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ETHNOGRAPHY, EPIDEMIOLOGY AND INFERTILITY IN EGYPT

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Abstract—Infertility in the developing world has been relatively neglected as an international health problem and a topic of social scientific and epidemiological inquiry. In this study, we examine factors placing poor urban Egyptian men and women at risk of infertility, and we explore the sociocultural and political-economic contexts in which these health-demoting factors are perpetuated. Our approach to the problem of Egyptian infertility attempts an explicit merging of ethnographic and epidemiological research designs, methods of data collection and analysis, and interpretive insights to provide improved understanding of the factors underlying infertility in the urban Egyptian setting.

Key words—infertility, risk factors, ethnography, epidemiology, Egypt

INTRODUCTION

Infertility in the developing world has been relatively neglected as both a significant international health problem and a legitimate topic of social scientific and epidemiological inquiry. The reasons for and consequences of this disinterest are manifold.

First, within the international health community, much of this neglect derives from an ideological orientation which holds that unchecked *fertility* leading to overpopulation is a problem of global proportions [1–3]; thus, infertility, as a kind of 'natural check' on population growth, is of little programmatic concern and may even tacitly be encouraged through family planning programs that fail to consider the special problems of infertile women [4, 5].

Second, given the logistical and methodological difficulties of carrying out epidemiological research in the developing countries [6–8], relatively little epidemiological research has been conducted on global patterns of infertility and on the identification of the particular, culturally specific factors placing men and women in different regions of the world at risk of infertility. For example, it is now recognized that sub-Saharan Africa is 'different,' epidemiologically speaking, from the rest of the world—with an 'infertility belt' stretching across Central Africa from Tanzania in the east to Gabon in the west [9–13]. Yet, why various sub-Saharan Africans are more likely to be infertile and how they perceive and cope with their infertility, especially in light of the growing AIDS epidemic in that region [14], are topics that have been relatively neglected. Instead, most epidemiological research on infertility remains focused on risk factors among populations in the West, with particular attention to 'lifestyle' issues such as overexercising, smoking, and alcohol consumption [15]. However, these factors are not necessarily similar to those placing non-Western populations at risk of infertility [7].

Similarly, a Eurocentric focus is apparent in the now burgeoning social scientific literature on infertility, much of it written by feminist scholars, which is oriented almost exclusively to the problems of affluent Western women and the patriarchal perils of new conceptive technologies which are aimed at women's bodies [e.g. 16–23]. In contrast, relatively little is known about the problems posed by infertility for Third World women, especially those living in ideologically pronatalist societies. Although well positioned to study the human suffering engendered by infertility in the Third World, anthropologists have done relatively little as of yet to give voice to the experiences of the infertile or to examine reproductive misfortune in general [24]. This disinterest is somewhat surprising, given the existing anthropological concern with virtually every aspect of normal human reproduction, from menarche to menopause [e.g. 25–31].

Certainly, in the case of infertility, it can be argued that anthropology and epidemiology need each other. Epidemiology, as a methodologically exacting discipline, is devoted to the discovery of disease prevalence and incidence rates and to the statistical assessment of causal associations between risk factors and disease outcomes in human populations. However, what epidemiology possesses in terms of methodological rigor it often lacks in contextual understanding of *why* certain human groups are at risk of problems such as infertility at particular historical moments [32]. This lack of contextual understanding has led one critic to point to

demiology's methodological '*rigor* mortis' [33]. Ultimately, epidemiology needs to understand and utilize anthropology's ethnographic methods and forms of qualitative data analysis to understand the range of possible culture-specific behavioral patterns requiring assessment as disease risk factors. Once these risk factors are assessed, anthropology can help to explain why such culturally embedded risk factors persist and may be resistant to change for sociocultural and political-economic reasons.

Anthropology also needs to understand and ultimately utilize epidemiological methods and forms of quantitative data analysis. Through ethnography, anthropologists are able to identify myriad, potentially health-demoting environmental and behavioral factors. Yet, in order to assess *which* of the many factors identified through ethnographic research place people, usually unwittingly, at risk of problems such as infertility, a formal epidemiological approach to risk assessment is also necessary.

Despite numerous recent calls for integrative, anthropological-epidemiological research [8, 34–37], such interdisciplinary ties have not been adequately forged—in infertility research or in the investigation of other health problems. We believe that the impetus for collaborative 'bridge-building' needs to come from within anthropology, where a tradition of interdisciplinary boundary-crossing already exists. For example, within anthropology's recent past, we have seen the development of such avowedly synthetic subspecialties as ethnoarcheology, in which archeologists employ the ethnographic methods of cultural anthropology to gain insight into premodern behavioral patterns [38–41], and ethnodemography (a.k.a. microdemography), in which demographic patterns are culturally contextualized with ethnographically derived information [42–45].

Furthermore, within anthropology, a movement is afoot to examine the ethnographic enterprise itself, in terms of both methodological rigor and reflexivity. Recent calls to reassess the ethnographic tool kit have pointed to the improved validity achieved by using multiple methods in one study, rather than relying on the ethnographic standbys of participant observation and/or interviews with key informants [46, 47]. Outside anthropology, the use of multiple methods is considered to be one form of 'triangulation' [48], a term referring to the process of cross-checking data that is beginning to be used in discussions of methodology within anthropology itself [49].

Given these synthetic tendencies and multiple-methodological trends, it seems both appropriate and timely for anthropologists to turn to the field of epidemiology to gain insight into the health problems of the human groups with whom they undertake their research. Following the precedent set by a number of epidemiologically minded anthropologists [8, 34, 50–54], we recommend the development of a synthetic enterprise, in which both ethnographic and epidemiological research designs, methods of data collection and analysis, and interpretive insights are employed in order to understand more clearly the factors underlying poor health.

In this article, we present an example of synthetic 'ethnographic-epidemiological' research on the understudied problem of infertility in Egypt [55]. Following an introduction to the research problem, study population, methods of data analysis, and potential sources of bias, we focus on factors that place lower-class Egyptian men and women at significant risk of infertility. Most important, we attempt to examine why these health-demoting factors continue to be maintained in a contemporary cultural setting marked by poverty and significant morbidity. We argue that at least some of the risk factors for infertility to which Egyptian men and women are exposed are tied to larger macrosociological forces which impinge upon the well-being of the Egyptian populace.

BACKGROUND TO THE STUDY

In Egypt, little statistical data on infertility exist; the reasons for this paucity of information are twofold. First, both the Egyptian government and donor governments, including that of the United States, share a preoccupation with Egypt's overpopulation problem [56–58]. Thus, infertility is viewed from a policy perspective as an insignificant social and statistical phenomenon. Second, because of the underdevelopment of epidemiology and the associated field of biostatistics in Egypt, as well as substantial differences in the ways in which Egyptian epidemiology is practiced, reliable descriptive epidemiological data on most health problems, including infertility, are largely lacking [59, 60].

