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# Contextual influences on contraceptive use in the Eastern Cape, South Africa

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**Abstract**

This paper uses linked individual and health facility data from the 1998 South Africa Demographic and Health Survey and the 1998 Eastern Cape Facility Survey to explore community and health facility influences on modern contraceptive use. Several pathways of influence between the community and individual contraceptive adoption are identified, centering primarily on the community climate of female autonomy. Few significant effects of the health facility environment on contraceptive adoption are identified. The residual variation in contraceptive use highlights the deficits that exist in current datasets for capturing community influences on contraceptive behavior.


*Keywords:* Contraception; South Africa; Community influences

## Introduction

The post-Apartheid era in South Africa has been characterized by a decline in fertility paralleled by an increase in contraceptive use among all four major population groups (Whites, Indians/Asians, Coloreds and Black Africans) (Burgard, 2004; Swartz, 2002). South Africa's demographic transition is considerably more advanced than other sub-Saharan African nations, the total fertility rate (TFR) declined from approximately 5.0 in 1970 to currently stand at 2.2 (South Africa Department of Health, 2000; US Census Bureau, 2007). The national average contraceptive use is 61% (urban 66%, rural 53%), and contraceptive method choice is dominated by injectable contraceptives (30% of all use) (South Africa Department of Health, 2000; Swartz, 2002). Despite the achievements made in lowering fertility, there remain substantial racial differentials in both fertility and contraceptive use. Although Black Africans account for 77% of the population, 61% exist in poverty and the 58% contraceptive prevalence is lower than that found in other groups (White 80%, Indian/Asian 76%, and Coloreds 69%) (Swartz, 2002). Previous studies of the determinants of contraceptive use in South Africa have focused on individual and household level influences, with the roles of gender and race often central to the discussion of contraceptive use (Maharaj and Cleland, 2005; Burgard, 2004; Myer et al., 2002). However, there is a dearth of literature

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that has examined the role of the community context in shaping an individual's decision to adopt contraception in South Africa. This paper uses data from the Eastern Cape Province, a province with poor economic and health indicators, to examine the roles that community and health care infrastructure characteristics have on a woman's adoption of modern contraceptive methods.

## Background

Studies of the determinants of health outcomes have long focused on individual risk factors, neglecting the wider social and cultural environment in which the outcomes occur (Pickett and Pearl, 2001; Grady et al., 1993; Stokols, 1992). Recently, there has been growing interest in examining community influences on health outcomes, in an attempt to understand how individual health outcomes and behaviors are influenced by factors beyond the household-level (see, for example, Chacko, 2001; Diez-Roux, 2001; Magadi, et al., 2000; Pebley et al., 1996; Grady et al., 1993; Von Korff et al., 1992). This growth of the application of *social epidemiology*, an approach which emphasizes social conditions as fundamental causes of disease (Link and Phelan, 1995; Koopman and Longini, 1994; Halloran and Struchiner, 1991), has been facilitated by the development of multilevel modeling techniques, which provide a mechanism for measuring the influence of community factors and unobserved community effects on health outcomes, while providing a robust method for analyzing hierarchically clustered data (Diez-Roux, 2001; Duncan et al., 1998; Goldstein, 2003; DiPrete and Forrostal, 1994). In a social epidemiology approach, social factors influencing disease are the focus of analysis and are not simply adjusted for or used as proxies for individual risk factors (Link and Phelan, 1995; Koopman and Longini, 1994; Halloran and Struchiner, 1991). However, many studies of community influences on health have focused attention on one aspect of the community environment, or on characteristics of the health care infrastructure in isolation, and there is a dearth of studies that have attempted to simultaneously quantify community social, economic, cultural and health care influences on health behaviors.

