15-year period in each country. The problem of decomposing age, year and cohort effects has a long literature in social studies and economics, and it arises because of the linear dependency between age, survey year and cohort. The idea is that although individuals cannot be followed with cross-sectional data, groups of individuals (birth cohorts in our case) can be followed over time in a way that is analogous to the way individuals can be followed in true panel data. The advantage of this type of data is that unobservable characteristics of groups/birth cohorts can be dealt with, just as individual “fixed effects” can be dealt with using true panel data (Crossley and Ostrovsky, 2003). Cross sectional estimates of age profiles are biased by unobserved differences across cohorts because in a cross-section age and birth cohort are (perfectly) correlated.

The choice of the x-year age and cohort bands is, of course, arbitrary. Essentially, the choice is a trade-off between a larger number of cohorts, a larger number of observations per cohort, and a larger number of observations in each cohort-age cell. Each synthetic cohort constructed for this analysis is composed of the respondents from the sample who were born in the same five-year interval. Sorting the data by ten five-year cohorts and four survey years and restricting the analysis to women 15 to 49 years of age results in 32 different cohort-year cells for Honduras and 33 cohort-year cells for Nicaragua. We calculate the sample contraceptive use proportions for each cohort-year cell and obtain an indication of the behavioral pattern of a particular cohort over time. These are synthetic cohorts in the sense that, while we do not track the same people, each segment tracks individuals born in the same five-year interval from successive cross sectional surveys.

A basic "age-year-cohort" model of contraceptive use can be written as:

CU =f (*A,C,Y*), where CU is contraceptive use, and *f(A,Y,C)* is a polynomial in age (*A*), year (*Y*) and cohort respectively (*C*) (Crossley and Ostrovsky, 2003). The identification problem that results from the linear dependency of age, cohort and year is well known in the literature (Mason and Fienberg, 1985; Deaton, 1997). Specifically, if cohorts are identified by the year of birth (as is usually the case), then *C =Y-A*. The only solution to the problem is to introduce some additional information (Crossley and Ostrovsky, 2003). This typically comes in the form of restrictions on the way in which various effects enter the model. For example, one might set year or cohort effects to zero. Another possibility is to parameterize one or more of the effects as a function of observable variables. We attribute the increase in contraceptive prevalence to age and cohort effects and cyclical residence, education, parity and wealth fluctuations to year effects. Thus, we fit nested logistic regression models for practice of any method and any modern method using pooled data for each country. In model 1 we adjust for survey round, while in model 2 we add the birth cohort to the model. Both models are additionally adjusted for residence (urban/rural), education (years), parity and wealth quintiles.

Results

Table 1 presents the characteristics of all women interviewed in each of the four surveys in Honduras and Nicaragua. More than half (51.4-58.4%) of all women interviewed in Honduras at any of the four time points live in rural areas, while some 31.1-49.8% of all women interviewed in Nicaragua during the four surveys do so. Only between three and four tenths of the women interviewed in all survey rounds and in both countries are either married or in union; their mean age varies little between survey years ranging from 28.2 years in Honduras in1991/92 and Nicaragua in 1998 to 29.2 years in Nicaragua in 2006. Similarly, parity levels vary slightly between rounds for both countries but have decreased over time from 3.0 children in 1991/92 to 2.5 children in 2006 in Honduras, and from 2.9 children in 1992/93 to 2.4 children in 2006 in Nicaragua. Conversely, the mean number of years of education has increased over time, more so in Honduras than in Nicaragua.

Table 2 shows the composition of contraceptive method use at the four time points in each country. The proportion of all women using contraception has increased by 16.4 percentage-points in Honduras and by 14.2% in Nicaragua between 1992 and 2006. Reliance on traditional contraceptive methods decreased in both countries over the same period of time. Of note, the percentage of women using IUDs decreased substantially and monotonically in Nicaragua, but increased between the 1st and 3rd survey round in Honduras, to decrease only slightly at the time of the 4th survey conducted in this country in 2006. Importantly, the use of injectable contraception increased substantially by 8.3 percentage-points in Honduras and by 16.8 percentage-points in Nicaragua between the 1st and 4th survey conducted in the two countries.

