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SPONTANEOUS AND INDUCED ABORTION

Report of a WHO Scientific Group

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SPONTANEOUS AND INDUCED ABORTION

Report of a WHO Scientific Group

A WHO Scientific Group on Spontaneous and Induced Abortion met in Geneva from 10 to 14 November 1969. The meeting was opened by Dr A. M.-M. Payne, Assistant Director-General, who welcomed the members on behalf of the Director-General.

1. INTRODUCTION

The problems of spontaneous and induced abortion have been referred to in previous meetings convened by WHO. Consideration was given in one meeting to the role of chromosomal anomalies in spontaneous abortions.[1] A Scientific Group on the health aspects of family planning[2] pointed to the mortality and morbidity associated with illegally induced abortion, and to the limited knowledge of many aspects of the epidemiology of abortion in different populations.

The present meeting was convened to discuss definitions, terminology, and sources of data; to review present knowledge of the epidemiology of abortion; to consider consequences in terms of maternal morbidity and mortality and of fetal deaths; and to recommend research areas of high priority. It did not concern itself with clinical management problems, not with the legal and demographic aspects of abortion.

2. DEFINITIONS

The Third World Health Assembly in 1950[3] adopted the recommendation by a WHO Expert Committee on Health Statistics, that fetal death be defined as " death prior to the complete expulsion or extraction from

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[1] *Bull. Wld Hlth Org.,* 1966, **34**, 765-782.

[2] *Wld Hlth Org. techn. Rep. Ser.,* 1970, No. 442.

[3] World Health Organization (1969) *Handbook of Resolutions and Decisions of the World Health Assembly and the Executive Board,* Geneva, p. 127 (resolution WHA 3.6).

its mother of a product of conception, irrespective of the duration of pregnancy. . . ".[1] The Expert Committee also recommended that fetal deaths be divided into three major categories : early fetal deaths at less than 20 completed weeks of gestation, intermediate fetal deaths at 20 but less than 28 weeks, and late fetal deaths at 28 weeks or more;[2] and that the last group be regarded as synonymous with the older, and widely accepted, concept of stillbirth.[3]

2.1 Definition of abortion

As used by the medical profession, the term " abortion " denotes the termination of a pregnancy before the fetus has attained viability, i.e., become capable of independent extra-uterine life. Viability is usually defined in terms of duration of pregnancy and/or weight of fetus, or occasionally length of fetus. A recent inquiry by WHO revealed considerable variation in the definitions used in different countries.[4]

It has traditionally been assumed that viability is attained at 28 weeks of gestation, corresponding to a fetal weight of approximately 1000 g. This definition is based on the observation that infants below this weight have little chance of survival, while the mortality of infants above 1000 g declines rapidly. In recent years, some authorities have placed the upper limit of abortion at 20 weeks or at 500 or even 400 g, because some infants of this weight have in fact survived, and the term " immature " has been used to describe fetuses weighing between 500 (or 400) and 1000 g. The etiological and clinical factors associated with intermediate fetal deaths (20–27 weeks) are in fact more similar to those found later in pregnancy than to those found in the early group.

Most members of the Scientific Group expressed a preference for 20 weeks as the upper gestational limit in defining abortion. The traditional limit of 28 weeks has been retained in this report, however, because it is used by most of the countries that have adopted a definition of abortion, because it complements the definition of stillbirth recommended by the WHO Expert Committee on Health Statistics (see section 2), and because it corresponds to a definition given in the International Classification of Diseases.[5] The choice of upper gestational limit is relatively unimportant as regards the incidence of abortion, since fetal deaths in the period

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[1] *Wld Hlth Org. techn. Rep. Ser.*, 1950, No. 25, p. 12.

[2] *Wld Hlth Org. techn. Rep. Ser.*, 1950, No. 25, p. 13.

[3] *Wld Hlth Org. techn. Rep. Ser.*, 1950, No. 25, p. 14.

[4] *Wld Hlth Statist. Rep.*, 1969, Vol. 22, No. 1, p. 38-42.

[5] World Health Organization (1967) *Manual of the international statistical classification of diseases, injuries, and causes of death,* 1965 revision, Geneva, p. 243.

20-27 weeks are far outnumbered by those occurring before 20 weeks. The choice is of greater importance when dealing with statistics relating to perinatal mortality.

From a clinical point of view it is important to make a further distinction between early and late abortions, separating fetal deaths at less than 12 completed weeks of gestation from those occurring at 12 but less than 20 weeks.

2.2 Duration of pregnancy

It is customary to define the duration of pregnancy in terms of the interval between the onset of the last menstrual period and the expulsion or removal of the fetus. This definition continues to be used although it is known that fertilization of the ovum occurs, on the average, about two weeks after the onset of menstruation, and that implantation is not completed until about one week later. From a clinical point of view, it is important to bear in mind that some women experience bleeding episodes after pregnancy has been established and that these episodes may be misinterpreted as menstrual flow.

The duration of pregnancy is customarily stated in weeks or lunar months. The latter practice involves problems of comparison, owing to the differences between completed months, nearest month, and ordinal month.[1] In terms of completed lunar months a pregnancy of three months' duration corresponds to 12-15 completed weeks; in terms of the nearest month, to 10-13 completed weeks; and in terms of ordinal months, an abortion during the third month of gestation has been preceded by 8-11 completed weeks of pregnancy. The use of weeks rather than months is generally regarded as preferable; if months are used it should be made clear which concept of month has been employed.

2.3 Failure of implantation

Whether the failure of a fertilized ovum to implant constitutes abortion depends on one's definition of conception and pregnancy. If conception is thought to occur with the union of sperm and ovum, then a fertilized ovum is a product of conception and its failure to implant constitutes abortion; if pregnancy is thought to begin with implantation, then prior loss of the ovum does not constitute abortion. Clinically, failure to implant causes, at most, a slight delay in the menstrual flow without a woman suspecting pregnancy. Because a woman cannot recognize failure to implant, it is necessarily ignored in all the studies of incidence based on interrogation.

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[1] i.e., first, second, third, etc., month of pregnancy.

2.4   Errors of registration

Notwithstanding the recommendation adopted by the WHO Expert Committee on Health Statistics (see pp. 5 & 6), deliveries prior to the 28th week of gestation of live-born infants who die soon after birth are sometimes mistakenly referred to as abortions. According to one major study,[1] the number of such infants equalled 0.25 % of all live births, 0.7 % of all fetal deaths prior to 28 weeks, and about one-sixth of all pregnancies terminating in either live birth or fetal death between 20 and 28 weeks. Conversely, a fetal death may on occasion be registered as a live birth followed by death of the infant, if economic or other advantage can be derived from this procedure.

2.5   Terminology of abortion

There are two major categories of abortion, spontaneous and induced. Induced abortions are those initiated by deliberate action undertaken with the intention of terminating pregnancy; all other abortions are considered as spontaneous even if an external cause is involved, such as trauma or communicable disease.

The legal conditions under which an abortion is induced may have important medical implications. Illegal abortions are frequently performed by unqualified persons under unsatisfactory conditions, with dire consequences. It should be noted, however, that self-induced abortions are subject to a high risk of infection and other complications, including fatal outcome for the woman, even in countries where they are legal.