Evidence as to how community contextual factors influence contraceptive use is limited (Stephenson and Tsui, 2002, 2003). At the community level, studies of contraceptive use have focused on the influence of health service characteristics, primarily the influence of quality of care on contraceptive adoption (Tuoane et al., 2003; Bongaarts and Bruce, 1995; Oliver, 1995; Tsui and Ochoa, 1992), in the absence of other community-level characteristics. Previous studies have demonstrated that, after controlling for individual characteristics, quality of care indicators such as distance to service, provider attitudes, and contraceptive method availability are strong influences on a woman's decision to adopt contraception (Hamid and Stephenson, 2006; Katende et al., 2003; RamaRao et al., 2003; Seiber and Bertrand, 2002; Magnani et al., 1999; Steele et al., 1999). Quality of care lays the foundation for long-term contraceptive use and greater client satisfaction (Jain, 1989). In a cross-country comparison of 15 countries, Blanc et al. (2002) have shown that within a year of starting use of a method, between 7% and 27% of women cease to practice contraception for reasons related to the quality of the service environment. In Bangladesh, clients who received what they perceived as high standards of care from field workers were significantly more likely to continue contraceptive use compared with those who felt that they received poor care, although the effects of quality of care provided by field workers upon contraceptive acceptance were less pronounced than those upon contraceptive continuation (Koenig et al., 1997). Thus, what may be most critical is not the absolute number of methods offered to the client but the degree of trust, rapport and confidence established between the field worker and the client. Another important aspect of service quality is the physical accessibility of the service: a study of service provision in rural Pakistan found that women who lived with 5 km of two community-based workers were significantly more likely to adopt a modern method of contraception (Sultan et al., 2002).

Recent attention towards the potential for community characteristics to influence health behaviors arises from the recognition of a disjuncture between theory and research practice (Grady et al., 1993). In the context of contraceptive behavior, a number of theories have hypothesized the influence of the community on a couple's fertility decisions (Casterline, 1985), yet until recently studies of contraceptive use dynamics have focused on individual and household-level determinants. However, there is less evidence for the roles of non-health facility community influences on contraceptive use. In a study of community influences on contraceptive use

in the USA, Grady et al. (1993) found that rapid population growth, high rates of unemployment, elevated levels of religious affiliation, higher socio-economic status and ready access to family planning services were all associated with increased uptake of contraception. Entwisle et al. (1996) use a combination of quantitative and qualitative data to describe the influence on physical (in terms of access to services) and social space (in terms of social networks) on contraceptive choice in rural Thailand. Similarly, Degraff et al. (1997) found that the presence of family planning services and community-level labor-market conditions and infrastructural development are strong influences on contraceptive use in the Philippines. However, there are a number of other possible pathways through which the community may influence contraceptive use. For example, contraceptive use may be indirectly influenced by economic development, through a relationship with access to health services (Diez-Roux, 1998), or through its relationship with female autonomy and positive attitudes towards health service use (Alan Guttmacher Institute, 1998). Some studies have examined other characteristics of the community, including the influence of levels of community economic development (Stephenson and Tsui, 2002; Diez-Roux, 1998; Saha, 1998; Nazzar et al., 1995; National Research Council, 1993), levels of school participation (Chacko, 2001; DeGraff et al., 1997), economic roles of children (Entwisle et al., 1989; Entwisle and Mason, 1985) and community fertility norms (Nsemuklia et al., 1999; Bongaarts and Bruce, 1995; Nazzar et al., 1995;) on contraceptive use.

Complicating the study of community influences on contraceptive use is the targeting of health services and campaigns towards socio-economically deprived areas and those areas with poor reproductive health indicators. Thus, health services and campaigns operate in communities in which women are the least likely to be utilizing contraceptive services. The potential biasing effect of the non-random placement of health services has been highlighted in studies that have examined the impact of public health interventions on individual health outcomes (see, for example, Angeles et al., 1998; Gertler and Molyneaux, 1994; Pitt et al., 1993). Gertler and Molyneaux (1994) note that the use of panel data can control for the endogeneity of program inputs by measuring the multivariate correlations between changes in the health outcomes and the explanatory variables; however, most commonly available data sources for the study of the determinants of contraceptive use in less-developed nations are cross-sectional in nature.

What is currently missing from the literature is an examination of community influences on contraceptive use that encompasses both community social, economic and cultural factors, and health facility factors beyond the simple presence of services. The incorporation of community-level factors into multilevel models of contraceptive use has the potential to allow the identification community-level characteristics that can be harnessed in the development of community-based family planning programs (Stephenson and Tsui, 2002, 2003).

