

# Equity of Skilled Birth Attendant Utilization in Developing Countries: Financing and Policy Determinants

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Millennium Development Goal 5, 1 of 8 global development goals agreed to by 190 world leaders in 2000, calls for a 75% reduction in maternal mortality between 1990 and 2015.<sup>1,2</sup> Maternal mortality is defined as the death of a woman while pregnant or within 42 days of termination of pregnancy from any cause related to the pregnancy.<sup>3</sup> The lifetime risk of dying in pregnancy or shortly after delivery stands at 1 in 30 000 in Sweden and 1 in 16 in sub-Saharan Africa—perhaps the largest differential between rich and poor countries of any health statistic.<sup>4</sup> Reduction of maternal mortality by 75% in the highest-burden regions such as sub-Saharan Africa will require a rapid and massive scale up of health systems including the provision of universal skilled birth attendance (by a doctor, nurse, or midwife), referral for complications, and widespread availability of emergency obstetric care, such as Caesarian section.<sup>5</sup>

There is growing focus on the skilled birth attendant, particularly the trained midwife, as the cornerstone of renewed global efforts to reduce maternal mortality.<sup>6</sup> However, access to skilled birth attendants is limited, particularly in countries with the highest maternal mortality. Only 32% of births in sub-Saharan Africa and 35% in South and Southeast Asia—the regions with the highest maternal mortality—are attended by a doctor, nurse, or midwife; this is in stark contrast to universal or near universal use of skilled birth attendants in the developed world.<sup>6</sup> Average utilization of skilled attendants was slightly less than 50% in a sample of 40 developing countries that reported standardized data, with much lower levels in rural areas.<sup>6</sup>

Although utilization of health services is a function of both patient demand and supply, in situations in which health budgets are very low, poor availability of services is a major constraint to utilization. The World Health Organization (WHO) Commission on Macroeconomics and Health determined that providing access to a basic package of essential services

**Objectives.** Developing countries with higher health care spending have greater overall utilization of maternal health services than do countries with lower spending. However, the rich tend to disproportionately use these services. We assessed whether redistributive government policies in the context of higher levels of health spending were associated with more-equitable use of skilled birth attendants (doctors, nurses, or midwives) between rich and poor.

**Methods.** We used data from Demographic and Health Surveys of 45 developing countries and disaggregated by wealth quintile. Multivariable regression analyses were used to assess the joint effect of higher health care expenditures, the wealth distribution of women's fifth-grade education (a proxy for redistributive policy environment within the central government) and the overall proportion of women with fifth-grade education (a proxy for female literacy and an indicator of governments' commitment to girls' education).

**Results.** We found that utilization of skilled birth attendants was more equitable when higher health expenditures were accompanied by redistributive education policies.

**Conclusions.** Higher health care expenditures should be accompanied by redistributive policies to reduce the gap in utilization of skilled birth attendants between poorer and richer women in developing countries. (*Am J Public Health.* 2008;98:142–147. doi:10.2105/AJPH.2006.104265)

costs approximately \$35 per capita per year.<sup>7</sup> In 2003, only 12 of 46 countries in the WHO Africa region spent this amount or more.<sup>8</sup> Higher absolute levels of health spending increase overall utilization of health services.<sup>9–12</sup> In previous work that used data from 40 developing countries, we have shown that countries with both higher total health spending and higher proportions of government spending on health have greater overall utilization of maternal health services including skilled birth attendants and Caesarian section.<sup>13</sup>

The international community is increasingly interested in effective ways to strengthen health systems and improve availability and utilization of health services through greater official development assistance for health. After decades of declining official development assistance, with the impetus of the Millennium Development Goals, 16 of 25 donor countries have pledged to increase their official development assistance to the international target of 0.7% of gross domestic product by 2015.<sup>14</sup> Donor countries have also set up an international policy dialogue on funding and policies required to

achieve the health Millennium Development Goals, including Goal 5.<sup>15</sup>

Although additional health care spending may help to reduce average maternal mortality ratios in developing countries, thereby decreasing the inequity between rich and poor countries, there is increasing concern that this spending may increase inequities between rich and poor groups within the country. For example, observers in developed and developing countries cite the “inverse care law,” which states that the availability of medical care is often not determined by medical need but by other considerations including socioeconomic status.<sup>16</sup> This results in a situation in which the poor who tend to have poorer health outcomes—for example, mortality of children under age 5 in the poorest 20% versus the richest 20% of children was nearly twice as high across 56 countries<sup>17</sup>—have the least access to health services.<sup>18–22</sup> This is likely a result of health system factors such as insufficient government health budgets, the relative unaffordability of out-of-pocket payments for health care for the poor, and urban and tertiary care bias in health budget allocations by Ministries