Diagnosis of illegal or self-induced abortion in most cases requires a statement by the woman involved, members of her family, or the abortionist. In the absence of such a statement or of evidence of manipulation, such as injury to the cervix or perforation of the uterus, it is rarely possible, either clinically or at autopsy, to differentiate between spontaneous and induced abortion. Most septic abortions are thought to be induced, but many induced abortions show no signs or symptoms of infection.

Such diagnostic categories as threatened, imminent, incipient, inevitable, and incomplete abortion are descriptive terms for stages in a process, and are significant only in relation to a specific moment in time. The process results either in continuation of the pregnancy (as may occur in threatened abortion) or in a complete or artificially completed abortion. Missed abortion is retention of the conceptus for a prolonged period, sometimes arbitrarily defined as two months or more.

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[1] French, F.E. & Bierman, J. M. (1962) Probabilities of fetal mortality. *Publ. Hlth Rep. (Wash.)*, **77**, 835-847.

A semantic distinction should be made between " abortus ", indicating the product of conception after its expulsion or removal, and " abortion ", indicating the process of expulsion or removal.[1]

The term " miscarriage " is employed by the lay public as equivalent to spontaneous abortion; its use in a scientific context is obsolescent and not recommended.

2.6 Ectopic pregnancy and hydatidiform mole

Ectopic pregnancy results from the implantation of a fertilized ovum outside the uterine cavity, usually in the fallopian tube. Ectopic pregnancy rarely produces a live-born infant; in most cases the fetus dies long before reaching viability, thus fitting the usual definition of an abortus. Ectopic pregnancies represent a very small fraction of all early and intermediate fetal deaths; they are, therefore, statistically unimportant.

Hydatidiform mole is a condition in which the chorionic villi are swollen by the accumulation of fluid. If an embryo is found it is usually severely stunted in growth. Abortion is inevitable.

Because of their special etiological, epidemiological, and clinical features, ectopic pregnancy and hydatidiform mole are usually discussed separately rather than under the heading of abortion. This practice will be followed in the present report (see section 6).

2.7 Mortality and morbidity due to abortion

Abortion appears in the International Classification of Diseases (ICD) in two places; (a) as a disease or cause of death of a woman [2] and (b) with reference to the fetus.[3] With reference to the woman, abortion is defined as " any interruption of pregnancy before 28 weeks of gestation with a dead fetus ".[2] This definition has remained substantially the same since 1938; in spite of its wording it does not include ectopic pregnancy. The following discussion is limited to the most recent revisions of the ICD, the seventh and eighth, adopted in 1955 and 1965 and published in 1957 and 1967, respectively.

The seventh revision of the ICD (see p. 194–195) specifies three primary categories of abortion :

650 Abortion without mention of sepsis or toxaemia

651 Abortion with sepsis

652 Abortion with toxaemia, without mention of sepsis

[1] *Bull. Wld Hlth Org.*, 1966, 34, 768.

[2] World Health Organization (1967) *Manual of the international statistical classification of diseases, injuries, and causes of death*, 1965 revision, Geneva, p. 243.

[3] World Health Organization (1967) *Manual of the international statistical classification of diseases, injuries, and causes of death*, 1965 revision, Geneva, p. 298.

Each of these three categories is divided into four sub-categories :

.0 Spontaneous or unspecified

.1 Induced for medical or legal indications

.2 Induced for other reasons

.3 Other

The sub-category " other " includes carneous mole, fleshy mole, haemorrhagic mole, molar pregnancy, placental polyp with abortion, and retained products of conception.

Ectopic pregnancy appears as category 645, with two sub-categories, with and without sepsis; hydatidiform mole appears as sub-category 648.1 under the heading of " other complications of pregnancy " (see seventh revision of ICD, p. 192–193).

In the eighth revision of the ICD (see p. 243–244), the four former sub-categories become six primary categories :

640 Abortion induced for medical indications

641 Abortion induced for other legal indications

642 Abortion induced for other reasons

643 Spontaneous abortion

644 Abortion not specified as induced or spontaneous

645 Other abortion

There are the following four sub-categories :

.0 With sepsis

.1 With toxaemia

.2 With sepsis and toxaemia

.9 Without mention of sepsis or toxaemia

except in the case of 642 " abortion induced for other reasons ", which is divided into five sub-categories :

.0 With sepsis

.1 With haemorrhage

.2 With sepsis and haemorrhage

.3 With laceration of pelvic organ (with or without mention of sepsis or haemorrhage)

.9 Without mention of sepsis, haemorrhage, or laceration

Ectopic pregnancy is still a separate primary category (631), with eight sub-categories by four locations (abdominal, tubal, ovarian, and other or unspecified) with and without sepsis. Hydatidiform mole again

appears as sub-category 634.2, under the heading of " other complica-
tions of pregnancy " (see eighth revision of ICD, p. 240).

For primary death classification, in the seventh revision of the ICD
(see p. 194–195) the sub-category " induced for medical or legal indica-
tions " included " abortion therapeutically induced on account of any
complication of pregnancy or other disease ". This instruction allocated
all deaths associated with therapeutic abortions to the three primary
categories 650–652. In the eighth revision, the corresponding instruc-
tion prescribes that category 640 is " not to be used if the complication
of pregnancy or other condition requiring induction is known ". Cate-
gory 640 is thus limited to therapeutic abortions for unstated reasons.
Statistics tabulated according to the seventh revision (650.1, 651.1, and
652.1) and the eighth revision (640, 641) are not, therefore, comparable.

As stated above, ectopic pregnancy is not included with abortion
in either the seventh or the eighth revision of the ICD. This is in confor-
mity with general medical usage. For the sake of consistency, however,
the definition of abortion should be made more specific by inserting the
word " intra-uterine " before the word " pregnancy ".

With reference to the fetus, the category 773 " termination of preg-
nancy " appears in the eighth revision of the ICD; no definition of
abortion is given in connexion with this category, nor has any provision
been made for classifying early and intermediate fetal deaths by cause.

3. SOURCES OF DATA

3.1 Vital statistics

Whilst the registration of stillbirths is mandatory in many countries,
registration of abortions has been attempted in a few areas only. Nowhere
has it been possible to achieve complete registration of abortions as part
of the vital statistics system. There are several reasons for this failure :
(a) many very early abortions are either undetected or do not require
assistance from health professionals; (b) registering an abortion offers
none of the economic, social, or political advantages that a live-born
child may later derive from his birth having been registered; there is,
therefore, no incentive for registration by the family; (c) a burial permit
cannot be used as an administrative device to enforce registration, since
formal interment is not customary in most communities; (d) although
abortions initiated by unqualified abortionists or by pregnant women
themselves may come to the attention of the authorities through requiring
medical after-care because of haemorrhage, infection, or other compli-
cations, illegal abortions performed by medical practitioners usually
escape such attention.

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Some countries and administrative areas have broadened their laws regulating abortion, and have made the reporting of all induced abortions mandatory. Some of these countries and areas publish annual statistics, which may be complete and comprehensive or incomplete and limited to national totals.

3.2 Hospital statistics

Many cases of abortion do not require hospitalization, hence the number of women admitted to hospitals for treatment or after-care do not represent the total number of abortions occurring in the community. The proportion of all cases of abortion that are admitted to hospital can rarely be estimated with a reasonable degree of accuracy, and no doubt varies between countries, within countries, and with time.