## Study setting

The third most populous province in South Africa, Eastern Cape is also the second poorest province, containing the country's highest unemployment rate of nearly 50% (Mahlalela et al., 2001). Prior to 1994 Eastern Cape was divided into three regions (Cape Provincial Authority and two independent black homelands Ciskei and Transkei); post-Apartheid, the governmental structures were divided into seven district councils (Mahlalela et al., 2001). Eastern Cape experiences some of the worst health indicators in South Africa, falling below the national average in child mortality and childhood immunization. The total fertility rate in Eastern Cape Province of 3.5 is well above the national figure of 2.9, paralleled by a relatively low modern contraceptive prevalence of 59% among women aged 15–45 years (South Africa Department of Health, 2000). As in most of South Africa, the injection is the predominant contraceptive method used by women in Eastern Cape, accounting for 65% of all use, followed by the oral pill (28% of use) (South Africa Department of Health, 2000). Eastern Cape also has the lowest percentage of women who report receiving family planning messages in the print media (31% compared to 54% for South Africa), although 30% report hearing family planning messages in the media (compared to 42% for South Africa). The Eastern Cape also has the second lowest percentage of demand for family planning met (68.4% and 83.8% for South Africa) (South Africa Department of Health, 2000). Family planning services are almost universally available at government clinics in Eastern Cape, and quality of care indicators such as method availability and uninterrupted electricity

supply are higher than the national average (MEASURE Evaluation and EQUITY Project, 2004; van Rensberg et al., 2001). In contrast, Eastern Cape government clinics have the lowest proportion of doctors in any province except Northern Province (MEASURE Evaluation and EQUITY Project, 2004; van Rensberg et al., 2001).

## Data and methods

Individual, household and community-level data for this analysis come from the 1998 South African Demographic and Health Survey (SADHS). The DHS use a stratified multi-stage cluster sample design to collect a nationally representative sample of women of reproductive age (15–45). Questionnaires are conducted with all eligible women in each sampled household, collecting data on fertility, family planning, and child health, in addition to demographic and socioeconomic data. A full description of the study design can be found at http://www.measuredhs.com. The quality of the SADHS data appears to be good. The SADHS data contain only 0.15% missing cases, with a 94% response rate for women, and little evidence of the misreporting of ages or timing of key events. Although there is evidence of a greater degree of missing data for variables relating the children (e.g. size of child at birth), these variables are not considered in the present analysis.

The 1998 Eastern Cape Facility Survey (ECFS) collected information from 624 government clinics, which were selected on the basis of proximity to the PSUs surveyed in the 1998 SADHS. Detailed information was collected from interviews with nurses on staffing and recent staff training, supervision visits, availability of drugs, supplies and basic infrastructure, service availability, emergency services, transportation and referrals. In terms of family planning services, information was collected on the number of family planning methods offered by the facility, whether each of the methods was in stock, and the training received by staff on family planning. The data from the 1998 ECFS was linked to the 1998 SADHS using the Global Positioning System coordinates for the facilities and households, such that each household was linked to the closest government clinic. Overall, 174 of the 624 clinics were linked to SADHS PSUs; the remaining clinics were located in areas that were not as proximate to the populations for which information was collected in the SADHS.

The 1998 SADHS collected a sample of 11,752 women aged 15–45 years; the sample is restricted to women interviewed in the Eastern Cape Region ($n = 2756$). Women who report that they have never had sexual intercourse (351), are currently pregnant (100), or are infecund (30) were excluded from the analysis, producing a sample of 2275 women aged 15–49 years. Women from one PSU in which there was no available health facility data were also excluded: the final sample size is 2262 women aged 15–49 years.

The dependent variable for analysis is binary coded one if the woman reports currently using a modern method of contraception (injection, oral pill, IUD, implant condom, female or male sterilization). The 1998 SADHS dataset has a hierarchical structure, with women nested within households and households within PSUs, thus violating the assumption of independence of ordinary logistic regression models. A multilevel modeling technique was employed to account for the hierarchical structure of the data and to facilitate the estimation of community (PSU) level influences on contraceptive method choice. The multilevel modeling strategy accommodates the hierarchical nature of the data and corrects the estimated standard errors to allow for clustering of observations within units (Goldstein, 2003). Multilevel models allow the identification of clustering in contraceptive method choice (also known as the random effect), providing a measure of the extent to which the odds of reporting the use of each category of contraceptive varies between communities, while also controlling for a range of individual, household, health facility and community-level factors thought to influence the outcome. A multilevel logistic model was fitted to the binary outcome of contraceptive use, using the MLWiN software package (CMM, 2007). The model is written as