Nevertheless, data on infertility have begun to emerge from Egypt's southern neighbors—nations which are part of the socalled sexually-transmitted-disease-induced infertility belt of sub-Saharan Africa [9–13]. Therefore, as part of an international, World Health Organization (WHO)-sponsored effort to trace global infertility patterns, especially those of Africa, an estimate of the infertility rate in Egypt as a whole has also been made [59]. However, this WHO estimate—that 8% of all married Egyptian couples who have never conceived are infertile—is probably low by several percentage points, according to a preeminent Egyptian infertility investigator [59]. Furthermore, little is known about the particular factors that may be associated causally with infertility in this cultural setting.

Given this scenario, one of us (M.C.I.) undertook an ethnographic-epidemiological study of infertility risk factors in Egypt. This was conducted as part of a larger anthropological study assessing the social and therapeutic ramifications of infertility among poor urban Egyptian women.

The study was carried out in Alexandria, a city of an estimated 5 million located in the northwestern

Nile Delta on the shores of the Mediterranean. The research lasted 15 months, from 1 October 1988 to 31 December 1989, and took place in the infertility clinic of the University of Alexandria's Shatby Hospital, the public obstetrics/gynecology teaching hospital serving the greater metropolitan area of Alexandria, as well as the rural areas of the northwestern Nile Delta region.

One hundred and ninety women were selected to participate in a case-control design. These women were representative of the patient population of Shatby Hospital: namely, lower and lower-middle-class women from Alexandria proper, as well as some women from the provincial cities outside Alexandria and the outlying rural areas of the Nile Delta. One hundred of these women were infertile cases, and ninety were fertile controls [61]. A comparative demographic profile of these populations of infertile and fertile women is presented in Table 1.

Cases were selected over a 12-month period (October 1988–October 1989) from the patient population of the university infertility clinic, where they were undergoing infertility diagnosis and treatment. All cases were of reproductive age (15–45), married, and had experienced an inability to conceive for at least 2 years. Cases were contacted by the first author from clinic waiting areas; in only two instances did women refuse to participate in the study, and all women who chose to participate completed the semi-structured epidemiological interview described below.

Table 1. Comparative demographic profile of 100 infertile cases and 90 fertile controls

	Cases ($n = 100$) (%)	Controls ($n = 90$) (%)
Age		
0–19	2	2
20–29	41	47
30–39	49	40
40+	7	11
Marital duration (years)		
0–4	20	25
5–9	40	30
10–14	22	23
15–19	14	12
20+	4	10
Ethnicity		
Lower Egyptian	64	77
Upper Egyptian	32	21
Bedouin	2	2
Nubian	2	0
Religion		
Muslim	94	98
Christian	6	2
Residency		
Urban	62	65
Transitional	25	22
Rural	13	13
Literacy		
Illiterate	51	40
Partial	20	27
Literate	29	33
Education		
None	32	27
Primary	43	46
Preparatory	4	12
Secondary/Vocational	17	11
University/Graduate	4	4
Employment		
Never	62	53
Ever	18	30
Current	20	17
Combined monthly income (in Egyptian pounds, $1 = LE 2.5)		
0–49	7	8
50–99	30	26
100–199	35	37
200+	26	24
no information	2	5

Of the 100 infertile women, 56 were primarily infertile, in that they had never conceived following at least one year of unprotected intercourse (and, in all cases, the desire to become pregnant). Thirty-seven women were secondarily infertile, in that they had failed to become pregnant following a previous pregnancy. Seven women were 'possibly' secondarily infertile, in that they suspected they had been pregnant and spontaneously aborted, although the spontaneous abortion had never been confirmed. Of these cases of proven and possible secondary infertility, 11 women had at least one living child, and 33 women had no children. Of those without children, 9 had delivered stillborn or live infants that had later died; the remaining 24 had experienced spontaneous abortions at various stages of gestation.

In addition, cases were categorized according to type of infertility, based on careful review of their diagnostic medical records. According to biomedical practice, infertility is categorized according to 'factors,' as shown in Table 2. Thus, for example, 56% of women in this study were diagnosed with ovarian-factor infertility, while 46% of the husbands of women in this sample were diagnosed as having 'male factors.' Many of the women and their spouses suffered from multifactorial etiology, as shown in Table 3. This information on infertility factors, or what is defined in this study as presence of 'disease,' reflects what was known about the entire population of 100 infertile women and their husbands upon inclusion in the study.

Fertile 'control' women were selected over a 12-month period (December 1988–December 1989) from the outpatient clinic and wards of the university hospital. These women were either (a) outpatients

Table 2. Infertility factors, by biomedical type, in study sample of 100 infertile Egyptian women[a]

Male factors:	40/87 = 46%
Female factors:	82/100 = 82%
Ovarian	49/87 = 56%
Tubal	41/89 = 46%
Cervical	25/56 = 45%
Uterine	19/100 = 19%
Miscellaneous	10/100 = 10%
Unknown factors:	6/100 = 6%
Coital factors:	13/100 = 13%

[a]These percentages do not equal 100 because of the fact that many couples were affected by more than one factor.

Table 3. Multifactorial etiology of infertility in study sample of 100 infertile Egyptian women

Number of biomedical factors	Women (%)
No factor (unexplained)	6
One factor	36
Two factors	29
Three factors	18
Four factors	10
>Four factors	1
	100

seeking contraception, treatment for minor gynecological complaints, or prenatal care, or (b) inpatients who were hospitalized for deliveries, hysterectomies, post-miscarriage care, or IUD removals. They were included in the study if they had living children and were free from infertility problems, as defined by them. Although fertile controls were not formally matched to infertile cases on possible confounding variables, an attempt was made to ensure that all controls, like cases, were women of reproductive age (15–45) and were of the lower and lower-middle socioeconomic classes.

Each fertile and infertile woman selected for the study agreed to participate in a confidential, in-depth interview, in which information about a wide range of potential risk factors for infertility was obtained through administration of a semi-structured questionnaire. The questionnaire contained both closed- and open-ended questions and covered the following areas: (1) basic demographic information about informants and their husbands, (2) marital history, (3) menstrual history, (4) hygienic behavior, (5) contraceptive history, (6) sexual history, (7) pregnancy history, (8) reproductive morbidity, and (9) general health of both informants and their husbands.

Insights obtained through periods of prior (1985–86) and preliminary (1988) ethnographic fieldwork in Egypt were crucial in designing the standardized questionnaire. Thus, in addition to 'standard' questions on known risk factors for infertility identified in the West [62], the questionnaire included many ethnographically derived questions about culture-specific Egyptian behavioral practices and environmental exposures that were deemed to be potential risk factors for infertility in this setting. The range of potential risk factors examined in this study and the source of questions about them (ethnographic fieldwork or Western epidemiological literature) is shown in Table 4.