Some hospitals keep complete records of all abortions performed by their staff, in conformity with national and/or local statutes, regulations, and customs. Many statistical series based on such records for individual hospitals have appeared in the medical literature.

3.3 Retrospective surveys

Because all investigators have encountered great difficulties in attempting to collect information on the number of abortions in a community at the time of their occurrence, retrospective surveys of selected groups of women have become a common method of research. The completeness of the information obtained in such surveys depends on (a) the ability of the women to remember abortions that have occurred several years previously and (b) their willingness to talk about abortions, particularly those illegally or self-induced. In addition, certain types of retrospective surveys are subject to special biases, which vary with specific types of informants.

3.3.1 Population samples

Several investigations have been made into the incidence of abortion among women in carefully selected samples of the general population in various localities. Some of these investigations, in which the primary concern was contraception, and abortion was an item of secondary importance, have tended to yield lower estimates of the incidence of abortion than others in which abortion was the primary concern. It is a matter for conjecture to what extent any survey has approached complete coverage. It is worth noting that the women interviewed in a recent nation-wide survey, in a country where abortion is freely available, only admitted to about half as many induced abortions as would

have been expected on the basis of the number known to have been performed in that country's hospitals.

The type of response may alter as public and private attitudes towards abortion change. A more permissive climate of opinion may encourage women to talk more freely about their experiences. This has been observed not only in successive surveys, but also in the responses of older and younger women in the same survey.

3.3.2 Obstetric patients

Because of the interviewer's difficulty in establishing close rapport in surveys of the general population, many investigators have turned their attention to special groups within the population where this problem is thought to be less serious. Obstetric patients constitute one such group, because they generally accept questions as to the number and outcome of previous pregnancies as a routine part of their medical history. The weakness of this method is that it only includes abortions that are followed by another pregnancy. Induced abortion within marriage may be resorted to not so much as a method of child spacing as a method of limiting the ultimate size of the family; therefore, either it is not followed by another pregnancy or if a 'further pregnancy occurs it may be terminated in the same way. Induced abortions are underrepresented, therefore, among the previous pregnancies of obstetric patients, quite apart from the question of under-reporting.

With regard to spontaneous abortion, the bias may be reversed. In a population in which many couples practise contraception successfully, women who experience spontaneous abortions are more likely to undertake additional pregnancies than those who carry their earlier pregnancies to term. This type of bias tends to increase the apparent incidence of spontaneous abortion among the previous pregnancies of maternity patients in such populations.

Another possibility of distortion is introduced by the fact that abortions tend to recur; this is true for both spontaneous and induced abortions. The incidence of abortion among previous pregnancies is higher, therefore, among women whose current pregnancy ended in abortion, than among those whose current pregnancy produced a viable infant. In other words, an abortion ratio calculated from the histories of parturient women alone will tend to be too low, whilst a ratio based on the histories of women with recent abortions may be too high. To obtain a balanced picture, therefore, one must include both obstetric patients who have given birth and those who have had abortions.

3.3.3 Gynaecological patients

Gynaecological patients may be as willing as maternity patients to answer questions concerning the number and outcome of their pre-

vious pregnancies, but their histories cannot provide a reliable basis for estimating the incidence of abortion in the general population. Some of these patients may suffer from conditions causing spontaneous abortion, and some from pathological conditions resulting from induced abortion. These biases would both tend to increase the numbers of abortions in the histories of gynaecological patients.

3.3.4 *Family planning clinics*

Many studies of the incidence of abortion have been based on the histories of women attending family planning clinics. Whilst it might be assumed that the woman seeking advice on birth control has confidence in the interrogator, this is not always the case. Furthermore, even the advantage of good rapport is offset by selective factors pertaining to attendance at the clinic. Women attending a family planning clinic often include a large proportion of the highly fertile, and of those who wish to limit the size of their family but have not succeeded in their contraceptive efforts. The combined effect of this double selection is to reduce the incidence of spontaneous abortion, and to increase that of induced abortion, in the histories obtained.

3.4 Prospective surveys

3.4.1 *Surveys of women*

Still another approach to the study of abortion is the prospective survey. Two types have been tried : surveys of women and surveys of pregnancies. In the former type, a group of women is identified and periodically re-interviewed to determine the occurrence of pregnancies, births, and abortions during each interval. In several studies, the reporting of fetal deaths was substantially more complete in a prospective survey than in a retrospective survey of the same women, taking age and parity changes into consideration.

3.4.2 *Surveys of pregnancies*

Prospective surveys of pregnancies are based on the identification of a group of intact pregnancies at as early a stage of gestation as possible. Pregnancies that come under observation because of actual or threatened abortion are excluded. The identified pregnancies are then followed up until they are terminated by abortion or delivery. On the basis of the data thus obtained, prenatal life tables have been compiled indicating the probability of fetal death per week per 1000 known pregnancies entering each successive week of gestation. Accumulation of these weekly probabilities up to and including the 28th week has given overall probabilities of abortion, per 1000 pregnancies entering obser-

vation, which are substantially greater than the unadjusted numbers of abortions per 1000 pregnancies derived from the same basic data. Special efforts are necessary if spontaneous and induced abortions are to be separated in studies of this type.

A promising method for studying the incidence of early abortion is by performing pregnancy tests on a group of women at appropriate (if possible, monthly) intervals. For maximum precision, it is important to employ a test giving the smallest number of false positive results; it is less important to avoid false negative results. If the group chosen for study consists of women desirous of pregnancy, a reliable estimate of spontaneous abortions may be obtained. Several studies of this type have been initiated in various countries, but no definite results are yet available owing to difficulties in collecting urine samples, interpreting test results, etc.

In surveys of the general population or of specific groups, due consideration should be given whenever applicable to the question of informed consent, as recommended in the Declaration of Helsinki.[1] In the research design and in handling the data, confidentiality and privacy should be maintained.[2]

3.5 Maternal mortality and morbidity due to abortion

3.5.1 Mortality

In many countries, information on the number of deaths attributed to abortion is obtained as a part of the tabulation of all registered deaths by cause. Some deaths due to abortion are presumably reported under other diagnoses, either unknowingly because the correct diagnosis was not made, or intentionally. It is not possible to determine the magnitude of this error for any country. However, some estimates of the number of deaths from abortion, e.g., 5000 to 10 000 annually in the USA, made three decades ago, which were possibly correct at that time and are still widely quoted, are patently much too high when compared with the total number of deaths, from all causes, of women of reproductive age in recent years.

There is substantial agreement among obstetricians and public health workers that, in most countries, a large majority of deaths attributed to abortion result from abortions induced by unqualified persons or by pregnant women themselves. As a rule, this predominance is not adequately reflected in statistics based on death certificates, since physicians do not usually certify a death as being caused by an unlawful act unless the diagnosis has been established beyond reasonable doubt. By and

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[1] World Medical Association (1964) *Declaration of Helsinki*, New York.

[2] *Wld Hlth Org. techn. Rep. Ser.*, 1969, No. 435, p. 16.

large, the category " abortion induced for other reasons " appears to be limited to situations where the death has been reported to the police or courts; in some countries this is definitely so.