of Health, as well as factors outside the health system including poor education, transport links, and the status of women.<sup>23–26</sup> The mounting evidence of inequities in health care has led to discussions in the health policy community and among policymakers in developing countries about the need to adopt a pro-poor approach that explicitly targets the most vulnerable groups in health resource allocations.<sup>16</sup>

Although evidence suggests that the rich within countries capture more of the benefits of health spending than do the poor, this is not inevitable. Equity in utilization of services between the rich and poor varies among countries at similar levels of health spending but with different policies on redistribution of health care resources. For example, in a sample of 21 industrialized countries, the 2 without a policy of universal coverage (United States and Mexico) had the greatest pro-rich inequities in physician visits when adjusted for health need.<sup>27</sup> Pro-poor policies including conditional cash transfers to the poor to encourage the use of health services can also reduce historic inequities in health outcomes such as child mortality, as has been demonstrated in several Latin American countries.<sup>28</sup>

One approach to assessing a country's commitment to redistribution is to examine the equity of utilization of essential services in sectors traditionally considered to be the responsibilities of governments, such as health and education. For the purposes of this paper, redistributive policies are defined as those that achieve equal or higher utilization of services for poorer compared with richer groups. More-equitable distribution in fifth grade completion, for example, may indicate commitment to redistribution within the education ministry and possibly within the government as a whole. A redistributive central government policy framework may in turn influence whether health dollars reach the poor.

We investigated the extent to which redistributive education policies modify the impact of higher health spending on the utilization of skilled birth attendants among the poorest compared with the least poor women in 45 developing countries. The concentration index of fifth grade completion, which measures the degree of inequality in education as a function of wealth, was used as a proxy for the degree of redistribution in education policy.

## METHODS

### Variables and Data Sources

The dependent variable in this analysis was the utilization of skilled birth attendants by the poorest versus the richest population quintile expressed as a ratio. Wealth quintiles were defined as the lowest 20% and the wealthiest 20% of the population ranked on an asset index (e.g., indoor toilet, running water, type of flooring). Utilization of a skilled birth attendant was defined as the percentage of live births that were attended by a doctor, nurse, or midwife within 3 years of the date of the survey. A perfectly equitable ratio would be 1, with less equitable ratios (less utilization by the poor than the rich) taking a value below 1. Comparison of the health outcomes and health service utilization of lowest to highest income quintiles is standard in the literature.<sup>18,22,29</sup> The data for the dependent variable were taken from World Bank Health, Nutrition and Population Round II Reports, which present wealth-disaggregated health statistics.<sup>30</sup>

These statistics were calculated by MEASURE DHS from the Demographic and Health Surveys (DHS) on the basis of respondents' possession of certain assets (e.g., indoor toilet, running water). These responses were then converted into an asset index that approximates the wealth of that household through principal component analysis.<sup>31</sup> This methodology has been widely used to conduct equity analysis of standard survey data.<sup>22,32–34</sup> MEASURE DHS is a project funded by US Agency for International Development and other donors to perform surveys in developing countries that can inform policy. Demographic and Health Surveys are administered to a nationally representative sample of 5000 to 30 000 households and use a standard survey instrument to permit comparison of data across countries. The surveys used were conducted between 1990 and 2001. In the case of more than 1 survey per country, the most recent survey was used.