Table 3 shows the number of women in each cohort-survey round cell in the two synthetic cohorts constructed for the two countries. Tables 4 and 5 show how the percentage of women using any method and any modern method of contraception,

respectively, varies between birth cohorts and with time. We grouped the cohorts into 5-year birth cohorts to depict these changes. It appears that more women use contraception as they reach their late 20s, their 30s and 40s, while use is more limited in younger and over 40 years of age women.

Results from the logistic regression models are shown in Table 6. Based on model I, women are 33% and 26% more likely to use a modern contraceptive method at each consecutive survey round in Honduras and Nicaragua, respectively. As expected, the birth cohort appears to confound the relationship between contraceptive use and survey round. Based on results from model II, the likelihood of women in the same birth-cohort practicing a modern contraceptive method increases by 24% in Honduras and by 15% in Nicaragua between survey rounds. Thus, birth cohort and seems to be the most important predictors of women practicing a modern contraceptive method.

Conclusion

In this study we have constructed a quasi-panel using four cross sections drawn from four different nationally-representative surveys for both Honduras and Nicaragua. As the above preliminary results show, these quasi-panels allow us to disentangle age and cohort effects in life-cycle profiles of contraceptive practice. This is the first quasi-panel analysis of contraception in Latin America of which we are aware.

References

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Table 1. Characteristics of women interviewed by country and survey round

Characteristics	Honduras				Nicaragua			
	Round 1 N=8076	Round 2 N=7505	Round 3 N=8362	Round 4 N=19948	Round 1 N=7150	Round 2 N=13634	Round 3 N=13060	Round 4 N=13896
Residence (%)								
Urban	48.4	45.3	48.6	41.6	68.9	57.5	55.8	50.2
Rural	51.6	54.7	51.4	58.4	31.1	42.5	44.2	49.8
Marital status (%)								
In union	41.5	32.9	31.3	41.3	31.8	40.1	41.2	32.6
Not in union	58.5	67.1	68.7	58.7	68.2	59.9	58.8	67.4
Age								
Mean (std dev)	28.2(9.5)	28.9(9.3)	28.9(9.2)	28.5(9.8)	28.7(8.9)	28.2(9.6)	28.4(9.8)	29.2(9.1)
Parity								
Mean (std dev)	3.0(3.1)	3.1(2.9)	2.8(2.6)	2.5(2.7)	2.9(2.8)	2.7(2.8)	2.6(2.8)	2.4(2.3)
Education (yrs)								
Mean (std dev)	5.1(4.0)	5.2(4.0)	6.5(4.9)	6.0(3.9)	5.9(4.1)	5.7(4.2)	5.8(4.3)	6.3(4.5)
Wealth quintile (WQ) (%)								
WQ1 (Poorest)	20.3	21.9	21.1	25.7	15.6	23.1	23.6	24.5
WQ2	18.6	18.7	18.4	22.8	15.5	21.1	21.0	22.1
WQ3	19.6	19.0	19.9	18.4	20.0	19.6	20.2	19.8
WQ4	20.6	20.6	20.5	16.5	23.6	19.1	19.3	18.5
WQ5 (Richest)	20.9	19.8	20.1	16.6	25.3	17.1	15.9	15.1

Table 2. Contraceptive use by type of method, country and survey round

Characteristics	Honduras				Nicaragua			
	Round 1 N=8076	Round 2 N=7505	Round 3 N=8362	Round 4 N=19948	Round 1 N=7150	Round 2 N=13634	Round 3 N=13060	Round 4 N=13896
Contraceptive use (%)	26.8	33.2	42.8	43.2	35.1	35.2	40.1	49.3
Modern method use (%)	20.1	26.7	35.3	37.3	32.4	33.5	38.6	47.6
Traditional or folkloric method use (%)	6.7	6.5	7.5	5.5	2.7	1.7	1.5	1.8
Pill use (%)	5.5	6.6	7.1	7.1	9.2	8.7	9.0	9.8
Male condom use (%)	1.6	2.1	2.2	2.3	1.8	1.5	1.7	2.4
Injectable use (%)	0.3	0.6	6.6	8.6	0.9	3.1	9.3	17.7
IUD use (%)	2.8	5.4	6.2	4.4	7.1	4.8	2.9	1.8
Female sterilization (%)	9.7	11.9	13.0	15.0	13.1	15.3	14.5	15.0
Withdrawal (%)	2.8	3.8	4.5	3.6	0.8	0.6	0.6	1.0
Rhythm (%)	3.8	2.7	3.1	1.9	1.9	0.9	0.9	1.2