Information on deaths associated with legal abortions can be obtained either from general cause-of-death statistics, if these have been tabulated in sufficient detail according to the ICD, or else from special reports on legal abortions made to a central authority and containing details of the outcome of the operation. General cause-of-death statistics cannot be used for this purpose (see instructions to the ICD, eighth revision, section 2.7). It may be assumed that the statistics obtained from a separate system of reporting are more complete. An attempt should be made to distinguish between deaths due to the operation, including deaths from anaesthesia, and deaths due to a disease or condition for which the pregnancy was terminated. The latter type of death may be of considerable importance in countries where medical indications for abortion are narrowly interpreted and most legal abortions are performed on severely ill women.

3.5.2 *Morbidity*

Information on maternal morbidity associated with abortion is derived primarily from hospital records. In some countries the more serious complications must be reported to a central authority, and statistics based on these reports have been published.

Valuable sources of information on the late sequelae of abortion are prospective studies of women known to have had abortions. The scientific value of such studies is greatly enhanced if the completeness of the follow-up approaches 100 %.

Another approach is the so-called " case–control " study. In such studies the investigator compares the relative frequency of a suspected causative factor, among persons suffering from a specified disease or condition (" cases ") and among other persons not suffering from this disease or condition, thought to represent the general population (" controls "). The " case–control " method has been used extensively in assessing the sequelae of induced abortion. The results of many of these studies have been inconclusive, because of the frequent difficulty in eliminating bias in the selection of " controls ", and in making them strictly comparable with the " cases ".

3.6 Other sources

In addition to the statistical sources for evaluating the incidence of, and mortality associated with, abortion, a broad spectrum of biological research methods has been brought to bear upon the subject, involving

anatomy, histology, embryology, physiology, genetics, cytology, chemistry, bacteriology, virology, etc. Research has included not only the examination of abortuses, but also such special approaches as the recovery of fertilized ova by medically indicated hysterosalpingectomy with subsequent flushing of the endometrial cavity and/or fallopian tubes, and by relating the results of such studies to the timing of a preceding coitus.

Police and court records may be important sources in medico-legal studies of induced abortion. It appears, however, that in most countries only a minute fraction of all illegal abortions come to the attention of the law-enforcement agencies, whose records are, therefore, of no value in assessing the true incidence or changes in incidence.

4. STATISTICAL ANALYSIS

The statistical analysis of data relating to abortion usually begins with tabulations by type of abortion, period of gestation, sex of fetus, and various characteristics of the women who have had the abortions. If the number of abortions justifies it, tabulation by single years of maternal age is more informative than tabulation by five-year age groups, especially for women under 20 years of age. As an alternative or supplementary procedure, the data may be tabulated in terms of age ranges considered relevant to the biological and social factors involved.

4.1 Abortion rates and ratios

Further statistical analysis is concerned with the frequency of abortion in relation to (a) the total population, or preferably the female population of reproductive age and (b) the total number of births, deliveries, or pregnancies. The types of information obtainable by these two main approaches are different but complementary. Both can produce information relevant to the understanding of abortion.

Some authorities have proposed that measures of the abortions/population or abortions/women relationship should be referred to as *rates*, and measures of the abortions/births, abortions/deliveries, or abortions/pregnancies relationship as *ratios*. Since the distinction is not universally accepted and could produce misunderstanding and confusion, the relevant denominator is identified in this report whenever necessary.

Abortion rates have been used primarily for the study of legal and other registered abortions, generally admissions to hospital for treatment or after-care. The crude abortion rate is the number of abortions per year per 1000 total population at mid-year; it corresponds to other crude rates in vital statistics, such as the crude birth rate. A more refined measurement is the general abortion rate per 1000 women of repro-

ductive age (conventionally defined as 15–44 or 15–49 years), analogous
to the general fertility rate. Age-specific abortion rates, like age-specific
fertility rates, can be cumulated to successive ages, usually at five-year
intervals. Cumulation over the entire reproductive period gives the
total abortion rate per 1000 women during their lifetime, in the same
way as the total fertility rate is calculated. Cumulative and total rates
may be computed either on a " period " basis, for one or several years,
or on a " cohort " basis, for women born during a given year or period.
The number of abortions per 1000 women, obtained in a retrospective
survey, is a weighted average of the cumulative abortion rates for all
cohorts of women included in the survey; it is of doubtful value statistic-
ally unless presented by age at interview. A related measure, the number
of women with abortion experience per 1000 women, equals the cumu-
lative rate of first abortions.

Abortion ratios may be computed per 1000 live births or deliveries
or per 1000 pregnancies (or, more accurately, per 1000 known pregnancies).
The abortion ratio per 1000 deliveries is most often used in studies of
legal abortions, especially if such abortions are relatively infrequent.
Age-specific abortion ratios per 1000 pregnancies are usually computed
in terms of age at conception, but age-specific abortion ratios per 1000
live births are often based on age when the pregnancy is terminated. The
latter method may introduce a serious error for the youngest age group
and smaller errors for all other age groups. Women who conceive
between 19 years 3 months and 19 years 9 months of age will most likely
appear in the " under-20 " age group if they abort, whilst most of them
will be in the " 20–24 " age group if they give birth. Conceptions during
these six months may represent more than 25 % of all conceptions during
the first 20 years of life. The displacement of births into the next higher
age group produces an inflation of the abortion ratio for the youngest
age group. Conversely, the abortion ratios for all higher age groups
are reduced, especially that for the highest age group. An illustrative
example of the distortion of age-specific abortion ratios appears in Table 1.

A similar distortion may also affect the abortion ratios for successive
calendar years if the annual number of pregnancies is changing rapidly.

4.2 Life tables

If the requisite data are available, weekly or monthly abortion ratios
for successive periods of gestation may also be computed. This type
of analysis requires the use of life table concepts and procedures, and
permits the study of spontaneous and induced abortions either in terms
of " gross " ratios as independent risks by means of single-decrement
life tables, or in terms of " net " ratios as competing risks by means of

TABLE I.   LIVE BIRTHS, LEGAL ABORTIONS,
AND SPONTANEOUS ABORTIONS, RELATED TO MATERNAL AGE. CZECHOSLOVAKIA, 1964 *

Age (years)	By maternal age at birth or abortion			By estimated maternal age at conception		
	Live births	Legal abortions	Spontaneous abortions	Live births	Legal abortions	Spontaneous abortions
Numbers :						
— 19	28 100	4 304	2 411	43 779	4 825	2 800
20-24	101 683	13 033	8 217	97 676	13 242	8 214
25-29	60 272	15 272	6 622	54 884	15 379	6 526
30-34	33 003	17 337	5 207	29 829	17 323	5 139
35-39	14 277	14 095	3 537	12 309	13 818	3 457
40 —	3 953	6 240	1 949	2 811	5 694	1 807
Total	241 288	70 281 [a]	27 943	241 288	70 281 [a]	27 943
Abortion ratios :						
— 19	—	153.2	85.8	—	110.2	64.0
20-24	—	128.2	80.8	—	135.6	84.1
25-29	—	253.4	109.9	—	280.2	118.9
30-34	—	525.3	157.8	—	580.7	172.3
35-39	—	987.3	247.7	—	1 122.6	280.9
40 —	—	1 578.5	493.0	—	2 025.6	642.8

[a] Excludes abortions for which information on maternal age was not available.