Table 4. Potential risk factors for infertility in Egypt, as derived from epidemiological sources and ethnographic research

Source	From western epidemiological literature	From ethnographic field research in Egypt
Contraceptive practices	Oral contraceptive usage Intrauterine device usage Other contraceptive practices	
Genital hygiene practices	Douching with device Use of female hygiene sprays	Female circumcision practices (type, practitioner) Regular manual douching Postcoital manual douching Use of genital depilatories
Sexual practices	Number of sexual partners (husband, wife) Age at first intercourse (husband, wife) Use of prostitutes (husband) Sexual frequency Sexual intercourse during menses Anal-to-vaginal intercourse Male sexual dysfunction (impotence, premature ejaculation, etc.) History of sexually transmitted disease (STD) (husband, wife) History of recurrent vaginal infections History of recurrent urinary tract infections (UTIs) (husband, wife) History of chronic prostatitis Serum chlamydial antibodies (wife)	Sexual infrequency due to absence of husband (labor migration, marital separation) Female sexual dysfunction (vaginismus, coitus interfeminium, etc.) Lack of knowledge of fertile period
Nutritional factors and consumption practices	Obesity (husband, wife) Diabetes (husband, wife) Caffeine consumption (tea, coffee, soft drinks; husband, wife) Alcohol consumption (beer, 'hard' liquor; husband) Cigarette smoking (husband, wife)	Consumption of raw beef Waterpipe smoking
Iatrogenic practices	Previous delivery (biomedical) Induced abortion (biomedical) History of postpartum infection Appendectomy Reproductive surgery	Previous delivery (traditional) Induced abortion (traditional) Splenectomy Dilatation and curettage (D & C) Tubal insufflation Cervical electrocautery
Marriage practices		Cousin marriage between husband/wife Cousin marriage between parents
Occupational exposures	History of pesticide exposure (husband) History of chemical exposure (husband) History of heat exposure (husband)	History of schistosomiasis (husband, wife)

Each informant was interviewed by the first author (with a research assistant present) in the Egyptian colloquial dialect of Arabic, for between 2–4 hr depending upon the informant. Women were interviewed alone in a private room at the hospital, and their husbands were not present. Because much of the interview revolved around intimate matters of reproductive, sexual, and genital hygienic behavior, interviewing, as opposed to observation, was the only possible method of data collection and was conducted with individual female informants in a private setting. Given the modesty code of the culture, joint interviewing of husbands and wives would have been extremely difficult and would have probably yielded unreliable information. However, interviews with women alone were deemed successful, because of the strict privacy of the interview setting and because of the carefully worded informed consent form which discussed in great detail issues of confidentiality. In most cases, once women were assured about the confidentiality of the information, they appeared very comfortable talking not only about themselves but about their husbands. Furthermore, most were eager to explain their own and their husbands' reproductive health profiles. Nevertheless, it is important to bear in mind that information about male behavior obtained in this study is 'second-hand' and may be biased in unknown ways. Yet, given the sex-segregated nature of health-seeking behavior in this setting, it was impossible to corroborate information by interviewing husbands, who rarely accompanied their wives to the hospital for treatment and who tended to view infertility and other gynecological complaints as 'women's problems' [63].

Other possible sources of bias—formally defined as "any effect at any stage of investigation or inference tending to produce results that depart systematically from the true values" [64, p. 10]—must be considered [65].

First, the study was not based on a random sample of infertile and fertile women. Because of the lack of epidemiological statistics on infertility in Egypt and because of the lack of medical record-keeping in the country, determining the sampling frame for the population of interest (i.e. all fertile and infertile women of reproductive age in the northwestern Nile Delta region of Egypt) was impossible. Furthermore, it was impossible to enumerate the sampling frame of the hospital in which the study was based. Therefore, a random sampling strategy could not be employed. Nevertheless, measures were taken to ensure that women participating in the study were selected independently of each other (i.e. were not related or acquainted), and efforts were made to ensure that women were chosen from a number of strata in terms of infertility type.

Because of the lack of a random sampling strategy, caution must be exercised in generalizing the findings of this study beyond the sample, since it is not necessarily representative of either the hospital population in which the study was based or the wider population of interest, both of which remain unknown. Furthermore, hospital-based studies are never representative of the community at large, since patients receiving treatment in hospitals are always self-selected. In our research, the fact that many women had infertility problems of long duration and of multifactorial etiology probably reflected the fact that the university hospital was a place of 'last resort' for many women who had been unable to overcome their infertility problems through treatment in other settings, both biomedical and traditional. Thus, the women may be unrepresentative of the wider population of infertile Egyptian women, whose problems are solved outside the hospital setting.

Second, prevalent cases (i.e. old cases as well as newly diagnosed ones) of infertility were selected rather than incident cases (i.e. newly diagnosed ones), leading to two related problems. First, by including many cases of long duration, early cases of infertility that were resolved quickly and easily were probably underrepresented. Second and perhaps most important, when cases of long duration are included it is often impossible to know whether exposure to risk factors of interest occurred *before* or *after* the onset of disease. For example, in this study, douching practices were explored. Some infertile women douched regularly, but this may have been a *result* rather than a *cause* of their infertility, in that douching is often prescribed as a treatment for infertile women in Egypt. However, in most instances, it was possible to confirm that exposure to the risk factor had occurred before onset of disease—and often well before.

Third, a number of sources of potential misclassification bias (i.e. where unexposed individuals are classified as exposed or vice versa) were present. The most important problem in this regard was the issue of non-blindedness of the investigator (i.e. observer bias). Namely, because the first author conceived of, designed, and carried out this study alone, she was aware of both the case-control statuses of study subjects, as well as the various hypotheses about potential risk factors being explored. Thus, conceivably, she may have been expected to be biased in her classifications of exposures to risk factors, tending especially to classify cases as 'exposed' and controls as 'unexposed.' However, given her awareness of this potential source of bias and because of her ethnographic training, she took great care to record as accurately as possible the answers of subjects and to classify these responses according to firmly operationalized categories.

Operationalizing behavioral variables, however, was often difficult—a problem in any study but one that was exacerbated by the cross-cultural setting. For example, the epidemiological ideal of precise wording of questions, to be read as exactly and systematically as possible in each interview, was simply impossible in this cross-cultural setting. Not

only did difficulties of translation into Egyptian colloquial Arabic arise, but many questions were simply not meaningful to subjects if phrased in such exacting language, particularly if medical in nature. For example, among poor urban Egyptian women, the genital region is referred to as 'from down'; sperm are referred to as 'worms'; and ejaculation is referred to as 'bringing.' Thus, operationalizing variables was more 'open-ended' than would be allowed in an epidemiological study in the West. Nevertheless, a significant degree of systematization of questioning—in a culturally meaningful fashion—was possible, suggesting that the resultant operationalism was valid.

Furthermore, because our design was retrospective case-control, recall bias—or the problem of selective memory common to both epidemiology and anthropology—was potentially present. Recall bias is a problem in case-control studies if cases and controls differ in both amount and accuracy of information about past exposures to risk factors. If the investigator is not blinded to the case or control status of the subjects, questions about specific exposures may also be asked several times of cases but only once of controls. In addition, because of their desire to know the 'cause' of their current health problems, cases are more likely to 'remember' exposures to risk factors which may or may not have been present. Thus, cases may overreport exposures, especially when they are aware of the goals of the epidemiological investigation.