Our key independent variable was total health expenditure in 2000 international dollars at purchasing power parity rates. The WHO defines total health expenditure by financing agent as general government expenditure plus private expenditure. General government health expenditure comprises

spending by all government entities and includes social insurance schemes and extra-budgetary spending on autonomous health institutions such as university hospitals. This category also includes donor funding that is channeled through the government (e.g., through sector-wide approaches) but excludes off-budget donor funding that is spent directly on discrete projects.<sup>35</sup> Private health expenditure comprises out-of-pocket expenditures or those made by private social insurance, other private insurance, not-for-profit institutions including nongovernmental organizations, and private firms and corporations.<sup>35</sup> The data for per capita health expenditures for the years 1998–2004 were taken from the WHO's national health accounts database.<sup>8</sup> Because health expenditure data was not routinely tracked by the WHO before 1998, we accessed the World Bank's World Development Report 1993, which focused on health care financing, for earlier health expenditure data.<sup>36</sup>

Other independent variables included proportion of the population below national poverty line, proportion of women aged 15 to 49 years in the household who completed fifth grade, the concentration index of women who completed fifth grade, and lastly, a 3-way interaction term that included the proportion of women who completed fifth grade, distribution of women who completed fifth grade, and total health expenditure.

We included proportion of the population below national poverty line in our models to differentiate between countries with the similar average level of national wealth but different distributions of income. This is a similar approach to that of Anand and Barnighausen.<sup>37</sup> The data for percentage of population below national poverty line was obtained from the World Bank's World Development Indicators online database. Poverty lines are nationally determined cutoffs and so represent different income levels in different countries. National estimates are based on population-weighted estimates from household surveys.<sup>30</sup>

We used the rate of fifth grade completion by women of reproductive age (15–49 years) in the household as an independent variable for 2 reasons. First, fifth grade completion is a proxy for female adult literacy, which is an important independent predictor of women's behavior, income, and health outcomes.<sup>37–39</sup>

Second, provision of primary education is highly subject to government policy and the extent to which women complete fifth grade is a measure of the government's investment in and policies regarding primary education and its outreach to girls. We used the concentration index of fifth-grade completion as an indication of the extent of the government's redistributive or pro-poor policy orientation. The concentration index is a calculation of the cumulative distribution of an outcome (in this case, fifth-grade completion) as a function of the cumulative distribution of the population ranked by wealth. An index of 0 implies perfect equity, with indices below 0 indicating higher fifth-grade completion rates among the poor and indices above 0 indicating higher rates of completion among the better off. As noted earlier, a more-equitable distribution of primary schooling may suggest a more redistributive or pro-poor policy environment within the central government. The proportion of women who completed fifth grade and the concentration index of women who completed fifth grade were all taken from the World Bank's Health, Nutrition, and Population Country Round II Reports, the same source as for the dependent variable.<sup>30</sup>

As per Evans et al., we did not include gross domestic product per capita in our final models, because this measure of wealth is highly correlated with absolute amount of health spending, and we found that including it did not change the fundamental associations between independent and dependent variables.<sup>40</sup>

Based on an a priori hypothesis that allocation of health funds is influenced by the policy environment in which funding decisions are made, we created an interaction term that combined funding and proxy variables for the extent of redistributive policies. We created a 3-way interaction term that used total health expenditure per capita, proportion of women who completed fifth grade, and the concentration index of women's fifth-grade completion. Interaction terms expressed the degree to which 2 or more independent variables exerted a joint influence on the dependent variable, in this case, the ratio of maternal health service utilization by the poor versus the rich. In practice, this means that the relationship between health spending and the

equity of service utilization differs at different average education levels and different distributions of education.

### Statistical Analysis

We examined an initial set of 56 countries available from the World Bank's Health, Nutrition and Population reports that disaggregated the utilization variables of interest by wealth quintiles. Nine countries for which values were not available for all independent variables were not included in the analysis. We further eliminated Dominican Republic and Ethiopia because of unreliable values for the concentration index, thus ending with a 45-country sample. (A list of the countries and the years of their surveys is available as a supplement to the online version of this article at <http://www.ajph.org>.) With the exception of Turkey, which is a higher-middle-income country, these countries are all classified by the World Bank as low- or lower-middle-income countries with incomes less than \$3465 as calculated by the Atlas method, an approach used to convert local currency to US dollars with a correction for currency fluctuations.<sup>41</sup>

Data for several of the independent variables of interest were not available for all the years of the DHS surveys used in the analysis. Health expenditure data were only available for 1990 (World Bank data) and then from 1998 onward (WHO data). Therefore, for countries with surveys done in 1990 or from 1998 onward, we used data on total health expenditures from the matching year. However, for 16 countries with surveys done between 1991 and 1997, we used an average of 1990 and 1998 health expenditure values for this variable. This method is similar to that used by Wang.<sup>42</sup> All health expenditures were adjusted to a base year of 2000 to permit comparability.