$$Y_{ij} = \pi_{ij} + \varepsilon_{ij} Z_{ij},$$

where $\log_e(\pi_{ij}/(1-\pi_{ij})) = \alpha + \beta X_{ij}^{\mathrm{T}} + U_j$. $Y_{ij}$ is a binary outcome (reporting of modern contraceptive use) for individual $i$ in PSU $j$, $Y_{ij}$ are assumed to be independent Bernoulli random variables with the probability of the reporting of contraceptive use $\pi_{ij} = Pr(Y_{ij} = 1)$. Consequently, to correctly specify the binomial variation, $Z_{ij}$ denotes the square root of the expected binomial variance of $\pi_{ij}$ and the variance of the individual residual term $\varepsilon_{ij}$ is constrained to be one. The outcome variable $\log_e(\pi_{ij}/(1-\pi_{ij}))$ fitted in the model is the $\log_e$ odds

of contraceptive use reported versus non-use. This constrained the predicted values from the model to be between zero and one. $\alpha$ is a constant, while $\beta$ is the vector of parameters corresponding to the vector of potential explanatory factors defined as $X_{ij}$. The PSU (level 2) residual term is defined as $U_j \sim N(0, \sigma_u^2)$. A cumulative model building process is used; model 1 includes only the random intercept term to identify the presence of community-level variation in contraceptive use. Models 2–5 add sequentially the health facility, community, household and individual-level variables, to examine how each of these groups of variables explains the residual community-level variation in contraceptive use.

The variables to be entered into the model are grouped into individual, household, health facility and community variables (Table 1). The choice of individual and household independent variables is informed by previous studies on the factors influencing contraceptive method choice. Table 1 shows all the health facility and community factors considered in the analysis, although only those that proved to be significantly associated with contraceptive method choice (Table 2) are presented in the final model. In terms of health facility characteristics, the analysis considered distance to the facility, staffing levels, staff training in family planning and reproductive health, availability of family planning and reproductive health services, and the presence of family planning methods. For community-level factors, the analysis considered levels of male and female education, levels of employment, community-level indicators of female autonomy, levels of child mortality, prevailing demographic behaviors, and community knowledge of family planning. Community-level factors are derived from individual data by aggregating individual responses to the PSU level, minus the index response. Interaction terms are fitted between race and each of the community and health system variables to examine whether community influences on contraceptive use vary by race.

Table 1
Individual, household, community and health facility variables considered in the analysis of contraceptive use

| Characteristic | Operational definition |
|---|---|
| Individual | |
| Respondent's age | Self-reported age in years: 15–19, 20–24, 25–29, 30–34, 35–39, 40–44, 45–49 |
| Parity | Self-reported number of children ever born: none, 1–2, 3–4, 5+ |
| Place of residence | Place of residence at time of interview: urban or rural |
| Respondent's educational attainment | Self-reported highest level of education achieved: none, primary, secondary, higher |
| Race | Self-reported race: White, Black African, Asian/Indian, Colored |
| Employment status | Respondent reports working outside the home: yes or no |
| Marital status | Self-reported marital status at time of interview: single, married, cohabiting, widowed or divorced, or in a non-cohabiting union |
| Spousal age difference | Calculated from respondent's reporting of her own and her husband's ages |
| Exposure to HIV/AIDS information | A summative index of the number of sources from which the respondent reports she has heard of HIV/AIDS; radio, television, newspaper, pamphlet/poster, clinic, friends, partner, or relative (range 0–8) |
| Partners approval of family planning | Respondent's report of whether her partner approves of family planning: woman is single, current partner approves, current partner disapproves |
| Household | |
| Household size | Self-reported number of people living in the household at the time of the interview |
| Asset score | Summative index of ownership of household goods: piped water, electricity, flush toilet, radio, television, refrigerator, bicycle, motorcycle, care, formal floor material (vinyl, carpet, tile, concrete or wood), formal wall material (cement, corrugated iron/ zinc, brick) (range 0–11) |
| Community | |
| Asset score | Mean asset score for all household in the PSU |
| Spousal age difference | Mean spousal age difference for all respondents in the PSU |
| Male to female primary education | Ratio of the number of men to the number of women in the PSU with primary education |