Finally, it is very important to note here that although the total sample size—100 infertile cases and 90 fertile controls—was representative of most case-control studies (although much larger than that of most anthropological studies), subdivision of the sample into infertility type rendered smaller sample sizes than usual for an epidemiological study. From an epidemiological standpoint, small sample sizes are problematic in terms of strength of association: namely, because of small numbers, the power to detect a significant association when an association is, in fact, present (i.e. the null hypothesis is false) is less than in a study with additional subjects. In terms of our research, a number of results appear to suggest probable associations between risk factors and infertility outcomes; however, because of small sample sizes, these results were not statistically significant at the $P < 0.05$ level (the standard for most epidemiological studies). If, however, the significance level is lowered to $P < 0.10$, which, as Bernard [46] suggests, is often appropriate for social scientific studies, then some of our results do appear to be significant. Thus, in the discussion that follows, we will report results that we believe are significant, including those with 'borderline' P-values in the 0.05 to 0.10 range. Lack of statistical significance at the $P < 0.05$ level may have been due to two factors: (a) lack of association, or (b) small sample size.

Before presenting these results, two major points must be made. First, although a number of potential biases and problems of small sample size are present, it is extremely important that studies such as this one be carried out, given what can be learnt about possible associations between risk factors and health outcomes. *All* studies—both anthropological and epidemiological—are subject to potential biases. Such biases must be considered when designing a study, mitigated as much as possible, and enumerated when findings are presented; however, they should not prevent research such as this from being undertaken. Based on the findings of such studies, further longitudinal cohort research can be undertaken to investigate possible associations between the health problems of interest and a narrower range of risk factors that appear in preliminary studies to be associated with these problems.

Second, some of the relationships between risk factors and infertility outcomes we investigated are not new. In many cases, studies in the West have provided convincing evidence of associations between these risk factors and infertility outcomes. Our goal here is to determine whether risk factors found to be associated with infertility in other parts of the world are also present as risk factors in Egypt. Furthermore, we attempt to determine which of these risk factors are more likely to be associated with infertility in Egypt and, given the characteristics of this cultural setting, why.

In addition, some of the risk factors to be discussed here are present in Egypt but are *not* found in other parts of the world and have never been investigated epidemiologically. We have attempted to identify these culture-specific risk factors and to explain their potential significance in the etiology of infertility. In summary, then, one of our goals was to determine how Egypt is similar to but different from Western settings where many infertility risk factors have already been illuminated, and to specify the cultural context of these similarities and differences in the Egyptian setting.

RESULTS

The results reported here refer to three types of infertility: cervical-factor infertility (CFI), male-factor infertility (MFI), and immunological-factor infertility (IFI). Although ovarian-factor infertility (OFI) and infertility due to 'coital factors' (i.e. sexual problems) were also considered in this study, statistically significant risk factors for these forms of infertility could not be discerned through epidemiological risk assessment. A number of statistically significant risk factors for tubal-factor infertility (TFI) in Egypt were discovered, but are described in detail elsewhere [66].

Of all of the potential infertility-related risk factors listed in Table 4, four factors, three individual and one 'composite,' appear to be significantly associated

Table 5. Measures of association for infertility risk factors in Egyptian study sample

Risk factor	Unadjusted OR (95% CI)	Adjusted OR (95% CI)
Number of cervical electrocauterizations	1.7 (1.6, 5.0)	2.1 (1.6, 7.8)[a]
Male heat exposure	1.7 (0.6, 5.0)	2.0 (0.6, 6.1)[b]
Male pesticide exposure	3.1 (1.1, 8.9)	2.7 (0.8, 9.4)[c]
Male chemical exposure	1.0 (0.5, 2.1)	1.1 (0.5, 2.7)[d]
Male schistosomiasis history	3.0 (0.8, 10.4)	2.4 (0.5, 11.8)[e]
Total number of occupational exposures	1.7 (1.0, 2.8)	1.8 (1.1, 3.0)[f]
Male cigarette smoking	0.5 (0.2, 1.3)	0.5 (0.2, 1.3)[g]
Male waterpipe smoking	1.8 (0.8, 4.1)	2.5 (1.0, 6.3)[h]
	Mean inbreeding coefficient between husband and wife	*T*-statistic (*P*-value)
All infertile women	0.0196	0.85 (0.40)
All non-tubal-infertility infertile women	0.0260	1.79 (0.08)
All fertile controls	0.0157	—
All women with history of spontaneous abortion	0.0234	1.57 (0.12)
All women without history of spontaneous abortion	0.0156	—

[a]Adjusted for marital duration and wife's age.
[b]Adjusted for pesticide exposure, chemical exposure, schistosomiasis history, marital duration, husband's age, husband's education.
[c]Adjusted for heat exposure, chemical exposure, schistosomiasis history, marital duration, husband's age, husband's education.
[d]Adjusted for heat exposure, pesticide exposure, schistosomiasis history, marital duration, husband's age, husband's education.
[e]Adjusted for heat exposure, pesticide exposure, chemical exposure, marital duration, husband's age, husband's education.
[f]Adjusted for marital duration, husband's age, husband's education.
[g]Adjusted for waterpipe smoking, tea drinking, marital duration, husband's age, husband's education.
[h]Adjusted for cigarette smoking, tea drinking, marital duration, husband's age, husband's education.

with CFI, MFI, and IFI outcomes in this Egyptian setting. More specifically, a gynecological practice known as 'cervical electrocautery,' which is widely performed by Egyptian biomedical practitioners, was found to be a significant risk factor for cervical-factor infertility among Egyptian women. Among Egyptian men, the common practice of waterpipe smoking, as well as a number of occupational exposures (to high heat, pesticides, workplace chemicals, and schistosomiasis, a parasitic infection contracted by Egyptian agricultural workers), were found to be significant risk factors for male-factor infertility. Finally, the common practice of close cousin marriage was found to be a significant risk factor for immunological-factor infertility.

Here, we will examine these statistically significant risk factors by type of infertility. As shown in Table 5, multivariate logistic regression was employed to derive both unadjusted and adjusted odds ratios (ORs), (with the exception of cousin marriage, in which a Student's *T*-statistic was used to compare mean inbreeding coefficients). Adjustments were made for two types of potential confounders: demographic variables (e.g. age, because of its well-known association with infertility) and other potential risk factors. We define a potential confounder as any variable related to both the disease outcome and to the risk factor of interest at $P < 0.20$.

From an anthropological perspective, our interest here is not only in the *statistical* significance of these risk factors, but in their *sociocultural* and *political-economic* significance in this setting. Although we have employed epidemiological forms of quantitative data analysis to determine which of the many factors listed in Table 4 are significantly associated with infertility outcomes in this setting, our primary focus here is on ethnographic contextualization: namely, *why* certain behavioral practices and environmental exposures that are ultimately deleterious to human fertility are maintained in the current Egyptian setting. To provide such contextualization, we rely on the findings from in-depth ethnographic investigation carried out by the first author in Northern Egypt from December 1985 to February 1986 and from September 1988 to December 1989.