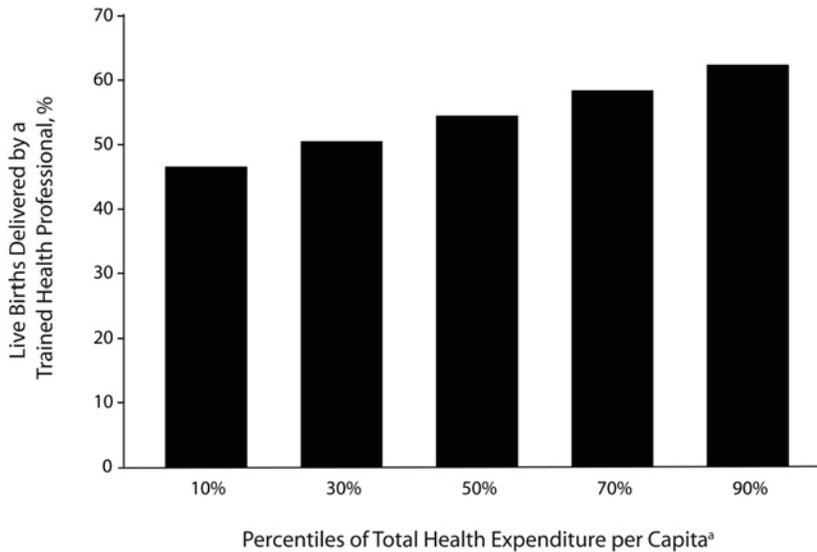
We examined each variable's distribution and descriptive statistics including means, medians, and ranges. To improve the linear relationship between per capita health expenditure and our outcomes of interest, we transformed this indicator by using a natural log function. We determined bivariate associations between all independent variables and dependent variables. We first created models that included all independent variables except

the interaction term and the concentration of education to isolate the influence of health care expenditure on equity of utilization of skilled birth attendants (lowest quintile to highest quintile ratio) as well as absolute levels of utilization by each of the wealth quintiles. We then created our final models for the dependent variable of interest (the ratio of utilization of skilled birth attendants in the lowest to the highest income group) that included all of the independent variables (including the 3-way interaction term). All models were tested to ensure they did not violate standard assumptions of linear regression with partial regression plots to assess linearity of independent predictors in the full model, quantile to quantile plots, and plots of residuals to assess homoscedasticity. We used SAS version 9.1 (SAS Institute Inc, Cary, NC) for the analysis.

### RESULTS

Summary data in Table 1 show the country sample to have overall low health expenditures (mean 117.56 year-2000 international dollars at purchasing power parity rates). Table 1 also shows that on average, women in the wealthiest income group had a substantially higher rate of utilization of skilled birth attendants than did women in the poorest income group. The mean concentration index of education was 0.30, which indicated moderate inequity of fifth-grade completion in the country sample. Figure 1 shows graphically that aggregate population utilization rates of skilled birth attendants tended to rise with rising health expenditures across the countries in the sample.

Bivariate analysis revealed significant associations between 3 of the 4 independent variables (health expenditures per capita, proportion of women who completed fifth grade, and the concentration index of women who completed fifth grade) and the dependent variable (ratio of utilization of skilled birth attendant of the poorest to the richest quintile). In the reduced multivariate analysis, which included all variables minus the interaction term, the only significant variable was the proportion of women who completed fifth grade. The results of the multivariable models that included the 3-way interaction term among



<sup>a</sup>In 2000 international dollars at purchasing power parity rates.

**FIGURE 1—Proportion of births with a skilled birth attendant, by percentiles of health expenditures, in 45 developing countries: Demographic and Health Surveys, 1990–2001.**

**TABLE 1—Descriptive Statistics for Key Variables Used in Analysis of 45 Developing Countries: Demographic and Health Surveys, 1990–2001**

	Mean (SD)	Median	Minimum	Maximum
<b>Independent variables</b>				
Total health expenditure per capita <sup>a</sup>	117.56 (103.67)	70.50	22.27	485.00
Proportion of the population below national poverty line, %	42.98 (16.18)	40.00	11.70	72.90
Proportion of women who completed fifth grade, %	52.22 (28.12)	50.00	6.90	99.50
Concentration index of women who completed fifth grade	0.30 (0.23)	0.24	0.001	0.87
Proportion of births assisted by a skilled birth attendant, %	52.02 (26.10)	46.90	12.10	99.00
<b>Dependent variables</b>				
Proportion of births assisted by a skilled birth attendant—lowest quintile, %	32.45 (29.10)	19.80	2.60	99.20
Proportion of births assisted by a skilled birth attendant—highest quintile, %	83.63 (16.37)	88.50	42.10	100.00