## Results

Significant community-level variation is present in contraceptive use, although the degree of variation declines substantially with the inclusion of health facility, community, household and individual-level variables into the model (Table 3). In terms of health facility factors, the only variable that maintained significance in the final model was

Table 1 (*continued*)

| Characteristic | Operational definition |
|---|---|
| Male to female secondary education | Ratio of the number of men to the number of women in the PSU with secondary education |
| Female employment | Percentage of women in the PSU who report working outside of the home |
| Control of earnings | Percentage of women in the PSU who report controlling their earnings |
| Age at marriage | Mean age at marriage for women in the PSU |
| Physical partner violence | Percentage of women in the PSU who report experiencing physical violence from their partners in the 12 months prior to the survey |
| Female approval of family planning | Percentage of women in the PSU who report that they approve of family planning |
| Male approval of family planning | Percentage of men in the PSU who report that they approve of family planning |
| Health facility | |
| Distance to service | Distance in kilometers to the nearest government health facility |
| Presence of doctors | Number of part-time and full-time doctors at the health facility |
| Presence of nurses | Number of part-time and full-time nurses at the health facility |
| Nurse posts filled | The proportion of nurse posts that are currently filled at the health facility |
| PHC training | The number of nurses with more than 6 months training in primary health care |
| Family planning training | The number of nurses who have received training in family planning in the 12 months prior to the survey |
| Number of contraceptive methods available | The number of contraceptive methods in-stock at the time of the survey |
| Other reproductive health services | The number of reproductive health services offered at the clinic: pre-natal, post-natal and delivery care, STD and HIV diagnosis and counseling |
| Facility assets | A summative index measuring the infrastructural capacity of the health facility: condoms available in reception, map of catchment area on display, adult scale, infant scale, telephone, fax machine, two-way radio, refrigerator, stethoscope, sphygmomanometer (range 0–10) |
| Drugs available | Health facility has 14 commonly used drugs available (range 0–14) |

Table 2
Distribution of individual, household, community and health facility variables significant in models of contraceptive use

| Characteristic | Percentage/mean (range) |
|---|---|
| *Individual* | |
| Respondent's age | |
| 15–19 | 15.6 |
| 20–24 | 18.2 |
| 25–29 | 14.5 |
| 30–34 | 14.3 |
| 35–39 | 15.3 |
| 40–44 | 13.2 |
| 45–49 | 8.9 |
| Parity | |
| None | 23.4 |
| 1–2 | 22.7 |
| 3–4 | 31.7 |
| 5+ | 22.2 |
| Place of residence | |
| Urban | 37.7 |
| Rural | 62.3 |
| Respondent's educational attainment | |
| None | 6.1 |
| Primary | 31.8 |
| Secondary | 55.2 |
| Higher | 6.9 |
| Race | |
| Black African | 88.6 |
| Colored/Asian | 7.5 |
| White | 3.9 |
| Employment status | |
| Not working | 76.8 |
| Currently employed | 23.2 |
| Marital status | |
| Single | 48.7 |
| Married | 38.3 |
| Cohabiting | 3.5 |
| Widowed or divorced | 5.4 |
| Non-cohabiting union | 4.1 |
| Spousal age difference | 4.9 (0, 44) |
| Exposure to HIV/AIDS information | 4.8 (0, 8) |
| Partners approval of family planning | |
| Single | 29.5 |
| Partner disapproves | 58.1 |
| Partner approves | 12.4 |
| Household | |
| Household size | 6.1 (1, 22) |
| Asset score | 3.5 (0, 11) |
| Community | |
| Male to female primary education | 0.23 (0, 1) |
| Age at marriage | 21.3 (16, 45) |
| Physical partner violence | 0.05 (0, 1) |
| Health facility | |
| Distance to service | 53.1 (4.8, 400.6) |
| Nurse posts filled | 0.74 (0, 1) |
| Facility assets | 7.2 (0, 10) |