* Sources : (1) Czechoslovakia, State Statistical Office (1967) *Pohyb obyvatelstva v Ceskoslovenské Socialis-ticke Republice v roce 1964* [*Population dynamics in the Czechoslovak Socialist Republic in 1964*], Prague

(2) Czechoslovakia, Ministry of Health (1965) *Statistika portretu za rok 1964* [*Statistical patterns for 1964*]. Prague

multiple-decrement life tables. The sum of the net ratios for spontaneous and induced abortions equals the abortion ratio per 1000 pregnancies for the aggregate of all abortions.

4.3 Maternal mortality and morbidity due to abortion

4.3.1 *Mortality*

Deaths from abortion are best analysed in terms of annual mortality rates per 100 000 women of reproductive age, or in specific age groups within this range, or else in terms of mortality rates per 100 000 abortions. For the sake of consistency the former should probably be referred to as ratios, but the term " mortality rate " is so well established that there appears to be little hope of changing it. Mortality in relation to the number of abortions has been successfully studied for legally induced abortions only; for other types of abortions, neither the numerator nor the denominator is known sufficiently accurately.

The time-honoured practice of computing mortality rates from abortions per 100 000 live births, as a part of maternal mortality, is not recommended, since women who have a live birth are not simultaneously

exposed to the risk of dying as a result of abortion. Secondary approaches to the evaluation of abortion are the proportion of abortion deaths among all deaths from complications of pregnancy, childbirth, and the puerperium, and among all deaths in women of reproductive age.

4.3.2 Morbidity

The concepts and procedures outlined in the preceding paragraphs, relating to mortality associated with abortion, also apply to morbidity and to specific complications.

5. SPONTANEOUS ABORTION

5.1 Incidence

According to embryological evidence the greatest loss of fertilized ova occurs prior to implantation, and the next greatest loss during the week following implantation. These generalizations are based on a comparison of the numbers of corpora lutea and of embryos in some polytocous mammals, and are further supported by observations on the condition of fertilized human ova recovered from the fallopian tubes or endometrial cavity. Since these early losses are not associated with any clinical signs and symptoms, they do not appear in statistics on the incidence of spontaneous abortion.

Even after excluding very early losses, the incidence of spontaneous abortion remains a matter of controversy. The major sources of error that must be considered when assessing all statistics on this subject are (a) unrepresentative nature of the populations available for study in various regions of the world; (b) understatement, caused by failure to recognize the abortion when it takes place, lack of recall, or inadequate rapport between the woman and the interrogator; and (c) overstatement, caused by the misreporting of temporary amenorrhoea and of induced abortions as spontaneous abortions.

In 1954, the Population Division of the United Nations published an estimate, based on 20 statistical series then available, of approximately 10 spontaneous abortions per 100 pregnancies.[1] Since the publication of this estimate, which is still widely quoted, a considerable amount of new data has become available suggesting that the earlier estimate was too low, and indicating that an overall ratio of 15–20 spontaneous abortions per 100 pregnancies may be a more reasonable estimate.

It seems reasonable to deduce that the incidence of spontaneous abortion varies among human populations, but it is not known to what

[1] United Nations, Population Division (1954) Fetal, Infant and Early Childhood Mortality. Vol. 1. The Statistics. New York, p. 14–15.

extent variations in abortion ratios found by investigators reflect differences in methodology and response, rather than true differences due to genetic and/or environmental factors.

5.1.1 Gestational age

The weekly abortion ratios decline throughout the period during which pregnancy is subject to the risk of clinically recognizable abortion, i.e., from approximately the fifth to the end of the 28th week of gestation. In one carefully conducted study [1] involving the entire population of one of the smaller Hawaiian islands, the following probabilities of fetal death during successive four-week periods were computed (A) per 1000 pregnancies entering each four-week period and (B) per 1000 pregnancies entering the fifth week of gestation :

Weeks	A	B
5th – 8th	108.1	108.1
9th – 12th	69.9	62.3
13th – 16th	44.8	37.2
17th – 20th	13.3	10.6
21st – 24th	8.5	6.6
25th – 28th	3.2	2.4
		227.2

According to the life table procedure, the fetal death ratio was 227.2 per 1000 recognizable pregnancies. Almost half of all fetal deaths occurred prior to the ninth week of gestation, three out of four prior to the 13th week, and more than nine out of ten prior to the 17th week. Other studies in Pakistan, Sweden, and the USA have yielded lower abortion ratios but a similar pattern of distribution of abortions by period of gestation.

5.1.2 Maternal age

According to limited observations in a few countries, the number of spontaneous abortions per 100 pregnancies increases with maternal age, pregnancy order, and the number of previous abortions. While these associations appear to be independent, they reinforce each other. The association with pregnancy order reflects, in part, the tendency of abortion-prone women to undertake additional pregnancies in order to achieve the number of children they want. The abortion ratio increases with age, however, even among women who do not have a history of previous abortion and who do not have to replace any previous fetal losses.

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[1] French, F. E. & Bierman, J. M. (1962) Probabilities of fetal mortality, *Publ. Hlth Rep. (Wash.)*, 77, 835-847.

5.2 Etiology and pathogenesis

Human development may be affected by a variety of disturbances due to genetic, infectious, physical, chemical, and other as yet unknown factors. Although the ultimate causes of spontaneous abortion and the precise pathogenetic mechanisms leading to it are unknown, significant morphological and other abnormalities are often recognized in the conceptus. Some of these abnormalities probably have a causal relationship to the event, but the recognition of one abnormality (e.g., morphological or chromosomal) does not preclude the possibility that multiple factors may act synergistically. For convenience, the major categories of determinants are discussed separately.

5.2.1 Genetic factors

The consensus of opinion from chromosome studies of embryonic tissue and amnion/chorion is that about 25% of spontaneously aborted conceptuses are aneuploid, compared with approximately 2.5% of conceptuses obtained by induced abortion or approximately 0.5% in the perinatal period. The frequency of aneuploidy is much higher in very early abortuses than after the first trimester, and the type of chromosomal aberration differs with advancing fetal age; more structural rearrangements and mosaics are found towards mid-pregnancy. The abnormalities identified are principally trisomies of autosomes, XO, and polyploidies (primarily triploidy).[1] While some of the trisomies identified in abortuses are also found among neonates, other trisomies (e.g., A, B, 16) and polyploidy appear to be incompatible with prolonged intra-uterine development. It is now apparent also that most XO conceptuses are aborted. The precise reasons for the frequent occurrence of chromosomal nondisjunction during gametogenesis, and the pathogenesis of the events leading to abortion, are not fully understood. In most cases these events appear to be the result of *de novo* mutations.

In some instances, chromosomal abnormalities have been found to be the result of faulty spermatogenesis. In others, faulty maternal gametogenesis must be responsible. Delayed ovulation leading to " over-ripeness " of the ovum has been incriminated as a possible cause, as have viruses, irradiation, cumulative effects associated with " aging ", and chemical factors, but none has been proved. The possible effects, if any, of the previous use of hormonal contraceptives on the occurrence of chromosomal abnormalities in the fetus are currently under investigation.

Abortuses having monosomy or trisomy of certain autosomal chromosomes (e.g., 19–20), have not been observed. This suggests that

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[1] *Bull. Wld Hlth Org.*, 1966, **34**, 765-782.

such zygotes fail to implant or are aborted too early to be clinically apparent. Implicit in this assumption is the notion that total zygotic loss may much exceed the abortion ratio described previously. It is not known at present whether single genic mutations (" lethal genes ") contribute to the causation of spontaneous abortions.