<sup>a</sup>Year-2000 international dollars at purchasing parity rates.

health expenditures, proportion of women who completed fifth grade, and the concentration index of women who completed fifth grade, are shown in Table 2. The variable that emerged as significant in this analysis was the interaction term. Total health expenditure per capita was significantly and positively associated with equity of utilization of skilled birth attendants, but this cannot be interpreted separately, because it is included in the interaction term.

The final models explained 58.9% of the variance in the outcome.

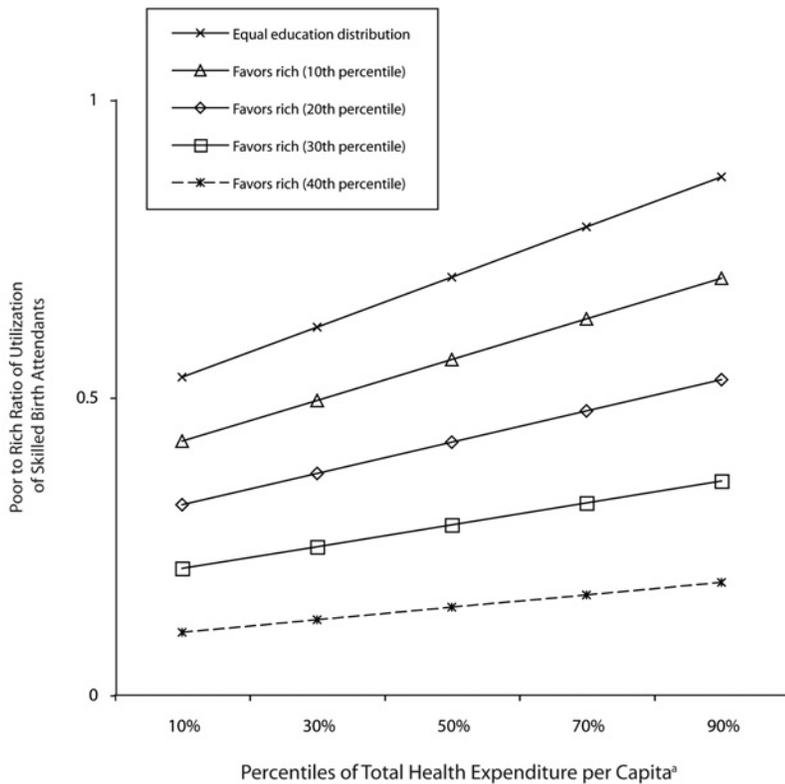
To illustrate the effect of the interaction term on the equity of utilization of skilled birth attendants, we constructed a graph (Figure 2) that shows the modeled results of increased health expenditure at different distributions (concentration indices) of education. Average population level of fifth grade completion was held constant to permit a

2-dimensional picture. Figure 2 shows that as equity of education rises (concentration index nears zero or perfect equity), the lowest quintile to highest quintile ratio of utilization of skilled birth attendants increases more rapidly (higher slope) with increasing health expenditure. At the highest level of government expenditures modeled, there were statistically significant differences in equity of skilled birth attendant utilization between the 40th and 20th (and lower) and 30th and 10th percentiles as well as between the 20th percentile and the distribution that represented equal education among wealth groups. Differences between consecutive scenarios (e.g., 30th and 20th percentiles) were not significant.