Cervical-factor infertility (CFI)

Twenty-five of 57 infertile cases (44%) who underwent evaluation in the university infertility clinic were diagnosed as having cervical-factor infertility, or CFI. In biomedical terms, CFI usually involves failure of the spermatozoa to 'penetrate' the cervical mucus, which normally provides a chemical milieu for transport of the sperm to the upper genital tract [67]. In women with CFI, the mucus acts as a barrier to, rather than as a medium for, healthy, motile sperm in their journey to the fertilizable ovum in the fallopian tubes.

Diagnosing CFI requires microscopic examination of the cervical mucus itself or, ideally, a postcoital test (PCT), in which a sample of cervical mucus is taken several hours after intercourse to assess the success of sperm penetration and transport in the mucus. The

PCT is also an effective initial test of immunological problems between infertile partners.

Unfortunately, in Egypt, many gynecologists in private practice who treat infertile women do not attempt to diagnose CFI through biomedically accepted techniques, including the PCT. Rather, in Egypt, CFI is essentially synonymous with 'cervicitis,' or infection of the cervix, which is believed to be associated with a condition called 'cervical erosion,' or *qarḥa* in Arabic. *Qarḥa* is a purported breakdown of the cervical epithelium resulting from chronic, severe cervicitis and is typically diagnosed in Egypt through speculum examination. According to many community-based Egyptian biogynecologists, if *qarḥa* is not treated, it leads to CFI in the female patient.

Yet, according to some university-based Egyptian gynecologists, who tend to be critical of Egyptian standards of community-based gynecological practice [63, 66], 'true' cervical erosions are: (a) rare and diagnosed in Egypt far more often than they actually occur, (b) probably not a major cause—if any—of infertility, which is the contemporary view held in the West [67], and (c) treated in ways that probably *produce* true iatrogenic CFI in otherwise healthy, fertile women, through destruction of their cervical-mucus-producing glands and subsequent fibrosis and stenosis of the cervix.

With regard to the last point, the many Egyptian gynecologists who are convinced that cervical erosions are, in fact, associated with infertility believe that they must be overcome through treatment before conception can occur. In Egypt, the preferred form of treatment for cervical erosions is cervical electrocautery (i.e. thermocautery), or *kayy* in Arabic. With *kayy*, cervical tissue is cauterized by the application of heat (i.e. the cervix is 'burned' or 'ironed,' as patients understand it), thereby supposedly removing the cervical erosion. Yet, according to some university-based gynecologists in Egypt, if performed aggressively and/or repeatedly, as is often the case, *kayy* may lead to permanent damage and destruction of the cervical-mucus-secreting glands, leading to subsequent *true* CFI through permanent changes in the quality and quantity of cervical mucus. As one university-based gynecologist lamented:

"In my whole life, maybe I cauterized four patients and only for *severe* cervical infections not correctable by any other means. I don't remember ever cauterizing an infertile patient. But, in Egypt, we are stuck to this opinion that erosions are abnormal, which was once in the literature, and that they could be corrected in this way. And the physician wants to do something for the patient to make the patient feel better and also to make money. But most don't know how to do it [cervical electrocautery], the strict way of doing this, and they end up destroying cervical crypts that create cervical mucus. So the patient ends up with absolute dysmucorrhea [i.e. poor cervical mucus] which can never be corrected. In other words, this electrocautery may *definitely* cause cervical-factor infertility."

In his statement, this physician points to two of the major problems characterizing contemporary Egyptian gynecology: first, the maintenance of outdated and even harmful traditions of medical practice and, second, the financial incentive to treat patients with therapies that may ultimately be health-demoting. Although a detailed critique of gynecology in Egypt is beyond the scope of this paper and can be found elsewhere [63], these problems require brief discussion in order to understand why cervical electrocautery is an iatrogenic risk factor for CFI among Egyptian women.

With regard to the maintenance of gynecological traditions, European-based biomedicine has largely been reproduced in Egypt without concomitant Western, Enlightenment-inspired notions of 'progress' and 'modernity'. As a historically recent colonial import in a country with a long, literate medical history [63, 68], Egyptian biomedicine does not replicate the Western model, in that recent advances in knowledge and practice are neither idealized nor incorporated in a process of continuous 'upgrading.' Rather, throughout the biomedical community in Egypt—and as evident in Egyptian gynecology—traditions are upheld, in part to honor the memory of the Egyptian biomedical forebearers who introduced these now obsolete forms of biomedical practice to the country. As a result, old biomedical customs, many of which have their historical roots in Western practice, die slowly in Egypt and tend to linger on for decades. Eventually, some of these forms of practice may 'trickle down' to the ethnomedical community, where traditional healers can be found to practice long-outdated forms of biomedical therapy once practiced by Egyptian physicians [68].

Furthermore, many biomedical practitioners 'overtreat' their patients with these outmoded forms of therapy because of their desires to 'do something' for patients in distress and because of their desires to generate income for themselves. Because Egypt is a poor country with an economy that is 'stalled' [69]; because an ill-coordinated national health policy has led to the training of excessive numbers of Egyptian physicians, most of whom want to practice in urban areas [70]; and because the large number of Egyptian patients who suffer from various illnesses are often willing to subject their bodies to costly invasive procedures and may even request the more 'popular' (and hence widely known) procedures from their physicians [63]; Egyptian physicians are under considerable pressure to perform invasive 'treatments'—ranging from injections to major surgeries—as a source of significant income and as a means of attracting patients. Indeed, many gynecologists describe the considerable pressure they feel to 'do something' for their infertile patients, even when 'treatment' is not indicated or is against the best interests of the patient.

Cervical electrocautery provides a case in point demonstrating both of these problems. One university-based gynecologist pointed out that electrocautery was considered a "good treatment thirty years ago," but that it has continued to be "very commonly done because of money." He, like nearly a dozen other university-based gynecologists participating as informants in this study, considered cervical electrocautery to be one of the major causes of CFI in Egypt.

Given this situation, we attempted to examine the statistical relationship between cervical electrocautery and CFI in this study. To investigate this relationship, we first subdivided the infertile group into those who had been adequately evaluated at the university hospital for CFI ($n = 57$); then, of these women, we compared those with proven CFI ($n = 25$) to those cases without CFI ($n = 31$). When cervical electrocautery was considered in a logistic regression model, controlling for a number of other potentially confounding variables, the relationship between electrocautery and CFI proved to be statistically significant, as shown in Table 5. Namely, it appears that Egyptian women who undergo one or more episodes of cervical electrocautery are at 2.1 times greater risk of CFI than are women who were never electrocauterized, a result statistically significant at the $P < 0.05$ level ($1.6 < 95\%$ CI < 7.8). Thus, it would appear that Egyptian women who undergo the common Egyptian gynecological practice of cervical electrocautery, or *kayy*, are more than twice as likely as women who were never electrocauterized to suffer from iatrogenically produced, cervical-factor infertility.

