


# **The Epidemiology of Infertility**

---

**Report of a WHO Scientific Group**



**Technical Report Series**  
**582**



**World Health Organization, Geneva 1975**

*This report contains the collective views of an international group of experts and does not necessarily represent the decisions or the stated policy of the World Health Organization.*

**WORLD HEALTH ORGANIZATION**

**TECHNICAL REPORT SERIES**

**No. 582**

# **THE EPIDEMIOLOGY OF INFERTILITY**

**Report of a WHO Scientific Group**

**WORLD HEALTH ORGANIZATION**

**GENEVA**

**1975**

ISBN 92 4 120582 2

© World Health Organization 1975

Publications of the World Health Organization enjoy copyright protection in accordance with the provisions of Protocol 2 of the Universal Copyright Convention. For rights of reproduction or translation of WHO publications, in part or *in toto*, application should be made to the Division of Publications and Translation, World Health Organization, Geneva, Switzerland. The World Health Organization welcomes such applications.

The designations employed and the presentation of the material in this publication do not imply the expression of any opinion whatsoever on the part of the Secretariat of the World Health Organization concerning the legal status of any country, territory, city or area or of its authorities, or concerning the delimitation of its frontiers or boundaries.

The mention of specific companies or of certain manufacturers' products does not imply that they are endorsed or recommended by the World Health Organization in preference to others of a similar nature that are not mentioned. Errors and omissions excepted, the names of proprietary products are distinguished by initial capital letters.

PRINTED IN SWITZERLAND

# CONTENTS

	Page
1. Introduction . . . . .	5
2. Magnitude of the problem of infertility . . . . .	8
2.1 Demographic data. . . . .	8
2.2 Epidemiological and clinical studies defining the prevalence of infertility, pregnancy wastage, and child loss. . . . .	10
3. Causes of infertility and pregnancy wastage. . . . .	11
3.1 Gonorrhoea and infertility . . . . .	12
3.2 Non-venereal diseases and infertility. . . . .	14
3.3 Conditions affecting pregnancy wastage . . . . .	16
3.4 Sociocultural factors. . . . .	18
4. Research approaches . . . . .	19
4.1 Terminology . . . . .	20
4.2 Problem definition. . . . .	21
4.3 Regional or population diagnosis . . . . .	22
4.4 Further research on the etiology of infertility . . . . .	23
4.5 Data collection and analysis . . . . .	27
4.6 Epidemiological investigation of pregnancy wastage. . . . .	32
4.7 Epidemiological investigation in populations with suspected problems of both infertility and pregnancy wastage. . . . .	33
5. Conclusions and recommendations . . . . .	34
Annex . . . . .	36

*This report contains the collective views of an international group of experts and does not necessarily represent the decisions or the stated policy of the World Health Organization.*

**WORLD HEALTH ORGANIZATION**

**TECHNICAL REPORT SERIES**

**No. 582**

# **THE EPIDEMIOLOGY OF INFERTILITY**

**Report of a WHO Scientific Group**

**WORLD HEALTH ORGANIZATION**

**GENEVA**

**1975**

ISBN 92 4 120582 2

© World Health Organization 1975

Publications of the World Health Organization enjoy copyright protection in accordance with the provisions of Protocol 2 of the Universal Copyright Convention. For rights of reproduction or translation of WHO publications, in part or *in toto*, application should be made to the Division of Publications and Translation, World Health Organization, Geneva, Switzerland. The World Health Organization welcomes such applications.

The designations employed and the presentation of the material in this publication do not imply the expression of any opinion whatsoever on the part of the Secretariat of the World Health Organization concerning the legal status of any country, territory, city or area or of its authorities, or concerning the delimitation of its frontiers or boundaries.

The mention of specific companies or of certain manufacturers' products does not imply that they are endorsed or recommended by the World Health Organization in preference to others of a similar nature that are not mentioned. Errors and omissions excepted, the names of proprietary products are distinguished by initial capital letters.

