We agree with Drs Plochg and Klanzinga that the members of the medical profession should play a role, but as we stated in our Viewpoint, they are not the only people in society with a stake in the outcome.

Dr Johns and colleagues suggest that the market is better suited for determining the distribution of training options than the government. We might argue that in the United States, the market has not done that well. And because the government definitely has skin in the game as the largest payer, it certainly should have the right to influence the manpower and reimbursement issues. We agree that financial considerations are not the only factor in career choices but are pretty sure that if primary care physicians incomes went up by 80% and specialist incomes went down to the same degree, it would change the distribution of services provided to patients.

In response to Dr Sheldon, we would simply say that manpower planning in the setting of the market distortions is fraught with difficulties.[1] Perceived shortages can quickly turn into perceived surpluses, and vice versa.

Allan S. Detsky, MD, PhD
Stephen R. Gauthier, BSc
Victor R. Fuchs, PhD

Author Affiliations: Institute of Health Policy Management and Evaluation (Dr Detsky; adetsky@mtsinai.on.ca) and Faculty of Medicine (Dr Gauthier), University of Toronto, Toronto, Ontario, Canada; and Department of Economics, Stanford University, Stanford, California (Dr Fuchs).

Conflict of Interest Disclosures: The authors have completed and submitted the ICMJE Form for Disclosure of Potential Conflicts of Interest. Dr Fuchs reported receiving a grant from the Robert Wood Johnson Foundation. No other authors reported disclosures.

1. Detsky AS. *The Economic Foundations of National Health Policy*. Cambridge, MA: Ballinger Publishing Co; 1978.

RESEARCH LETTER

Changes in Prevalence of Girl Child Marriage in South Asia

To the Editor: Girl child marriage (ie, <18 years of age) affects more than 10 million girls globally each year and is linked to maternal and infant morbidities (eg, delivery complications, low birth weight) and mortality.[1,2] Half (46%) of child marriages occur in South Asia.[1,2] This study assessed whether prevalence of girl child marriage has changed over the past 2 decades in 4 South Asian nations with a girl child marriage prevalence of 20% or greater.[1-3]

Methods. All available population-based Demographic and Health Surveys (DHS) data from Bangladesh, India, Nepal, and Pakistan between 1991 and 2007 were analyzed. The DHS are nationally representative surveys that measure demographics, health, and nutrition with standard measures across nations and over time. Data collection and management procedures are described in detail elsewhere.[3] Briefly, cluster randomized samples are selected.[4] After stratification by rural or urban area and geographic or administrative regions, random clusters of approximately 25 households are selected from each area, and an eligible woman is identified from each household. All data were collected from women in or near households but not necessarily in a private setting.

The DHS procedures were approved by ICF Macro International institutional review board and the ethics review boards of each nation included in the study. Oral informed consent was obtained from all respondents. The University of California at San Diego institutional review board ruled this study to be exempt from full review due to use of secondary analysis of data with no identifiers.

The age at marriage variable was based on the difference between the date of start of first marriage or union and the respondent's date of birth (items provided via self-report). Analyses were restricted to women aged 20 to 24 years to allow for the inclusion of all women married or in union by age 18 years within the closest period for which data were available.

Prevalence estimates and 95% confidence intervals were calculated for girl child marriage and subgroups using DHS-calculated individual weights[4] to take into account the multistage sampling design and provide results for all (not just ever married) women. Cochran-Armitage tests[5] were used to test linear time-trend data by country; χ^2 tests were used for nonlinear trends with tests adjusted for complex survey design.[6] Significance was set at $P<.05$ using 2-sided tests. Analyses were conducted in SAS version 9.2 (SAS Institute Inc) and Microsoft Excel.

Results. Sample sizes ranged from 1064 to 22 807 (**Table 1**). The prevalence of girl child marriage decreased in all countries from 1991-1994 to 2005-2007 (**Table 2**). Significant relative reductions occurred in marriage of girls prior to age 14 years across all 4 nations, ranging from –34.7% (95% CI, –40.6% to –28.1%) to –61.0% (95% CI, –71.3%

Table 1. Sample Details and Response Rates by Survey Year

	Bangladesh					India			Nepal			Pakistan	
	1994	1997	2000	2004	2007	1993	1999	2006	1996	2001	2006	1991	2007
Sample age range, y	10-49	10-49	10-49	10-49	10-49	13-49	15-49	15-49	15-49	15-49	15-49	15-49	15-49
Response rate, %	97	98	97	99	98	96	95	95	98	98	98	96	95
Sample type	EM	EM	EM	EM	EM	EM	EM	AW	EM	EM	AW	EM	EM
Unweighted total No.	9493	8981	10 373	11 300	10 996	89 506	90 303	124 385	8429	8726	10 793	6611	10 023
Study sample aged 20-24 y	2038	1716	1910	2202	2174	17 218	15 973	22 807	1629	1651	2042	1064	1560

Abbreviations: AW, all women; EM, ever married.