5.2.2 Infectious factors

Infectious diseases may cause spontaneous abortion either through fetal infection and death or by initiating uterine contractions. At times it may be impossible to ascertain whether hyperpyrexia or fetal infection was the pathogenetic factor. Fetal infection with rubella is not only responsible for specific congenital anomalies but also results in more frequent spontaneous abortion. Cytomegalic inclusion disease, variola, and other viral infections are also known to cause fetal death. Numerous other viral infections (hepatitis, respiratory disease viruses, etc.) have been associated with increased fetal wastage, but the pathogenetic mechanism, particularly the occurrence of fetal infection, has been less well documented and needs further study.

A few abortions have resulted from fetal vaccinia, when vaccination has been performed during pregnancy. The reason for this rare complication is unknown; it is not considered a contraindication to vaccination of pregnant women in smallpox endemic areas, since there is a greater risk from the disease itself.

Protozoa (*Toxoplasma gondii*), fungi, and bacteria are also known to infect the fetus occasionally. In general, the contribution of such infections to spontaneous abortions is small or not understood. Recently it has been suspected that endocervical infection (often with mycoplasma organisms) may be the cause of abortions during the second trimester. The recurrence rate is high and chorioamnionitis is a regular finding. Simultaneous urethral infection of the sexual partner has been an important associated finding.

5.2.3 Physical and chemical factors

Trauma can rarely be proved to be the direct cause of a spontaneous abortion; it is difficult to lay down criteria for establishing a causal relationship. It is generally assumed that bleeding and expulsion commence soon after the traumatic episode.

Various types of radiation have been shown to cause congenital anomalies and fetal death, the amount of radiation energy delivered and the stage of fetal development being important variables. There is no scientific evidence that diagnostic roentgenography during pregnancy is a cause of spontaneous abortion.

Similarly, the effects of severe hypoxia vary with the stage of fetal development and can only rarely be incriminated as causing abortion.

Many chemicals, including drugs, are transferred from mother to fetus and a few are known to cause fetal abnormalities, notably thalidomide, goitrogens, and folic acid antagonists. In some cases abortion may ensue. There is no evidence that more widespread agents, e.g., pollutants and heavy metals, cause spontaneous abortion.

It is not known whether the presence of an intra-uterine contraceptive device (IUD) increases the likelihood of spontaneous abortion.[1] Although a high incidence of abortion is reported among women pregnant with an IUD *in situ*, these women are highly motivated to avoid an unwanted birth and it has not been possible in all cases to separate spontaneous from induced abortions.

5.2.4 Other factors

Immunological factors may contribute to the occurrence of spontaneous abortion. There is some epidemiological evidence, for example, that blood group O women, in unions incompatible with respect to blood group, have a statistically significant deficiency of blood group A and B offspring, which increases with parity.

Whilst emotional factors (" stress ") have often been incriminated in the causation of spontaneous abortion, this relationship must still be regarded as hypothetical and in need of further study. The presumed pathogenetic mechanism of such abortions is not clear (e.g., circulatory, endocrine, etc.).

It has not been established conclusively whether severe malnutrition, or specific vitamin or endocrine deficiencies, cause spontaneous abortion in man. Animal experiments suggest that these factors may have a contributory effect.

Treatment with steroid hormones is often given on the assumption that inadequate placental or ovarian hormone secretion is responsible for some spontaneous abortions. The scientific evidence for this is controversial, but recent studies suggest that such " replacement therapy " is ineffective in preventing spontaneous abortions.

Maternal and fetal haemoglobinopathies influence the rate of prenatal losses. There is no conclusive evidence that sickle cell anaemia predisposes to abortion, but a sickle cell crisis occurring before the 28th week of pregnancy may precipitate abortion. Fetal death in such circumstances may be brought about by hypoxia subsequent to the haemolytic event, through hyperpyrexia due to malarial infection or pyelonephritis accompanying or precipitating the crisis, or perhaps because of some placental factors as yet unknown. In α-thalassaemia the abnormal

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[1] *Wld Hlth Org. techn. Rep. Ser.*, 1968, No. 397, p. 22.

fetal haemoglobin often leads to hydrops fetalis. Little is known about the contribution of this and other haemoglobinopathies to the overall frequency of spontaneous abortion, but it probably varies with the ethnic composition of a population.

Anatomical factors are occasionally responsible for spontaneous abortion. Thus uterine anomalies (uterus unicornis or didelphys, uterine hypoplasia) or uterine tumours (leiomyoma) may lead to abortion for vascular or mechanical reasons, or through causing abnormal placentation.

Incompetent cervix is an uncommon obstetric condition characterized by painless dilatation of the cervix in the second trimester of pregnancy, sometimes leading to expulsion of the conceptus. Other cervical conditions, such as scars from lacerations, conization, or amputation, also predispose to spontaneous abortion.

Placental factors other than the one mentioned above are suspected of being important causes of abortion, but their importance is difficult to assess for various reasons. While placental anomalies such as velamentous insertion of the cord, absence of one umbilical artery, placenta praevia, or hydropic change of some villi are seen more frequently in early spontaneous abortions than in the later months of pregnancy, they are frequently compatible with complete gestation and normal fetal development. Their significance in the etiology of abortion must be assessed with caution; the spontaneous abortion may be due to multiple causes.

There is evidence that multiple pregnancy tends to terminate prematurely, and that the more numerous the fetuses the earlier this event occurs. In twins, and possibly in higher orders of multiple births, there is a selectively greater and earlier loss of monozygotic as opposed to dizygotic fetuses; this is presumably related to placental factors. The higher incidence of abortion in multiple pregnancy in general is probably related to uterine factors. More precise information on these points is needed, however, taking into account the manner of placentation and the sex of fetuses.

Male determinants of spontaneous abortion must be considered. For example, male mycoplasma urethritis may, as previously mentioned, be related to maternal endocervicitis and therefore contribute to abortion. Similarly, aneuploid spermatozoa occasionally lead to spontaneous abortion. The possibility of less specific conditions, such as " poor sperm quality ", being responsible for a proportion of spontaneous abortions needs to be studied.

5.2.5 Structural study

The spontaneously aborted conceptus presents in many different morphological forms. The embryo is usually, but not always, structurally abnormal, especially in the earlier spontaneous abortions. Often no

embryo is found, even in complete sacs. Several classifications have been employed to categorize these abnormalities and it is hoped that some such classification may eventually become meaningful in relation to the etiological mechanism. None, however, has been particularly helpful so far, and such descriptions of embryos as stunted, cylindrical, nodular, etc., have shown no correlation with chromosomal or other mechanisms. An exception is the much increased frequency of grossly recognizable hydatidiform swelling of villi (not to be confused with true hydatidiform mole) in cases of triploidy. In general, approximately 30–40 % of embryos recovered from spontaneous abortions are malformed, as compared with 1.5 % from induced abortions.

5.3 Habitual abortion

Habitual abortion is a rare condition in which, at least in the absence of treatment, each of a sequence of pregnancies ends in spontaneous abortion. Clinically, the diagnosis is usually made on the basis of a history of three or more consecutive abortions.