PRINTED IN SWITZERLAND

# CONTENTS

	Page
1. Introduction . . . . .	5
2. Magnitude of the problem of infertility . . . . .	8
2.1 Demographic data. . . . .	8
2.2 Epidemiological and clinical studies defining the prevalence of infertility, pregnancy wastage, and child loss. . . . .	10
3. Causes of infertility and pregnancy wastage. . . . .	11
3.1 Gonorrhoea and infertility . . . . .	12
3.2 Non-venereal diseases and infertility. . . . .	14
3.3 Conditions affecting pregnancy wastage . . . . .	16
3.4 Sociocultural factors. . . . .	18
4. Research approaches . . . . .	19
4.1 Terminology . . . . .	20
4.2 Problem definition. . . . .	21
4.3 Regional or population diagnosis . . . . .	22
4.4 Further research on the etiology of infertility . . . . .	23
4.5 Data collection and analysis . . . . .	27
4.6 Epidemiological investigation of pregnancy wastage. . . . .	32
4.7 Epidemiological investigation in populations with suspected problems of both infertility and pregnancy wastage. . . . .	33
5. Conclusions and recommendations . . . . .	34
Annex . . . . .	36

# WHO SCIENTIFIC GROUP ON THE EPIDEMIOLOGY OF INFERTILITY

Geneva, 30 June – 4 July 1975

## *Members : \**

- Dr E. Alihonou, Chief, University Gynaecological and Obstetric Clinic, Cotonou, Dahomey (*Chairman*)
- Dr O. P. Arya, Consultant Venereologist, Liverpool Area Health Authority (Teaching), Liverpool Royal Infirmary, Liverpool, England (*Rapporteur*)
- Dr S. K. Gaisie, United Nations Regional Institute for Population Studies, University of Ghana, Legon, Ghana
- Dr D. N. Lantum, Professor of Community Health, University Centre for Health Sciences, University of Yaoundé, Yaoundé, Cameroon (*Vice-Chairman*)
- Dr E. Placca, Assistant Chief, Department of Maternal and Child Health, Ministry of Health, Lomé, Togo

## *Representatives of other organizations :*

### *International Planned Parenthood Federation :*

Dr H. Corvalan, Senior Evaluation Officer, London, England

### *International Union against the Venereal Diseases and the Treponematoses :*

Dr A. Siboulet, rue du Faubourg-Saint-Honoré, Paris, France

### *International Union for the Scientific Study of Population :*

Dr H. Leridon, National Institute of Demographic Studies, Paris, France

## *Secretariat :*

- Dr M. A. Belsey, Medical Officer, Human Reproduction, WHO, Geneva, Switzerland (*Secretary*)
- Dr G. Causse, Chief Medical Officer, Venereal Diseases and Treponematoses, WHO, Geneva, Switzerland
- Dr K. Edström, Medical Officer, Maternal and Child Health, WHO, Geneva, Switzerland
- Dr J. B. Lawson, Consultant Gynaecologist, Department of Obstetrics and Gynaecology Newcastle General Hospital, Newcastle-upon-Tyne, England (*Temporary Adviser*)

---

\* Unable to attend : Dr P. Cantrelle, Office de la Recherche scientifique et technique outre-mer, Paris, France ; Dr A. Laplante, International Development Research Center, Ottawa, Canada ; Dr J. K. G. Mati, Associate Professor of Obstetrics and Gynaecology, University of Nairobi, Faculty of Medicine, Kenyatta National Hospital, Nairobi, Kenya.



# THE EPIDEMIOLOGY OF INFERTILITY

## Report of a WHO Scientific Group

A WHO Scientific Group on the Epidemiology of Infertility met in Geneva from 30 June to 4 July 1975. The meeting was opened by Dr D. Tejada-de-Rivero, Assistant Director-General, on behalf of the Director-General.

### 1. INTRODUCTION

The WHO programme of research in human reproduction is concerned with problems that have clinical or public health importance such as infertility, disorders of pregnancy and lactation, and family planning. The Eighteenth World Health Assembly requested implementation of a programme of reference services and studies on the health aspects of infertility and the need for information and advice to couples on infertility was reiterated by the Twenty-first World Health Assembly in 1968. A WHO Scientific Group on the Biological Components of Human Reproduction<sup>a</sup> also identified the need for research into the incidence and causes of conditions that impair reproductive capacity. Infertility would appear to be particularly acute in certain countries in Africa south of the Sahara and the discussions of the Group focused mainly on the problem as related to these countries. Many of these countries are eager to set up services to prevent or cure the underlying causes, and formal requests for assistance have been received by WHO from several of them.

Involuntary infertility is a world-wide problem, but its frequency varies from area to area. It seems likely that up to 5% of all couples are infertile for complex reasons that are difficult to diagnose and for which present day treatment is therefore largely ineffective.