©2012 American Medical Association. All rights reserved.

Downloaded From: http://jamanetwork.com/ on 05/23/2013

to –46.9%). Little or no change over time was seen in marriage of 16- to 17-year-old adolescent girls for any nation except Bangladesh, where such marriages increased by 35.7% (95% CI, 18.5% to 55.3%).

Comment. Reductions in girl child marriage in South Asia have occurred but are largely attributable to success delaying marriage among younger but not older adolescent girls. Improvements in education of girls and increasing rural to urban mi-

Table 2. Prevalence of Girl Child Marriage in Bangladesh, India, Nepal, and Pakistan

Age at Marriage	% (95% CI) 1991-1994	1995-1998	1999-2001	2002-2004	2005-2007	Relative Change From Time 1 to Final Time[a]	*P* Value[b]
			Bangladesh				
<14 y	33.8 (31.6 to 36.0)	35.0 (32.6 to 37.4)	24.9 (22.9 to 27.0)	24.4 (22.1 to 26.6)	18.5 (16.5 to 20.4)	–45.3 (–51.7 to –38.1)	<.001[c]
Unweighted; weighted, No.	791; 785	714; 730	551; 592	603; 633	427; 469		
14-15 y	24.3 (22.5 to 26.1)	21.0 (19.0 to 22.9)	24.6 (22.8 to 26.4)	25.5 (23.4 to 27.5)	27.1 (22.5 to 25.1)	11.6 (0.7 to 23.7)	.004[c]
Unweighted; weighted, No.	564; 564	433; 438	565; 583	650; 662	663; 688		
16-17 y	15.2 (13.7 to 16.7)	12.6 (11.0 to 14.1)	15.8 (14.3 to 17.3)	18.8 (17.0 to 20.6)	20.6 (18.7 to 22.5)	35.7 (18.5 to 55.3)	<.001[c]
Unweighted; weighted, No.	351; 352	261; 262	377; 375	506; 489	539; 522		
Total <18 y	73.3 (71.4 to 75.1)	68.5 (66.5 to 70.5)	65.3 (63.5 to 67.1)	68.7 (66.9 to 70.4)	66.2 (64.0 to 68.3)	–9.7 (–13.3 to –5.9)	<.001[c]
Unweighted; weighted, No.	1706; 1701	1408; 1430	1493; 1550	1759; 1783	1629; 1679		
			India				
<14 y	9.6 (9.0 to 10.2)		8.0 (7.5 to 8.5)		6.3 (5.8 to 6.8)	–34.7 (–40.6 to –28.1)	<.001
Unweighted; weighted, No.	1650; 2119		1309; 1693		1025; 1431		
14-15 y	19.5 (18.8 to 20.2)		18.5 (17.6 to 19.4)		16.3 (15.6 to 17.0)	–16.5 (–21.1 to –11.6)	<.001
Unweighted; weighted, No.	3660; 4307		3363; 3932		2712; 3716		
16-17 y	21.0 (20.3 to 21.8)		19.7 (19.0 to 20.5)		21.9 (21.2 to 22.7)	4.2 (–0.8 to 9.4)	<.001[c]
Unweighted; weighted, No.	4232; 4639		3966; 4193		3993; 4994		
Total <18 y	50.2 (49.3 to 51.1)		46.2 (45.2 to 47.2)		44.5 (43.7 to 45.4)	–11.3 (–13.7 to –8.9)	<.001
Unweighted; weighted, No.	9542; 11 065		8638; 9817		7730; 10 140		
			Nepal				
<14 y		8.6 (7.2 to 10.1)	3.6 (2.8 to 4.4)		3.8 (2.7 to 4.8)	–56.5 (–68.4 to –39.9)	<.001
Unweighted; weighted, No.		162; 165	78; 72		79; 75		
14-15 y		25.6 (23.0 to 28.1)	24.5 (22.3 to 26.8)		18.7 (16.5 to 20.9)	–26.8 (–37.2 to –14.8)	<.001
Unweighted; weighted, No.		476; 488	466; 491		400; 373		
16-17 y		26.1 (23.7 to 28.4)	27.9 (25.7 to 30.2)		29.0 (25.7 to 32.2)	11.1 (–3.9 to 28.3)	.67
Unweighted; weighted, No.		502; 498	564; 559		589; 578		
Total <18 y		60.3 (57.8 to 62.9)	56.1 (53.7 to 58.6)		51.4 (47.7 to 55.1)	–14.7 (–21.5 to –7.3)	<.001
Unweighted; weighted, No.		1140; 1152	1108; 1123		1068; 1025		
			Pakistan				
<14 y	6.4 (5.0 to 7.8)				2.5 (2.0 to 3.0)	–61.0 (–71.3 to –47.0)	<.001[c]
Unweighted; weighted, No.	125; 112				86; 78		
14-15 y	11.8 (9.7 to 13.9)				8.9 (7.8 to 9.9)	–24.8 (–39.2 to –7.0)	.58[c]
Unweighted; weighted, No.	210; 206				295; 277		
16-17 y	13.4 (11.3 to 15.5)				12.7 (11.5 to 13.8)	–5.3 (–21.1 to 13.6)	.53[c]
Unweighted; weighted, No.	263; 234				401; 396		
Total <18 y	31.6 (28.9 to 34.3)				24.0 (22.5 to 25.6)	–23.8 (–31.7 to –15.1)	<.001[c]
Unweighted; weighted, No.	598; 552				782; 751		