Table 3. Number of women in each cohort-survey round cell

	Honduras				Nicaragua			
Birth cohort	Round 1 N=8076	Round 2 N=7505	Round 3 N=8362	Round 4 N=19948	Round 1 N=7150	Round 2 N=13634	Round 3 N=13060	Round 4 N=13896
1942-1946	552	32			313			
1947-1951	724	524	17		483	646	19	
1952-1956	921	728	585	198	869	1196	1020	9
1957-1961	1155	1035	789	1647	1107	1500	1224	970
1962-1966	1296	1190	1114	1984	1374	1833	1609	1277
1967-1971	1524	1306	1308	2294	1413	2030	1646	1674
1972-1976	1863	1394	1547	2688	1346	2364	2024	2249
1977-1981	41	1292	1622	3280	231	3144	2410	2627
1982-1986			1345	3874	14	921	3108	2773
1987-1991				3983				2317

Table 4. Percentage of women using contraception (all methods) by birth cohort and survey round

Birth cohort	Honduras				Nicaragua			
	Round 1 N=8076	Round 2 N=7505	Round 3 N=8362	Round 4 N=19948	Round 1 N=7150	Round 2 N=13634	Round 3 N=13060	Round 4 N=13896
1942-1946	25.5	16.7			25.4			
1947-1951	41.3	31.1	34.0		39.5	33.6	10.5	
1952-1956	42.0	41.8	42.7	28.8	46.6	41.0	39.7	11.1
1957-1961	41.4	46.0	51.2	43.5	49.9	49.7	51.1	41.2
1962-1966	34.9	47.5	55.5	54.1	45.4	53.3	58.0	52.2
1967-1971	20.7	40.4	56.7	52.6	34.5	49.5	58.3	61.0
1972-1976	4.8	25.6	47.6	53.5	12.0	36.6	49.1	60.7
1977-1981	0.0	7.3	39.2	44.1	4.8	14.6	38.7	57.4
1982-1986			13.1	27.3	7.1	4.3	12.5	48.6
1987-1991				7.6				23.6

Table 5. Percentage of women using modern contraception by birth cohort and survey round

Birth cohort	Honduras				Nicaragua			
	Round 1 N=8076	Round 2 N=7505	Round 3 N=8362	Round 4 N=19948	Round 1 N=7150	Round 2 N=13634	Round 3 N=13060	Round 4 N=13896
1942-1946	21.4	13.9			23.6			
1947-1951	31.5	23.5	30.0		36.7	32.4	10.5	
1952-1956	33.44	33.9	35.6	25.8	41.8	38.9	37.9	11.1
1957-1961	32.3	38.5	42.1	34.7	46.9	46.7	48.6	39.8
1962-1966	25.1	39.4	46.0	44.3	41.9	50.3	55.6	50.6
1967-1971	14.1	32.4	47.9	44.6	31.9	47.6	56.2	58.6
1972-1976	2.8	19.8	39.1	45.4	10.9	35.0	47.4	58.6
1977-1981	0.0	4.9	31.8	37.6	4.3	14.1	37.5	55.1
1982-1986			10.0	23.1	7.1	4.1	12.1	47.2
1987-1991				6.6				22.8

Table 6. Associations between contraceptive use, birth cohort and survey round in Honduras and Nicaragua: 1991-2006

Covariates	Honduras (N=43,888)		Nicaragua (N=47,740)	
	Model I OR (95% CI)	Model II OR (95% CI)	Model I OR (95% CI)	Model II OR (95% CI)
Contraceptive use (any method)				
Round	**1.26 (1.22, 1.30)**	**1.08 (1.06, 1.11)**	**1.24 (1.20, 1.27)**	**1.12 (1.10, 1.14)**
Cohort		**1.19 (1.16, 1.23)**		**1.14 (1.10, 1.18)**
Contraceptive use (modern method)				
Round	**1.33 (1.30, 1.37)**	**1.10 (1.08, 1.12)**	**1.26 (1.22, 1.30)**	**1.13 (1.11, 1.15)**
Cohort		**1.24 (1.20, 1.28)**		**1.15 (1.12, 1.19)**

Note: All models are also adjusted for residence (urban/rural), parity, education (years), household wealth (quintiles) and complex survey design.