Superimposed on this "hard core", additional factors may raise the prevalence of infertility to 30% or even higher in some communities, particularly in certain countries in Africa south of the Sahara. If these additional factors could be defined, it is probable that much of the infertility would be preventable.

---

<sup>a</sup> WHO Technical Report Series, No. 435, 1969.

In most cultures, failure to bear children may carry a sense of personal failure as well as a social stigma. Where infertility is widespread and has major social implications there is a significant demand for diagnostic and therapeutic services.

Preliminary investigations into the underlying causes have demonstrated gaps in the available information and point to the need for research. Major issues include the magnitude and geographical distribution of infertility, and the need to distinguish between the different conditions that are loosely grouped under the general term of infertility.

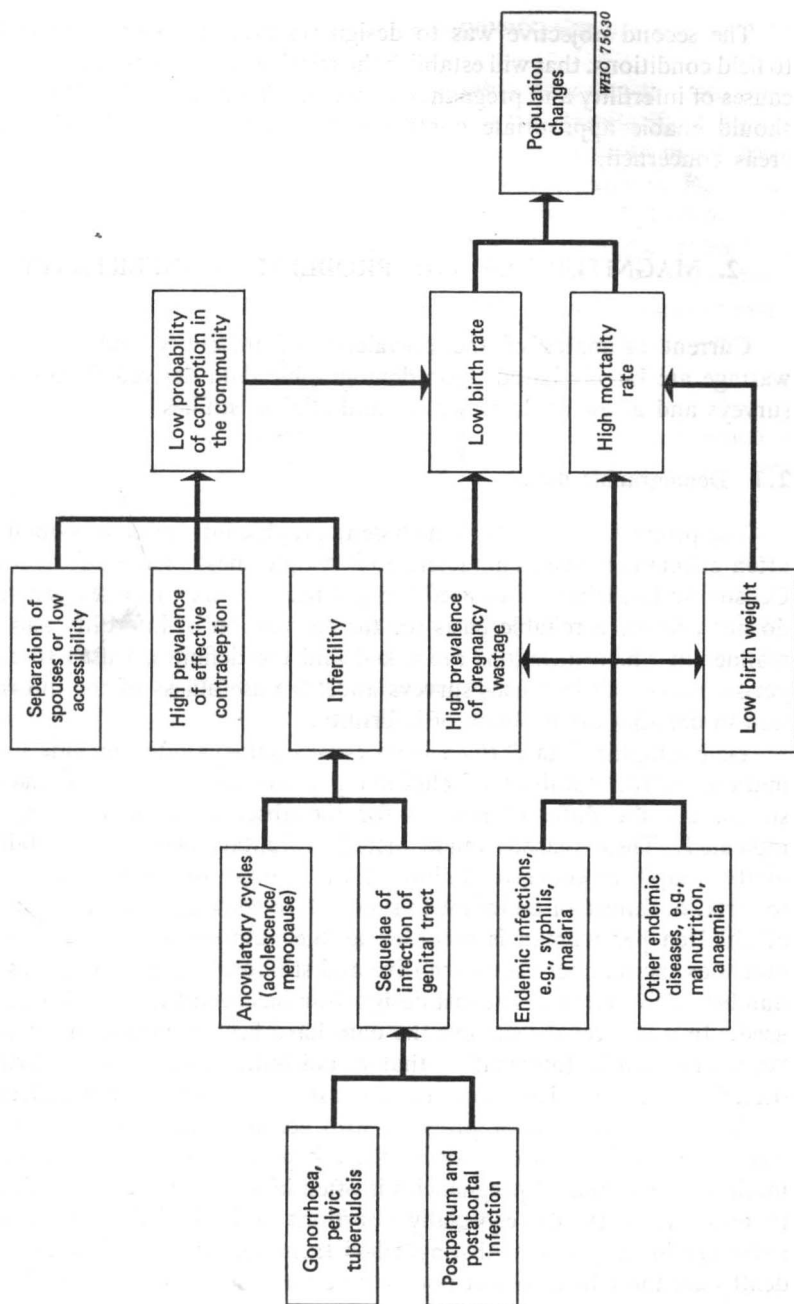
The term infertility is sometimes used by affected couples as though it were synonymous with childlessness; this is confusing. Demographically, the term infertility has also been mistakenly used to describe such situations as diminished fertility, low population growth rates, low population density, or even depopulation. Misunderstanding arises particularly when it is not certain whether the phenomenon refers to the individual couple or to the community as a whole. Throughout this report the term infertility is used in relation to couples. The indicator of the infertility of the couple is the woman, whether the infertility is due to failure of the woman to conceive or of the man to impregnate her. Infertility in the population as a whole is referred to in terms of prevalence rates.