## DISCUSSION

Previous work has shown that, in the aggregate, access to health services in developing countries improves with higher health spending.<sup>9–12</sup> The so-called “inverse care law,” which contends that the poor who often have the greatest health needs often receive the fewest health services, also has been amply demonstrated.<sup>19,22</sup>

Our analysis also shows, however, that redistributive education policy changes this trend and increases equity of utilization of skilled birth attendants. Given that primary education is in most countries funded and provided by the government, we used the distribution of education among socioeconomic groups as a proxy for the extent of redistributive policies within the government. We found that at any given level of health care spending poor women’s use of skilled birth attendants varies substantially, depending on the equity of distribution in education. For instance, in countries with health expenditures at the 50th percentile, the ratio of the poorest quintile’s use of skilled attendants compared with that of the richest quintile can be as low as 0.15 or as high as 0.70. Conversely, as countries spend more on health, the use of skilled birth attendants rises across wealth quintiles. However, the poorest groups only accrue substantial benefits when the policy environment favors redistribution. For example, among countries with equal education distribution, the equity of access to attendants rises dramatically with rising health care spending, whereas in those



<sup>a</sup>In 2000 international dollars at purchasing power parity rates.

**FIGURE 2—Poor to rich ratio of skilled birth attendants, by percentile of health expenditure, in 45 developing countries: Demographic and Health Surveys, 1990–2001.**

**TABLE 2—Results of Multivariate Regression Analysis of the Effect of Independent Variables on the Ratio of Utilization of Skilled Birth Attendants Between the Poorest and Richest Quintiles in 45 Developing Countries: Demographic and Health Surveys, 1990–2001**

Independent Variable	Ratio of Utilization of Skilled Birth Attendant of Lowest to Highest Wealth Quintile (b)
Total health expenditure per capita	0.13649 (.028)
Proportion below national poverty line	-0.00105 (.572)
Proportion of women who completed fifth grade	0.00152 (.708)
Concentration index of women who completed fifth grade	-0.22744 (.583)
Three-way interaction among fifth grade education, concentration index of education, and total health expenditure per capita	-0.00591 (.002)
Adjusted R <sup>2</sup>	0.5886

with regressive education achievement, there is minimal improvement in equity with similar increases in spending.

The optimal scenario is one that combines higher health care expenditures and equitable policies. We modeled the situation of a country with a perfectly equal educational distribution

and spending in the 90th percentile and found that the poor-to-rich ratio was 0.87, meaning the poor used the services at 87% of the rate of the rich. Distribution of women’s education, as a proxy for the extent of redistributive policies in the government, is, thus, an important effect modifier of the

relationship between funding levels and equity of utilization of these services.

The mechanisms by which distribution of education influences the equity of health service utilization are likely manifold. In a country where the distribution of education is pro-poor (low concentration index), poor women may have increased access to skilled delivery care for 2 reasons. The first is that governments that allocate more education funding and other resources to rural and other areas where the poor live would be more likely do the same with health care funding, improving availability of services to poorer women. In addition, a more pro-poor distribution of education would mean that more poor women complete primary education, which would make them more likely to seek skilled birth attendants, because education is an important predictor of health-seeking behavior.<sup>37–39</sup> Country-level policy analysis would be required to gain insight into the pathways underlying the relationship between funding and redistributive policies to achieve equitable provision of services.

**Limitations**

There were several important limitations in this study. The sample size was small, and the analysis should be repeated as new reproductive health surveys and better national health accounts data become available. Data for some independent variables were not available for the specific years of some DHS surveys in the sample. Although several year-matching methods did not produce meaningfully different results, exact year matching would have been optimal. Given that the distribution of education, which gives insight into the decisions of 1 government ministry, is an imperfect approximation of the degree of redistributive government policies in a country, the analysis would be strengthened by the inclusion of other measures for redistributive policies, ideally from other sectors. Unfortunately this was precluded by lack of data. Other factors not examined here, such as women’s empowerment, may also influence access to services by the poor. Perhaps most importantly, the data available only permit cross-sectional analyses; longitudinal work is needed to permit inference about how changes in government expenditure on health and pro-poor policies improve equity of health services utilization.

## Conclusions

This work supports the thesis that higher levels of health expenditure do not automatically mean substantially greater use of skilled birth attendants by poor women. Poor women's access to education, which is in the domain of government policy and reflects a redistributive policy environment, is an important influence on improving the equity of access. Thus, as developing countries work to expand health services to reach the Millennium Development Goals, more health funding should be accompanied by strong redistributive policies if those health services are to reach the poor. ■

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## Contributions

M.E. Kruk and S. Galea jointly formulated the study design and planned the data analysis. M. Prescott led the data analysis and contributed to the study conceptualization. All authors participated in interpreting the results. M.E. Kruk led the writing of the article with contributions from both coauthors.

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## Human Participant Protection

No institutional review board approval was required for this study.

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