It appears to be well established that some women are more likely than others to experience spontaneous abortion, but it is also clear that many sequences of abortion may be fortuitous. If all pregnancies have a 10 % chance of ending in spontaneous abortion, the probability is that one woman in 1000 will have a sequence of three abortions; if all pregnancies have a 20 % chance of ending in abortion, the probability is that one woman in 125 will have such a sequence.

It is not possible to estimate, from data now available, the probability of spontaneous abortion in a woman with a specified pregnancy history, such as a sequence of three consecutive spontaneous abortions. Earlier estimates of 73 % and 84 % for this probability, which are still widely quoted, were arrived at by an incorrect methodology that has been discredited by later work. Any evaluation of the effectiveness of therapy in patients diagnosed as suffering from habitual abortion should, therefore, be based on a suitable experimental design.

5.4 Sex of fetus

Meiotic division of male germ cells is expected to lead to a sex ratio of unity among X- and Y-containing spermatozoa. A differential loss of male and female conceptuses as a result of spontaneous abortion may be an important determining factor in the higher sex ratio found at term, and numerous studies have been made on this subject.

Several methods are of practical importance in attempting to determine the sex of a spontaneous abortus, but none is infallible. When a fetus is available, the external and internal genitalia may be inspected

and the gonads examined histologically. The normal large size of the embryonic clitoris may simulate a penis, however, and the gonads may be structurally abnormal.

Tissue cultures may be grown from the fetus or amnion or, less commonly, the chorion. Karyotyping of cells in mitosis usually shows the nature of sex chromosomes. Care must be taken, however, that no maternal (decidual) cells are mistakenly cultured from the placenta. Moreover, the high frequency of XO abortuses (structurally females), particularly in early abortions, increases the difficulty of establishing a true sex ratio, since the " intended " sex of such abortuses cannot be ascertained by karyotyping. Also, triploid conceptuses with an XXY sex chromosome complement cannot be used in this context, since it is unknown whether the extra haploid set is paternal or maternal in origin.

Most commonly, " nuclear sexing " of embryonic, amnionic, or chorionic cells has been employed. This technique also must be used with caution. In such studies the XO abortuses would be counted as males (perhaps erroneously). The occurrence of mosaicism, and other difficulties, may make it impossible to draw meaningful conclusions as to the sex of a conceptus by this method.

Nevertheless, when all these techniques have been combined in representative studies of spontaneous as well as induced abortions, it has been found that the XX karyotype is more frequently represented in chromosomally normal as well as abnormal abortuses. This is contrary to the result of previous studies when only one parameter was used. The introduction of corrections for the XO conceptuses leads to a more nearly equal sex ratio. In three recent animal studies employing these techniques one pre-implantation blastocysts, a 1 : 1 sex ratio was found, and the same may hold for man.

These considerations are important not only from a general biological point of view, but also with respect to the causes of spontaneous abortions. It may eventually be possible, for example, to determine whether sensitization to Y-linked gene products increases the frequency of abortion. More immediately, the sex ratio of abortuses is relevant to the etiology of hydatidiform moles.

6. ECTOPIC PREGNANCY AND HYDATIDIFORM MOLE

6.1 Ectopic pregnancy

The incidence of ectopic pregnancy in not readily ascertainable in countries with inadequate health services, but there is good evidence that it varies among populations with different socio-economic and ethnic characteristics. The overall incidence in the USA in 1967 was about

5 per 1000 deliveries, corresponding to 1-2 % of the estimated total number of spontaneous and induced abortions. The recurrence rate is approximately 10 %, and 10 % of women admitted to hospital for an ectopic pregnancy have had such an event previously.

The ratio of ectopic pregnancies per 1000 live births tends to increase with age and to decrease with pregnancy order. It should be noted, however, that the significant denominator for the incidence of ectopic gestation is the number of pregnancies, not live births, because in general the proportion of pregnancies carried to term decreases with age and with pregnancy order (see section 5.1.2).

The etiology and pathogenesis of ectopic pregnancy may differ from those of abortion of intra-uterine pregnancies. It is suspected that its occurrence rate varies with the frequency of antecedent genital tract infection, especially gonorrhoea, and its sequelae; the latter can frequently be diagnosed from a careful study of the removed fallopian tube. Other causes of ectopic pregnancy are not well known. They may be related to anatomical abnormalities of the genital tract (e.g., those caused by endometriosis), to endocrine factors, or even to factors inherent in the blastocyst such as chromosomal anomalies or twins. The surgically obtained material is ideally suited for studies similar to those recommended for spontaneous abortions of uterine origin, e.g., cytogenetic studies.

The maternal prognosis differs in ectopic pregnancy and in the abortion of a uterine pregnancy. Tubal rupture and internal bleeding usually necessitate surgical intervention. Hence the mortality rate for this type of abortion, which is of the order of 300 per 100 000 in the USA, may be much higher in countries without adequate hospital facilities.

6.2 Hydatidiform mole

The frequency of this type of abortion (occasionally erroneously considered a tumour of the placenta) varies markedly (from 1 : 200 to 1 : 2000 pregnancies) in different populations. The reasons for this wide variation are unknown, but since the condition often leads to marked maternal morbidity, and occasionally to mortality and/or the development of a malignant tumour (choriocarcinoma), it constitutes an important aspect of reproductive failure. The highest frequencies have been reported in Asia (but not in Asians elsewhere) and in a few areas of South America and Africa. Nutritional deficiencies, virus infections, and immunological factors have been suspected but not proved to be of etiological importance.

Studies using nuclear sexing and determination of the chromosome complement indicate that perhaps 90% of hydatidiform moles have a normal female karyotype. Triploidy is rarely found in hydatidiform moles although often associated with hydatidiform swelling of villi, a possible antecedent condition.

7. INDUCED ABORTION

7.1 Motives for seeking abortion

Most induced abortions the world over are performed because the pregnant woman does not wish to carry her pregnancy to term, to give birth, and/or to raise a child, at least not at the time she finds herself pregnant. In a small minority of cases a wanted pregnancy is terminated to avert a threat to the woman's life or health, or because it is known or feared that the child will be deformed or defective.

A woman's motives for wanting to end a pregnancy are determined by her life situation and by the values and customs of the community in which she lives. In most cultures, since time immemorial, some pregnancies have been considered to be socially undesirable. These may include pregnancies in unmarried women; pregnancies resulting from rape, incest, or adultery; pregnancies in women whose children have reached maturity; impregnation by a male from an alien group, tribe, or race; and many other categories.

A common reason for seeking an induced abortion is a couple's desire to achieve the size of family that they consider appropriate for themselves. The decision is sometimes based on economic considerations, including low income, unemployment, inadequate housing, interference with the woman's education, training, and earning capacity, and any other threat to achieve the size of family that they consider appropriate for themselves.

In most cases individual psychological factors are involved. These are difficult to define and evaluate. They are based principally on the woman's ambivalent attitude towards her pregnancy, particularly in the early months; they may depend on her personality structure, but more often result from a disturbed relationship to her husband or other male partner, or to her parents or other members of her family. Her emotional attitude may change drastically in the course of the pregnancy.

7.2 Indications for inducing abortion

The indications for induced abortion that are accepted by society, as distinct from the motives of the individual pregnant woman or her family, vary between countries. They may conveniently be discussed under four headings : medical, eugenic, humanitarian, and social. It should be noted, however, that there is no uniformity among authorities in different countries as to the number of indications to be distinguished, their designations, or their scope. In countries where abortion is permitted on request of the pregnant woman, the only indication is unwanted pregnancy.