In order to establish the underlying causes more clearly, it is necessary to differentiate between the inability to conceive, the inability to carry a conceptus to a live birth, and the failure of a live birth to survive. These three categories will be referred to as *infertility*, *pregnancy wastage*, and *child loss*, respectively. The relationship of these three categories, the factors affecting them, and their contribution to population changes are illustrated in Fig. 1 (the problem of population changes is beyond the terms of reference of this report).

Infertility can be considered in terms of primary infertility, when the woman has never conceived, and secondary infertility, when she has conceived at least once but not subsequently despite efforts to become pregnant. Infertility and pregnancy wastage are often perceptually linked as one problem by couples requesting services, and the associated or causative factors may be common to both. For these reasons, the Scientific Group considered both infertility and pregnancy wastage and concentrated upon the conditions thought to be responsible for high prevalence rates.

The first objective of the Scientific Group, once it had formulated operational definitions of infertility and pregnancy wastage, was to plan research on their prevalence in communities.

FIG. 1. CAUSES OF INFERTILITY, PREGNANCY WASTAGE, AND CHILD LOSS AND THEIR RELATIONSHIP TO BIRTH AND MORTALITY RATES AND POPULATION CHANGES



The second objective was to design research schemes, appropriate to field conditions, that will establish the relative importance of the various causes of infertility and pregnancy wastage. The results of such research should enable appropriate control measures to be introduced in the areas concerned.

## **2. MAGNITUDE OF THE PROBLEM OF INFERTILITY**

Current estimates of the prevalence of infertility and pregnancy wastage are largely based upon demographic data derived from census surveys and a few epidemiological and clinical studies.

### **2.1 Demographic data**

The primary purpose for which demographic information is obtained often affects the form, character, and completeness of the information. Census or household lists used for political or tax purposes generally do not provide a reliable basis for the calculation of infertility and the manner in which questions are asked and the definitions used to categorize individuals in census surveys affect the usefulness of the information in defining the problem of infertility.

Demographic data derived from census surveys often include information on the numbers of children per woman by age and marital status, but the different reasons for the absence of children are not indicated. These reasons might include voluntary childlessness, failure of the couple to conceive, failure of the woman to carry a pregnancy to term, or failure of an infant to survive. In some censuses the number of children per woman is recorded as the number currently living, in others as the number ever born (live and stillborn), and in others as the number of live births. The last designation has been the most frequently used. In a few census surveys the data have been recorded in terms of "ever pregnant". Information that would indicate secondary infertility (i.e., failure to conceive again since the last conception) is rarely collected.

Inaccuracy is a major problem with census data in many areas of Africa, and reliable information on age is particularly defective. Information on numbers of pregnancies is often incomplete because of failure to recall some events, especially abortions and stillbirths. Early neonatal deaths may not be distinguished from stillbirths, and when child deaths are thought to reflect poorly on a woman, or when discussion of

them is believed to bring bad luck to the survivors, she may be unwilling to mention them at all.

For all these reasons, existing demographic data can be used only as a very crude measure of infertility. However, despite these limitations, there is no doubt that an infertility problem exists in many areas of Africa. In parts of Gabon, Cameroon, Central African Republic, and Zaire the rates of childlessness among women aged 50 years or more have been reported to be as high as 20%–40%. Even higher rates have been noted among younger women. A similar situation has also been described in parts of East Africa, Sudan, and elsewhere in the continent. It would seem likely that infertility plays a role in these situations.

#### 2.1.1 *Indirect indices of infertility*

The percentage of childlessness among all women of reproductive age in a community is a crude index of infertility. Even in societies where all women ultimately marry, the rate of childlessness is greatly influenced by the mean age of marriage, the mean age at menarche, the numbers of women in different age groups, and infant mortality.