Male-factor infertility (MFI)

Forty of 87 husbands of infertile women who had undergone semen analyses suffered from male-factor infertility, or MFI. In biomedical terms, MFI involves problems of both semen and sperm, including abnormalities of seminal volume and viscosity, sperm motility, sperm concentration (or count), sperm morphology, and autoantibody formation against sperm. In this study, in 11 of the 87 cases evaluated (13%), MFI was the sole cause of the couple's infertility.

In the West, epidemiological risk factors for MFI have been substantially investigated and appear to fall into two major categories: occupational exposures (to heat [71–72], X-rays [73], workplace toxins [73–79]) and consumption practices (including cigarette smoking and tobacco chewing [73, 80–83], marijuana smoking [81], coffee drinking [73], alcohol consumption [81], and use of various drugs [73]). (Many of these risk factors have also been investigated in women [84–87].)

In Egypt, on the other hand, epidemiological assessment of risk factors for MFI has yet to be undertaken. For this reason, we decided to include a number of occupational exposures (to high heat, pesticides, other workplace chemicals, and schistosomiasis infection) and consumption practices (cigarette and waterpipe smoking, tea and coffee drinking, and alcohol consumption) as potential risk factors for MFI in our study.

It is important, however, to reiterate some of the limitations of our investigation. First, information about these potential risk factors for infertility in men was obtained from women only. Therefore, information on male behaviors and exposures used in this analysis was obtained 'second-hand' from wives. In most cases, however, women appeared to be well-informed of their husbands' consumption habits, work environments, and medical histories and had little trouble answering related questions.

Second, our information about exposure to potential risk factors for MFI is rather 'general' in the sense that we did not have specific information on, for example, types of chemicals and pesticides in the work environment or amount or kind of tobacco consumed in a session of waterpipe smoking. Rather, we know, for example, whether individuals had past exposure to pesticides used in agricultural work, whether or not an individual was currently exposed to chemicals in the workplace, or whether or not an individual had ever been a regular (i.e. daily to weekly) waterpipe smoker.

Finally, it is interesting to note that many of these risk factors were essentially absent among women, given that women of the urban lower class in Egypt generally do not smoke, drink alcohol or excessive amounts of tea or coffee, or work outside the home. Furthermore, although a few rural-born women in this study had been or were engaged in agricultural work, and thus had histories of schistosomiasis, they rarely administered pesticides to crops, a job handled by men. Thus, in both case and control populations, the numbers of 'exposed' women were too low to make epidemiological analyses of these risk factors for female infertility meaningful.

Among husbands, on the other hand, exposures to all of these potential risk factors, with the exception of alcohol and illicit drug consumption, were quite high. In terms of occupational exposures, the vast majority of husbands in this study were unskilled manual laborers, who in some cases had migrated from rural areas where they had once been engaged in farming. Such rural-to-urban migration, a phenomenon that has continued unabated in Egypt during the past four decades, has resulted in the swelling of the urban, unskilled male wage labor force and concomitant un- and underemployment in the cities [88]. While the vast majority of lower-class urban Egyptian women are barred from the wage labor force for cultural and economic reasons [89], lower-class urban Egyptian men have become proletarianized, often ekeing out an existence through strenuous factory or construction work. Those who have been unable to support themselves and their families on Egypt's notoriously low wages

have migrated *en masse* to the oil rich countries of the Arab Gulf and Libya (and, before the Gulf War, Iraq), where they man the petroleum factories and construction sites.

Many Egyptian men engaged in factory and construction work, either at home or abroad, have inevitably faced exposure to occupational toxins, the use and disposal of which is unregulated and is contributing to mounting pollution problems in the cities [88]. For example, in the Alexandria vicinity, many lower-class men find employment in textile factories, where they are exposed to dyes and inhalable textile particles; cement factories, where they inhale air-borne cement particles; and pharmaceutical factories, where exposure to numerous chemical substances is great. In our sample, for example, the single most frequent occupational category among husbands was 'factory worker,' the majority working in either textile mills or cement factories. Nearly half of all husbands in both the case and control groups were exposed to chemicals at work. Indeed, wives, who were responsible for laundering their husbands' clothes, reported that their husbands often returned home sweating and saturated with workplace materials.

Furthermore, almost one-third of husbands in this study worked under conditions of high heat, either within factories or through outdoor work in which almost continuous exposure to the sun's ultraviolet rays was common. Although relatively few husbands in this study were currently engaged in farming, those who had been in the past had often administered toxic pesticides *by hand* and also had histories of schistosomiasis infection.

Schistosomiasis, a life-threatening, parasitic blood fluke infection contracted through exposure to infested canal water, is the major 'disease of development' in Egypt, affecting the vast majority of the agricultural populace [90]. Although this disease has been present in Egypt since pharaonic times, its recent spread in Egypt has been attributed to the development of the Aswan High Dam/Lake Nasser project of the 1960s–70s and the resultant construction of a massive network of parasite-infested irrigation canals.

As noted by McFalls and McFalls [91], schistosomiasis may lead to infertility, especially in the male, through destruction of the urinary tract and blockage of the vessels necessary for the passage of sperm-containing seminal fluid. Yet, little is known about the relationship between schistosomiasis and MFI in Egypt, although a study from neighboring Sudan found schistosomiasis to be highly prevalent among men with MFI [92].

In Egypt, however, widespread awareness of the potential link between schistosomiasis and MFI among the general public has been created by the airing of a series of public service announcements (PSAs) on the dangers of untreated schistosomiasis. In one of these PSAs, a famous actor, playing the part of a village mayor, warns his fellow citizen of the assorted serious health problems stemming from schistosomiasis. Of all of the problems mentioned, 'infertility' is the one most feared by the astonished villager, who repeats the Arabic word for 'infertility' with incredulity.

Apparently, this health message about the dangers of schistosomiasis has been effective in increasing knowledge about the disease, its transmission, and its health consequences. For example, within weeks of the PSA's first airing, women in this study began reporting that the schistosomiasis parasite, known as a 'worm,' causes MFI by 'eating the husband's worms' (i.e. sperm)! Thus, although women's notions of the mechanisms of MFI-producing schistosomiasis were inaccurate, they tended to be concerned and informed about their own husbands' experiences with schistosomiasis, given their interest in the fertility-related consequences of this condition.

Given the scope of the schistosomiasis problem in Egypt and the other potential occupational risk factors for MFI, an attempt was made to assess the relationship between occupational hazards and MFI in our group of husbands. When each of the risk factors was considered independently in a logistic regression model, the adjusted ORs for heat exposure, pesticide exposure, chemical exposure, and a history of schistosomiasis were 2.0, 2.7, 1.1, and 2.4, respectively; none of these adjusted ORs were statistically significant at the $P < 0.05$ level, perhaps due to the lack of statistical power and the adjustment for numerous confounders. However, when all of these risk factors were considered together in a composite 'occupational exposure' variable, as shown in Table 5, the increase in risk of MFI with each additional occupational exposure was 80%, a result that was statistically significant at the $P < 0.05$ level ($1.1 < 95\%$ CI < 3.0).