Table 3
Multilevel logistic model for contraceptive use among sexually active women 15–49 in Eastern Cape province, South Africa

| | Model 1 | Model 2 | Model 3 | Model 4 | Model 5 |
|---|---|---|---|---|---|
| Health facility | | | | | |
| Mean distance to nearest health facility | | *0.002* (*0.001*) | 0.001 (0.001) | 0.001 (0.001) | *0.002* (*0.001*) |
| Mean proportion of nurse posts that are currently filled | | *0.589* (*0.184*) | 0.365 (*0.173*) | 0.190 (0.166) | 0.173 (0.181) |
| Mean asset score for health facilities | | *0.091* (*0.045*) | 0.057 (0.042) | 0.020 (0.040) | 0.009 (0.043) |
| Community | | | | | |
| Ratio of men to women with primary education in the PSU | | | *−1.067* (*0.227*) | *−0.726* (*0.217*) | *−0.521* (*0.234*) |
| Mean age at marriage for women in the PSU | | | *0.059* (*0.020*) | 0.041 (*0.019*) | 0.047 (*0.021*) |
| % women in PSU who report physical violence from their partner in last 12 months | | | *2.612* (*0.909*) | 2.129 (*0.885*) | 2.010 (*0.0931*) |
| Household | | | | | |
| Number of people currently living in household | | | | −0.008 (0.016) | *−0.044* (*0.018*) |
| Asset score | | | | *0.129* (*0.021*) | 0.064 (*0.029*) |
| *Individual* | | | | | |
| Woman's age (15–19) | | | | | |
| 20–24 | | | | | −0.301 (0.166) |
| 25–29 | | | | | *−0.411* (*0.199*) |
| 30–34 | | | | | *−1.057* (*0.220*) |
| 35–39 | | | | | *−1.252* (*0.230*) |
| 40–44 | | | | | *−1.609* (*0.240*) |
| 45–49 | | | | | *−2.250* (*0.273*) |
| Woman's education (none) | | | | | |
| Primary | | | | | 0.436 (0.242) |
| Secondary | | | | | *0.568* (*0.247*) |
| Higher | | | | | *0.624* (*0.315*) |
| Parity (none) | | | | | |
| 1–2 | | | | | *0.319* (*0.148*) |
| 3–4 | | | | | *1.134* (*0.178*) |
| 5+ | | | | | *2.127* (*0.226*) |
| Marital status (single) | | | | | |
| Married | | | | | 0.682 (0.773) |
| Cohabiting | | | | | 1.140 (0.797) |
| Widowed or divorced | | | | | *−1.354* (*0.247*) |
| Non-cohabiting union | | | | | *−0.895* (*0.250*) |
| Place of residence (rural) | | | | | |
| Urban | | | | | *0.382* (*0.192*) |

Table 3 (*continued*)

| | Model 1 | Model 2 | Model 3 | Model 4 | Model 5 |
|---|---|---|---|---|---|
| Race (Black) | | | | | |
| Colored | | | | | −0.075 (0.240) |
| White | | | | | *0.846* (*0.357*) |
| Employment status (not working) | | | | | |
| Currently employed | | | | | *0.331* (*0.132*) |
| Number of years age difference with spouse | | | | | *−0.030* (*0.015*) |
| Number of sources from which heard information on HIV/AIDS | | | | | *0.112* (*0.022*) |
| Woman's report of partner's approval of family planning (single) | | | | | |
| Partner disapproves | | | | | *−2.410* (*0.774*) |
| Partner approves | | | | | *−1.137* (*0.762*) |
| Community-level random intercept | *0.638* (*0.098*) | 0.557 (*0.091*) | *0.394* (*0.077*) | 0.293 (*0.068*) | 0.290 (*0.073*) |

the mean distance to the nearest health facility. Unusually, an inverse relationship was found: women who lived further away from the health facility were more likely to be using a modern method of contraception. Three significant community-level effects were identified. Women living in communities with the ratio of men to women with primary education was higher were less likely to be using contraception. Conversely, women living in communities with a higher mean age at marriage and in which a higher percentage of women reported recent physical violence from their partner, were more likely to be using modern contraception. In terms of household-level factors, women living in larger households were less likely to be using contraception, while women living in wealthier households were more likely to be using contraception. None of the interaction terms tested between community and health facility variables and race was statistically significant.