Measurements of the prevalence rates of childlessness or of the mean number of children ever born among women who have completed their reproductive life would theoretically permit comparison of rates among different communities, but these statistics also have their limitations. Recall among older women is grossly incomplete with regard to abortions. Furthermore, an examination of these statistics among older women does not necessarily represent the situation as it currently exists. The sequence of events leading to childlessness in such women is likely to have taken place thirty or more years earlier. In addition, a high level of maternal mortality in an area reduces the number of fertile women at the end of their reproductive years, thus slightly increasing the magnitude of the problem as measured by the proportion of infertile women in the older groups.

To determine whether the problem still exists requires an analysis of data based on the reproductive histories of women currently in their most active reproductive years.

Data from large geographical units may show wide variation in the magnitude of the problem within a given country. Furthermore, it is not uncommon to find pockets of apparent infertility even within areas that are characterized by high levels of fertility.

In these circumstances, the ethnic or tribal group may be the best unit of study as the habitat, social conditions, and health problems are likely to be common to the whole unit.

A useful technique in establishing the etiology of infertility is to demonstrate that a change in the incidence or prevalence of some factors such as disease control measures involving the use of antimicrobial drugs is associated with a subsequent change in the prevalence of infertility in the same community.

Such an analysis requires a knowledge of the rates of infertility of the groups of older women when they were younger. This type of analysis is referred to as birth cohort analysis. It is the preferred technique for identifying changes of factors affecting a disease over a period of time.

## 2.2 Epidemiological and clinical studies defining the prevalence of infertility, pregnancy wastage, and child loss

Few published data exist from Africa on the relative importance of these different categories in contributing to the problem. Community-wide epidemiological or demographic studies dealing with infertility, pregnancy wastage, and child loss have been mainly concerned with communities experiencing depopulation. It is only in this type of study that the relative importance of the different categories of infertility, pregnancy wastage, and child loss has been examined.

The most complete epidemiological study on the prevalence of infertility, pregnancy wastage, and child loss is that by Scragg undertaken on the island of New Ireland in the Western Pacific.<sup>a</sup> This study of several villages combined a demographic survey and clinical diagnostic studies on defined groups of women. In the study (Table 1), the impor-

TABLE 1. INFERTILITY, PERINATAL DEATH, AND INFANT MORTALITY AS RELATED TO POPULATION CHANGE IN NEW IRELAND

Area	No. of women	Primary infertility	Secondary infertility	Still-births rate/1000 live births	Neonatal death rate/1000 live births	Total deaths under one year	% change over generation of 28 years
Lemankua	94	3.2	1.1	26	36	71	+154.0
Solas	133	4.5	4.5	16	131	319	+103.2
Tigak	196	21.9	22.7	67	80	125	- 24.8
Tabar	407	30.2	15.0	45	71	142	- 41.0

<sup>a</sup> SCRAGG, R. F. R. Depopulation in New Ireland : a study of demography and fertility. Administration of Papua and New Guinea, 1957.

tance of infertility is apparent. In the village of Tigak and Tabar, the combined primary and secondary infertility rates of 40% were clearly the main factor in depopulation. In Solas, although infant mortality was 31%, depopulation did not follow because the infertility prevalence rate was only 9%.

### 3. CAUSES OF INFERTILITY AND PREGNANCY WASTAGE

The epidemiological and clinical data on the etiology of infertility and pregnancy wastage in countries in Africa south of the Sahara are limited. Such studies as exist have either been incomplete in terms of the diagnostic procedures used, based on highly selected populations, or focused on testing the association of one single etiological agent or mechanism with infertility or pregnancy wastage.

Several studies have examined different possible causes of infertility in a series of women or couples who presented themselves with this complaint to a specific hospital or clinic for diagnosis and treatment. The populations in these studies represent highly selected groups who had access to, accepted, and used the particular health facility. There are further limitations to such exclusively clinical studies. For example, although it is possible to document carefully the presence of tubal occlusion in the individual patient, it is not usually possible to identify the underlying cause of the occlusion, such as gonorrhoea, or post-partum or postabortal infection.

The association between a specific condition and infertility or pregnancy wastage has been examined in several studies. These have generally focused on gonorrhoea and serological evidence of treponematoses. Only limited conclusions can be drawn from the results of such studies. If the condition is diagnosed in the individual couple, statistical and epidemiological techniques exist for defining the relative risk of an association with infertility or the attributable risk of that condition contributing to infertility or pregnancy wastage. If, however, the association is demonstrated merely by showing a correlation of the prevalence of the condition with the prevalence of infertility or pregnancy wastage in several communities, then the relative etiological importance of that condition in comparison with others cannot be directly determined from the study of individual couples.