In other words, an Egyptian male worker who is exposed to chemicals in the workplace is at an 80% greater risk of MFI than one who is not and has no other occupational risk factors. Similarly, an Egyptian male worker who is exposed to both chemicals and high heat in the workplace is at an 80% greater risk of MFI than one who is exposed to chemicals alone. Thus, with each additional occupational exposure, the risk of MFI increases incrementally by 80%, an increase that is significant at the $P < 0.05$ level.

Egyptian men may also be at increased risk of MFI because of their use of tobacco. In this study population, husbands' tobacco consumption was quite high and represented a major financial burden for most poor families. For example, only 39 of 190 husbands (21%) had never smoked cigarettes. Of the 145 regular cigarette smokers, 102 (70%) smoked between one and three packs per day, at a daily cost of LE 1–3 (U.S. $ 0.40–1.20) for the lowest-priced, Egyptian-manufactured 'Cleopatra' brand. Thus, cigarette expenditures for most men were between

LE 30–90 per month. Although monthly combined household incomes ranged from LE 40–400 per month, the majority (65%) ranged from LE 50–200. In other words, expenditures for cigarettes regularly consumed one-third to one-half of all income in the majority of households, a problem acknowledged as a major one by many women.

In nuclear family households supported by a cigarette-smoking husband, husbands' needs for 'pocket money' to buy cigarettes were often regarded by women as the major reason for their inability to provide proper nourishment for their children. Similarly, among infertile women, husbands' expenditures for cigarettes were viewed as a drain on resources best spent on infertility therapies. Although some husbands had intentionally 'weaned' themselves (often with wives' encouragement) from cigarettes to the less expensive form of waterpipe smoking or had stopped smoking altogether, the majority of husbands in the study were addicted to tobacco, having begun smoking in most cases during late adolescence.

On a cultural level, smoking symbolizes the rite of passage from boyhood to manhood among urban Egyptian youth, who are bombarded with advertisements encouraging them to smoke. Throughout Egypt's major cities, the 'dumping' of excess American tobacco on the Egyptian market is apparent in omnipresent billboards of that peculiarly American male icon, the 'Marlboro Man,' smoking cigarettes from the familiar red-and-white pack. Although Marlboros, at twice the cost of a pack of Egyptian Cleopatras, are beyond the financial grasp of most lower-class Egyptians, men aspire toward Marlboro smoking, or at least to the smoking of the few other foreign brands available in the country.

In addition, many urban Egyptian men who cannot afford cigarettes or who prefer to smoke in the 'traditional' fashion enjoy the ritual of communal waterpipe smoking, especially in cafés and after meals. The waterpipes, which are large and set on the floor, are filled with honey- or molasses-imbued tobacco, known as *mučassal*, smoked through long pipes with wooden mouthpieces. Many men who are regular waterpipe smokers also do so at home. Waterpipes are also used to smoke hashish, although very few husbands in this study did so on a regular basis, if at all.

Just as with cigarettes, waterpipe smoking can be a potent addiction and, more important to this discussion, is one that appears to be more problematic from the standpoint of male infertility. Namely, whereas cigarette smoking was not statistically associated with MFI in this study (OR = 0.5), multivariate logistic regression showed waterpipe smoking to be significantly associated with MFI at the $P < 0.05$ level (OR = 2.5; $1.0 < 95\%$ CI < 6.3). In other words, men who smoke waterpipes regularly appear to be at 2.5 times greater risk of MFI than are men who do not smoke waterpipes (after controlling for cigarette smoking), as shown in Table 5. None of the other consumption practices examined in this study, including tea and coffee drinking and alcohol consumption, appeared to pose a similar increased risk of MFI among Egyptian men.

Immunological-factor infertility (IFI)

In the biomedical community, there has been growing recognition of the problem of 'immunological-factor infertility,' or IFI. In cases of IFI, so-called 'antisperm antibodies' form at the site of the cervix in the female preventing ascent of sperm into the upper genital tract, while in other cases, so-called 'autoantibodies' form in the male, immobilizing the sperm before they enter the female body.

Although specific diagnostic tests for IFI have been developed in the West, they have only begun to reach Egypt and are not widely available even within university settings in that country. Furthermore, although the postcoital test (PCT) can be used to detect IFI, such knowledge is not generally shared by Egyptian gynecologists, given the misunderstandings surrounding CFI discussed earlier.

Because only a handful of infertile women in this study had undergone specific diagnostic testing for IFI, it was impossible to subdivide the infertile group according to this disease outcome. Nevertheless, we were interested in the possible relationship between close cousin marriage (i.e. inbreeding) and IFI, given recent research on this subject in the West. Namely, evidence suggests that cousin endogamy may be related to infertility through the mechanism of shared human leukocyte antigens (HLAs). For example, in studies conducted among highly inbred Hutterites in the U.S. and Canada, couples sharing one or more HLA antigens had longer intervals from marriage to the birth of each child, as well as smaller family sizes [93]. These findings suggest that fertility is reduced in couples who are too immunologically related, and are quite different from findings linking female infertility to various chromosomal abnormalities [94, 95].

In Egypt, close cousin marriage over multiple generations is an ancient tradition that has continued into the present [89]. In our study, 32% of all marriages was between cousins. These cousin marriages were of the following types: 9% patrilateral parallel (FBD), the preferred form in the Middle East; 1% patrilateral cross (FZD); 4% matrilateral parallel (MZD); 6% matrilateral cross (MBD); and 12% second cousin or greater.

According to many lower-class urban Egyptians, cousin marriages have two major positive attributes, which is why they continue to be arranged by families in both the countryside and the cities [89]. For one, familial loyalty appears to play a role in securing such marriages, given that male cousins often tend to feel 'protective' toward their female cousins in general.

Furthermore, the 'background' (i.e. family and upbringing) of a cousin is generally known to all, ensuring that the future husband/wife is more a 'known quantity' than a 'stranger.'

Yet, despite the fact that cousin marriages are quite common, they have increasingly come to be viewed, especially in the cities, as a 'mixed blessing.' On the negative side, cousin marriages are seen as being plagued by three potential problems. First, cousins are often united in marriage under familial pressure; thus, they may bring resentments with them into the marriage, especially if one or both partners had hoped to marry a 'stranger.' Second, aunts and uncles—or the parents/in-laws of the husband and wife—may intervene in their children's marriages in ways that they would not were their son/daughter to be married to a non-relative. As noted by many women in this study, an aunt may make a particularly nagging mother-in-law, given the aunt's perception of her inherent rights to assert control over a niece who happens to be her daughter-in-law. Finally, many women view their male cousins as 'brothers'; thus, taking a cousin as a husband may feel semi-incestuous to a woman, leading to sexual problems that may be related to reduced fertility. Thus, although the practice of cousin marriage is widely accepted among urban and rural lower-class Egyptians—and is, in fact, preferred as a cultural ideal among some groups in Egyptian society—it is nevertheless viewed with ambivalence by many urban women, who see it as having its own unique set of problems. For this reason, many women in this study were adamant in their preference for 'stranger marriage.'