[a] Calculated as relative change = 1 – (final time %/time 1 %).
[b] Based on Cochran-Armitage time trend analyses[5] adjusted for sampling design using Rao-Scott adjustments[6] to assess significant trends over time by age at marriage within nations.
[c] χ^2 Analyses with Rao-Scott adjustments[6] were conducted for child marriage age categorizations in Bangladesh and for 16- to 17-year-old adolescent girls in India due to nonlinear trends. Rao-Scott adjusted χ^2 analyses were also conducted for Pakistan because it had only 2 data points for time.

 ©2012 American Medical Association. All rights reserved.

Downloaded From: http://jamanetwork.com/ on 05/23/2013

gration may have supported these reductions,[1,2] but many schools graduate students at the 10th standard (about 15-16 years), maintaining vulnerability to early marriage for 16- to 17-year-old girls. Laws against early marriage have existed for decades, setting the legal age for girls at marriage as 18 years in Bangladesh, India, and Nepal, and 16 years in Pakistan, but appear inadequate to affect this issue. Increased prevalence of marriage among 16- to 17-year-old girls in Bangladesh requires further study.

Study limitations include possible social desirability or recall bias and potential inaccuracies reporting age at marriage. Focus on young women reduces risk for recall bias. Differential survey time points allow greater time for change to be assessed for Pakistan and less time for Nepal. Analyses are restricted to time trends and lack consideration of variables (eg, changes in education) to explain findings.

Anita Raj, PhD, MS
Lotus McDougal, MPH
Melanie L. A. Rusch, PhD, MSc

Author Affiliations: Department of Medicine, University of California, San Diego School of Medicine, San Diego (Drs Raj and Rusch) (anitaraj@ucsd.edu); and Joint Doctoral Program in Public Health and Global Health, San Diego State University/University of California, San Diego (Ms McDougal).

Author Contributions: Dr Raj had full access to all of the data in the study and takes responsibility for the integrity of the data and the accuracy of the data analysis.
Study concept and design: Raj, McDougal.
Acquisition of data: Raj, McDougal.
Analysis and interpretation of data: Raj, McDougal, Rusch.
Drafting of the manuscript: Raj, McDougal.
Critical revision of the manuscript for important intellectual content: Raj, McDougal, Rusch.
Statistical analysis: McDougal, Rusch.
Obtained funding: Raj, McDougal, Rusch.
Administrative, technical, or material support: Raj, McDougal.
Study supervision: Raj.

Conflict of Interest Disclosures: The authors have completed and submitted the ICMJE Form for Disclosure of Potential Conflicts of Interest. Dr Raj reported having grants pending with the National Institutes of Health and the Kellogg Foundation. Dr Rusch reported having grants pending with the National Institutes of Health; receiving compensation for travel and meeting expenses from the British Columbia Centre for Excellence in HIV/AIDS; and receiving an honorarium from the Ontario HIV Trails Network. Ms McDougal did not report any disclosures.

Funding/Support: This work was funded by a grant from the David and Lucile Packard Foundation.

Role of the Sponsor: The David and Lucile Packard Foundation was not involved in the design and conduct of the study; collection, management, analysis, and interpretation of the data; and preparation, review, or approval of the manuscript.

1. Raj A. When the mother is a child: the impact of child marriage on the health and human rights of girls. *Arch Dis Child*. 2010;95(11):931-935.
2. United Nations Childrens Fund (UNICEF). Working towards a common goal: ending child marriage. http://fieldnotes.unicefusa.org/2011/10/ending-child-marriage.html. Accessed January 2, 2012.
3. Macro International Inc. MEASURE DHS STATcompiler. http://www.measuredhs.com. Accessed January 2, 2012.
4. Rutstein S, Rojas G. *Guide to DHS Statistics.* Calverton, MD: ORC Macro; 2006.
5. Armitage P, Berry G, Matthews JNS. *Statistical Methods in Medical Research.* 4th ed. Oxford, UK: Blackwell Science; 2002.
6. Rao JNK, Scott AJ. On chi-square tests for multiway contingency tables with cell proportions estimated from survey data. *Ann Stat*. 1984;12(1):46-60.

©2012 American Medical Association. All rights reserved.

Downloaded From: http://jamanetwork.com/ on 05/23/2013