Furthermore, the demonstration of an association, for example between serological evidence of syphilis and infertility, is not synonymous with causation. The positive serology is more likely to be an

indirect indicator of gonorrhoea, a known cause of infertility, and the occurrence of which parallels the occurrence of syphilis.

Table 2 lists some of the diseases that have been most frequently associated with infertility and/or pregnancy wastage and shows what is at present known or suspected about their relative importance. In the following sections, a more detailed discussion of the etiological and quantitative relationships is given that takes into account all the limitations of the existing data.

TABLE 2. POSSIBLE MAJOR CAUSES OF INFERTILITY OR PREGNANCY WASTAGE IN AFRICAN AREAS WHERE THERE IS A HIGH PREVALENCE OF CHILDLESSNESS

Disease	Cause/effect relationship		Degree of contribution	
	Infertility	Pregnancy wastage	Infertility	Pregnancy wastage
Gonorrhoea	well established, direct	none	potentially major	none
Syphilis	none	well established, direct	none	potentially major, usually minor
Genital tuberculosis	well established, direct	none	apparently minor	none
Postabortal or postpartum sepsis	well established, direct	none	potentially major	none
Obstetric difficulties	indirect (secondary infertility only)	direct and possibly indirect	potentially major (secondary infertility only)	potentially major
Other systemic and local infections (see text)	a few, weak correlation	several, established	minimal	apparently minor

### 3.1 Gonorrhoea and infertility

#### 3.1.1 *Gonorrhoea, pelvic inflammatory disease, and tubal occlusion*

Pelvic inflammatory disease resulting from contagious spread of *Neisseria gonorrhoea* is the most common complication of primary genital tract infection. The infection in the woman starts as cervicitis, usually asymptomatic, and ascends by way of the uterine mucosa to produce endosalpingitis, followed by spread to the other layers of the fallopian tubes. Often salpingitis arises at the end of menstruation from a carrier state. Destruction of the tubal mucosa and subsequent scarring frequently leads to partial or complete tubal obstruction. The risks of occlusion appear greater the longer the infection



has continued and may also increase with repeated infection. Attempts to associate a gonococcal infection with tubal occlusion in individual cases are often difficult. The longer the duration of the salpingitis the smaller the possibility of identifying *N. gonorrhoea* in the individual.

### 3.1.2 *Gonorrhoea and its sequelae of infertility in the male*

In the male, gonorrhoea begins as urethritis and is usually symptomatic. However, an asymptomatic infection is not uncommon especially in areas with high prevalence of gonorrhoea and inadequate treatment. An ascending infection may involve the prostate gland and the seminal vesicles. The mechanism whereby the epididymis becomes involved is not well understood. It is generally thought to become affected as a result of retrograde passage of infected urine from the urethra along the lumen of the vas deferens. Both chronic seminal vesiculitis and chronic epididymitis may be associated with abnormal sperms, and the latter with occlusive azoospermia. The relative importance of the sequelae of gonorrhoea in man on the prevalence of infertility has not been well documented. However, very high prevalence rates of thickened epididymes (27.3%) have recently been reported from an area with low fertility and high prevalence of gonorrhoea.<sup>a</sup> In the era before effective chemotherapy, epididymitis was described as occurring in 17%–30% of the male cases of gonorrhoea.<sup>b</sup> But now, in areas with developed and widely available health services and with appropriate antibiotic treatment of gonorrhoea, this complication is rarely seen.

### 3.1.3 *The association between gonorrhoea and infertility in general*

In the absence of valid and reliable serological or other tests for gonorrhoea that are applicable several years after the original infection, the establishment of an association must depend on the simultaneous comparison of the prevalence rates of both infertility and gonorrhoea in several communities. Some supportive evidence can be obtained by cohort analysis of the prevalence of infertility or age-specific birth rates in communities where mass penicillin treatment for yaws or even gonorrhoea has taken place. An association of gonorrhoea and infertility has been inferred in several communities from a comparison, on a community basis, of such indices as prevalence rates of *N. gonorrhoea* in surveys, rates of reported gonorrhoea and urethritis, and urethral

<sup>a</sup> ARYA, O.P. ET AL. *Bull. World Health Organ.*, 49 : 587–595 (1973).

<sup>b</sup> WHO Technical Report Series, No. 262, 1963.