Women living in urban areas, working outside the home and with increased exposure to information on HIV/AIDS were more likely to be using contraception. Reporting of contraceptive use also increased significantly with educational attainment and parity. Relative to women aged 15–19 years, women aged 25 years and above were significantly less likely to report contraceptive use, although there was no significant difference in contraceptive use between women aged 15–19 and 20–24 years. White women were significantly more likely to report contraceptive use than Black women, and there was no significant difference in contraceptive use between Black and Colored women. Relative to single women, women who were widowed, divorced or in a non-cohabiting union were less likely to be using contraception, although there was no significant difference in the reporting of contraceptive use between single women and women who were married or cohabiting. Women who reported that there partner disapproved of contraceptive use were less likely to be using contraception than single women.

## Discussion

The community and health facility variables included in the analysis do not fully explain the community-level variation in contraceptive use in Eastern Cape Province; hence, there are factors operating at the community level that were omitted from the analysis that are shaping inter-community variations in contraceptive use. The presence of community residual variation in contraceptive use has been shown in previous studies (Stephenson et al., 2007; Amin et al., 2002; Stephenson and Tsui, 2002), and is often attributed to factors that are either not commonly collected in community surveys or less tangible factors that are difficult to quantify. The former may include the presence of

social networks that act as vehicles for the transmission of contraceptive knowledge in communities. Entwisle et al. (1996) found such networks to be an important force in explaining community variation in contraceptive use in rural Thailand, noting that social networks provide women with access to information on contraception and allow the transmission of positive attitudes towards contraception. However, social network data are absent from the SADHS (1998) data, and thus the residual variation in contraceptive use may be a product of the presence of more cohesive social networks in some communities. Much of the community-level data used in the analysis were derived from individual responses; the residual variation in contraceptive use may reflect the lack of data that capture the structural elements of the community environment, and that are measured at the community level. For example, it seems plausible that community-level structural factors (e.g. the presence of employment opportunities) or indicators of place (e.g. physical characteristics of the community) may influence contraceptive use through providing access to economic and social resources. It is expected that the inclusion of data on these elements of the community physical and social environment would reduce the residual variation in contraceptive use.

Alternatively, factors that cannot be easily quantified in a survey may be driving the residual variation in contraceptive use. For example, beliefs surrounding contraceptive use that prevail within a community may be a strong influence on a woman's decision to adopt contraception. Previous studies have shown that women may choose to adopt family planning, or indeed choose a particular method, as a result of the methods adopted by those in the community, and that an individual's decision to adopt a modern method of contraceptive is strongly influenced by how she perceives other community members will judge her actions (Potter, 1999; Rutenberg and Watkins, 1997). The analysis found no significant relationship between contraceptive use and the percentage of men or women in the community who approved of family planning; however, perhaps these indicators are too crude to capture the complex community-level attitudinal forces that influence contraceptive use. Further work is needed to develop tools that can capture these elements of the community environment.

Disappointingly, only one health facility characteristic was significantly associated with contraceptive use. The analysis considered several dimensions of the health facility environment: the availability of services and family planning methods, levels of staffing and training, and the infrastructural capacity of the health facility. Although in earlier models women who lived in communities in which the health facility had a higher number of nurses present and had greater infrastructural capacity were more likely to use contraception, after the inclusion of all other variables only women who lived further away from government clinics were more likely to be using contraception. The lack of impact of the health facility environment on contraceptive use may be a reflection of the inclusion of only government health facilities in the ECFS (1998). The private sector currently serves approximately 15% of family planning users in South Africa, with higher levels of private sector utilization among the White and Asian populations (Swartz 2002). Gready et al. (1997) found that many South African women report negative experiences of government operated family planning services, and have greater confidence in services offered by the private sector. Thus, the data are not capturing the complete service environment in the community, and it may be possible to explain more of the variation in contraceptive use with data representative of all family planning service providers.