Furthermore, a nationally televised public service announcement (PSA), similar to that described for schistosomiasis, has warned Egyptians about the dangers of familial endogamy, pointing specifically to the increased risk of birth defects among the children of cousins. Although the problems of reduced fertility and spontaneous abortion were not discussed in the PSA, at least some Egyptians seem to have also considered these possibilities. For example, in this study, a significant number of women explained that husbands and wives who are cousins are less likely to conceive because "their blood, which is the same, doesn't mix." Yet, the 'same blood' theory was also used by some women to justify the cousin marriage preference, which they viewed as leading to a greater likelihood of fertility between related spouses. The vast majority of women, however, believed that cousin marriage had 'no effect' on fertility, although most argued that it could lead to 'problems' (i.e. deformities) in the offspring, as stated by the PSA.

We attempted to investigate the relationship between infertility and cousin marriage by comparing inbreeding coefficients among infertile and fertile groups of women and their husbands. Because of lack of diagnostic information on IFI, this comparison was not limited to a subset of infertile women, but rather included the entire group of 100 infertile and 90 fertile women. Genealogical information on the relationship between husband–wife and their parents was collected, and from this information, inbreeding coefficients were calculated for each couple. Following this, mean inbreeding coefficients were calculated for (a) all infertile women (mean = 0.0196), (b) all infertile women without tubal-factor infertility (given the known infectious etiology of TFI) (mean = 0.0260), and (c) all controls (mean = 0.0157). Likewise, mean inbreeding coefficients were calculated for all women in both groups with a history of spontaneous abortion (mean = 0.0234) and all women without such a history (mean = 0.0156), given that spontaneous abortion is thought to be another potential sequela of immunological 'closeness.'

As shown in Table 5, a Student's T-statistic, comparing the means, was calculated for (a) all infertile cases vs controls ($T = 0.85$; $P = 0.40$), (b) all non-TFI infertile cases vs controls ($T = 1.79$; $P = 0.08$), and (c) all women with spontaneous abortion histories vs those without ($T = 1.57$; $P = 0.12$). These results suggest that the non-TFI cases were significantly more likely to be related to their spouses than were fertile controls, and that women with spontaneous abortion histories were also more likely to be related to their spouses, although the latter finding was not statistically significant at the $P < 0.10$ level. In other words, 'inbreeding', the result of generations of close cousin marriage, appears to be a significant risk factor for IFI in this setting, and possibly for spontaneous abortion as well.

DISCUSSION

Given the paucity of knowledge about infertility in Egypt, we attempted to: (1) examine factors placing poor urban Egyptian men and women at risk of infertility, and (2) consider the larger sociocultural and political-economic forces that contribute to the unfortunate persistence of these fertility-demoting risk factors in this setting. Although numerous behavioral and environmental risk factors, many of them ethnographically derived, were evaluated (as shown in Table 4), only four of them—iatrogenic cervical electrocautery, male occupational exposure to noxious agents, male waterpipe smoking, and close-cousin marriage—were found to be statistically associated with CFI, MFI, and IFI outcomes among the study sample.

Beyond their individual statistical significance, however, these risk factors—particularly the former three—must be regarded as untoward consequences of the urbanization process in Egypt, a process that has left many impoverished Egyptians in poor health. For one, in urban areas of Egypt, competition among biomedical practitioners, who tend to eschew rural practice, has become intense in many instances,

leading some practitioners to perform lucrative, but ultimately iatrogenic procedures such as cervical electrocautery. Although decried by many university-based Egyptian physicians, the iatrogenic practice of gynecology is widespread in urban areas and is perhaps especially deleterious to urban poor women, who are often financially unable to avail themselves of the services of knowledgeable specialists.

In addition, poor urban men are especially vulnerable to what the World Health Organization (WHO) and UNICEF have called the 'diseases of industrialization' [96], of which male infertility may be a particularly potent example. As noted by Yach *et al.* [96], workers in the developing countries such as Egypt are exposed to a 'triple burden of disease': namely, occupational, domestic, and environmental exposures. Many poor urban Egyptian men, for example, have sought employment in the urban industrial sector, where they are exposed to risks associated with products in the workplace and to the stresses associated with factory production. Furthermore, they return to home environments that may lack potable water, electricity, sewage facilities, solid waste disposal, and which tend to be congested with human and sometimes animal occupants. In addition, in the cities of Egypt, including Alexandria where this study was conducted, the general environment has succumbed to high levels of ambient air pollution, particularly in peri-urban areas which are situated in close proximity to established industrial zones. As a result, proletarianized male workers in Egypt may be at risk of numerous health problems—of which decreased fertility is but one example—at work, at home, and in their communities.

Exacerbating their risk of poor health is smoking, which is widespread among urban men of all social classes but which is especially pernicious among the Egyptian poor, who face multiple insults to both their health and financial well-being. Aggressive urban marketing strategies by multinational tobacco companies have enhanced the social patina of smoking in Egypt as a practice that is desirable, respectable, and particularly masculine; thus, urban male youth are generally eager to become smokers, be it of cigarettes or the more traditional waterpipes that are found in every urban cafe. Given the reported association between tobacco use and decreased male fertility in the West, it is not surprising that, in this study, a similar association was found; but, in this case, the association was between the traditional Egyptian practice of waterpipe smoking and male infertility. Because smoking tobacco through waterpipes is generally considered by Egyptians to be cheaper than cigarette addiction, it may be that waterpipe smokers are able to consume greater quantities of tobacco in a form that may promote enhanced inhalation of tobacco smoke. Certainly, the differences in the health-demoting effects of cigarette vs waterpipe smoking, including as they pertain to male infertility, require further investigation.

CONCLUSION

In this article, we have examined factors placing poor urban Egyptian men and women at risk of infertility, a global health problem which has attracted insufficient attention from the international health, epidemiological, and social scientific communities. Of the many potential risk factors considered in this study, four of them—cervical electrocautery, male occupational exposure to noxious agents, male waterpipe smoking, and close cousin marriage practices—appear to be significantly associated with infertility outcomes in this setting.

In examining the effects of these various risk factors on infertility in Egypt, our secondary aim has been to show the benefits of a combined 'ethnographic-epidemiological' approach to the study of an important but underprivileged health problem. In this study, we have utilized: (1) insights from ethnography to generate testable hypotheses about behavioral and environmental risk factors for infertility among the Egyptian urban poor; (2) a classic epidemiological research design, i.e. retrospective case-control, with which to examine these hypotheses among a group of ethnographic informants; (3) a shared ethnographic-epidemiological form of data collection, i.e., in-depth interviewing, to collect information about potential risk factors and infertility outcomes from these informants; (4) epidemiological risk assessment to establish statistical associations between these risk factors and infertility outcomes; and (5) ethnographic contextualization of the sociocultural and political-economic environment which perpetuates and in some cases promotes these linkages between risk factors and infertility outcomes in Egypt. Thus, our explicit attempt has been to merge ethnographic and epidemiological research strategies, forms of data collection and analysis, and interpretive insights to produce results that we believe combine the strengths of both perspectives.

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