The results also highlight the influence of expected gender roles and levels of female autonomy that exist in communities in shaping contraceptive use. Living in a community in which there was a higher mean age at marriage for women increased the likelihood of contraceptive use; these are likely to be communities in which there exist alternative opportunities to marriage for women, for example, education or employment, which act to both delay marriage and also create knowledge of and demand for contraception. Earlier age at marriage has been consistently linked to lower levels of female autonomy (UNICEF, 2001), indicating that women in communities in which women typically marry later may have higher levels of functional autonomy or decision making power to adopt contraception. Conversely, women in communities in which there was a higher ratio of male to female primary education were less likely to use contraception, suggesting that living in a community in which there are fewer opportunities for women to accumulate social capital inhibits contraceptive use. Interestingly, residence in a community in which a high number of women report physical violence from a male partner was

associated with a higher likelihood of contraceptive use. Previous studies have suggested that physical domestic violence is a deterrent to contraceptive use in South Africa. In a qualitative study from South Africa, Wood and Jewkes (1997) report that young women who attended family planning clinics often faced physical violence from their partners. The result found here may reflect women's reluctance to have children in a violent environment, with fears of unplanned pregnancies precipitating violence, or of future violence towards the child. However, this unusual result warrants further investigation to determine the characteristics of communities with high levels of domestic violence, and how these may help to explain the observed relationship with contraceptive use.

At the individual level there was a strong influence of race on contraceptive use; White women were more likely to adopt contraception than Black African women, a result that has been shown in many previous studies (Swartz, 2002). However, race proved not to interact significantly with any of the community or health facility variables: suggesting that the community-level influences on contraceptive use do not vary by race. This may be a product of the continued geographic segregation of races, a by-product of the Apartheid era that remains in South Africa. Significant interaction terms may be found in communities that contained variation in racial composition, e.g. the influence of distance to health services on contraceptive use may vary for White and Black respondents in community, with the possibly higher socioeconomic status of the White respondent providing greater ability to surmount distance to service as a barrier to contraceptive adoption. However, few of the communities in the data contained substantial variation in racial composition, limiting the ability to detect racial differences in community influences on contraceptive use.

The results add significantly to our understanding of the role of the community context in shaping contraceptive behavior. Previous studies have called for a focus on factors beyond the individual and household that influence contraceptive use (Chacko, 2001; Diez-Roux, 2001); however, few have considered the multiple dimensions of the community environment that can influence individual behavior. The present study goes beyond the broad definition of a "community effect" and takes a holistic view of the community environment, examining the social, economic and behavioral aspects of the community that may influence behavior. Additionally, previous studies focused on the role of the health service environment and indicators of quality of care as influences on contraceptive use (Tuoane et al., 2003; Bongaarts and Bruce, 1995; Oliver, 1995; Tsui and Ochoa, 1992); the present study finds that although there is some evidence of a health service effect, there are other aspects of the community environment (e.g. the climate of female autonomy) that are important in shaping contraceptive use.

Although the analysis has focused on a social epidemiology approach, the results also point to the importance of place in shaping contraceptive behavior. There are clearly some communities in which there exist better quality health services and greater opportunities for women that promote contraceptive use, and there is also evidence of targeting of services towards areas of greater need. Further research is warranted to examine the extent to which variations in contraceptive use vary spatially in this context and are linked to physical aspects of the community environment, to provide a fuller understanding of the role of place in shaping behavior.

The lack of data collected at the community level and data on non-governmental health facilities are limitations to this study, reflected in the continued presence of community-level variation in contraceptive use. This again highlights the need to incorporate community-level data collection activities into routine data collection efforts, to further our understanding of the influences on contraceptive use that exist beyond the household.

## Conclusion

The results highlight how aspects of the community can influence an individual's use of modern contraception. This knowledge can be used by program managers to shape the development of family planning provision and promotion programs. In particular, the results point to the role of the climate of female autonomy and expected gender roles in the community in shaping contraceptive use, demonstrating how communities with more opportunities for women to accrue social capital also facilitate greater contraceptive adoption. Community-level family planning focused interventions should be aimed at the structural elements of communities and the key actors in communities that currently inhibit women's autonomy, and should focus on providing opportunities

for women to develop functional autonomy, for example, through employment and educational opportunities. The exact mechanisms through which the significant contextual factors influence individual contraceptive behavior need to be identified through further in-depth qualitative and quantitative research. This study has, however, provided an important step towards our understanding of the numerous ways in which the contraceptive decisions made by an individual are influenced by the characteristics of the communities in which they live, and has provided new information on the synergistic effects of the community and health facility environments on contraceptive adoption.

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