7.2.1 Medical indication

According to the traditional attitude, which still predominates in many countries, abortion is justified only if the pregnancy constitutes a serious threat to the life of the pregnant woman, which cannot be averted by any other measure. Some countries stipulate that the threat to life must be immediate and certain; for others, the probable deterioration of a potentially life-threatening condition is an acceptable indication. The list of diseases thought to pose a serious threat to life has been subject to change and has become shorter. During the 1920s and 1930s, for example, pulmonary tuberculosis and hyperemesis gravidarum were important medical indications for inducing abortion. In recent decades, the importance of these and many other physical disorders has been substantially reduced, both by improvements in the management of obstetric patients and also because some of these conditions are now seen less frequently. Examples of the physical indications that remain are severe hypertension, chronic cardiac and renal disease, and cancer of the breast and pelvic organs.

The decline in physical disease as a medical indication for abortion has been associated, in some countries, with an increased concern about the effect of an unwanted pregnancy and motherhood on a woman's mental health. This concern is not necessarily oriented exclusively, or even predominantly, to the prevention of suicide, but rather to avoiding a threatened deterioration in the woman's functioning as a person.

The traditional attitude has been to view any threat to the woman's life, or to her physical or mental health, posed by pregnancy and/or childbirth as a purely medical problem and to ignore the circumstances under which the woman must live during pregnancy and after delivery. In recent years this interpretation has been increasingly rejected as unrealistic, and it is regarded as appropriate to consider environmental factors in assessing medical indications for the termination of pregnancy. This newer concept, which is in harmony with the World Health Organization's definition of health as " a state of complete physical, mental and social well-being and not merely the absence of disease or infirmity "[1], is sometimes referred to as " extended medical indication " or " social-medical indication ".

7.2.2 Eugenic indication

In some countries, anticipated physical or mental impairment of the child to be born is regarded as a valid reason for terminating a pregnancy. The so-called eugenic indication was originally concerned primarily with the hereditary, i.e., genetic, transmission of mental deficiency, mental disease, idiopathic epilepsy, and severe physical impairments. Since the

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[1] Off. Rec. Wld Hlth Org., No. 2, p. 100.

1940s, however, the concept has been expanded to include intra-uterine damage to the fetus caused by environmental agents such as drugs (e.g., thalidomide), radiation, and viral infections, the most important of which has been rubella.

Until recently fetal impairment, both genetic and environmental, could only be assessed on the basis of probability; this fact led to the erroneous destruction of healthy fetuses through induced abortion. During the last few years, however, it has become possible to identify at least a few types of fetal defects, such as Down's syndrome, by amniocentesis and cell culture, and anencephalia, by ultrasound, at a sufficiently early stage of gestation to permit termination of pregnancy before the fetus is capable of extra-uterine life.

7.2.3   Humanitarian indication

The terms humanitarian, ethical, or juridical indication are used in reference to pregnancies resulting from rape, incest, and other sexual offences. Abortions on these grounds are considered justified in some countries.

7.2.4   Social indication

The term social indication refers to situations in which the aim of the abortion is to promote, not the physical or mental, but rather the social well-being of the pregnant woman and her family. It is difficult to define or measure social well-being in objective terms such as age, marital status, number of children, family income, etc. Because of this difficulty, if not for other reasons, social indications are less widely accepted than are medical, eugenic, and humanitarian indications. Where social indications are accepted in principle, the responsibility for the decision is frequently left to the pregnant woman, her family, and her doctor, without trying to impose objective standards.

The indications for abortion that are considered valid by the medical profession or by individual practitioners are not necessarily those that are legally authorized in a given country. The problems resulting from such discrepancies have been resolved by medical practitioners in several ways : some doctors refrain from performing an abortion although they feel that there are valid reasons for it; some perform an abortion openly, on their own responsibility, in contravention of the law; others terminate a pregnancy on grounds that are objectively present and legally authorized, but do not represent the primary indication. The implications of such practices, for the correct documentation of abortions and the collection of statistics, are self-evident.

7.3 Governmental regulation

The induction of abortion is subject to governmental regulation in most if not all countries. This regulation varies from complete prohibition in some countries to abortion on request, with services provided by governmental health authorities, in others. Between these extremes, the legislatures of some countries have attempted to define the conditions under which pregnancy may lawfully be terminated, and have established procedures for authorizing abortion in individual cases. In some countries legislation forbidding or limiting abortion is only partially enforced, at least in private medical practice; women of low socio-economic status, who depend on public medical services, thus tend to have less access to induced abortion under medically favourable circumstances than do women in the more affluent parts of the community.

For the purposes of this report the population of the world can be divided into three parts, according to the type of statutory regulation of abortion.

About two-thirds of the world's population live in countries where induced abortions are either entirely prohibited or are permitted for medical indications only, the latter being more narrowly or more broadly interpreted. For abortions performed according to statutes, the abortion ratio is generally below 5 per 1000 live births, and the abortion rate below 0.5 per 1000 women aged 15–44 years. The great majority of induced abortions in these countries are performed illegally, often under unsatisfactory conditions.

About one-thirtieth of the world's population lives in countries, or administrative areas of countries, where an extended version of the medical indication has been written into the law. In addition, eugenic and humanitarian indications are usually recognized. Abortion ratios for legal abortions range from about 30 to 80 per 1000 live births, and abortion rates from about 2 to 8 per 1000 women of reproductive age. Typical of this group are the countries of northern Europe and, since 1968, the United Kingdom. In some countries of this group, it appears that the incidence of illegal abortions has declined in recent years and that as many as half of all induced abortions are now performed in hospitals.

About one-eighth of the world's population lives in countries where abortion is permitted for broadly interpreted social indications, or at the request of the pregnant woman. Where statistics on legal abortions are published, the ratio is generally above 300 per 1000 live births and the rate above 20 per 1000 women of reproductive age. In this group of countries, which includes Japan, the USSR, and most socialist countries of eastern Europe, most induced abortions are performed in hospitals or clinics or, in some countries, doctors' surgeries.

Relatively little up-to-date information on the legislation and practice of abortion is available for mainland China.

7.4 Incidence of induced abortion

Little is known about the incidence of induced abortion in most countries, where the great majority are performed clandestinely. Among women aborted by untrained persons or by themselves an unknown proportion, probably a minority in many countries, seek medical attention and may be admitted to hospital; however, those treated or hospitalized cannot easily be distinguished from women who have had spontaneous abortions. The difficulties encountered in obtaining reliable information on spontaneous abortions are multiplied in retrospective and prospective surveys of induced abortions.

In evaluating induced abortions, both legal and illegal, it is important to distinguish between abortion rates, per 1000 total population or per 1000 women of reproductive age, and abortion ratios, per 1000 live births or deliveries or per 1000 pregnancies. This is illustrated by the following example : suppose there are two populations of 1 million persons each, one with 45 000 live births and 9000 induced abortions, the other with 15 000 live births and 6000 abortions. The abortion rates per 1000 population are 9.0 and 6.0, respectively, whereas the abortion ratios per 1000 live births are 200 and 400, respectively; i.e., one population has a higher abortion rate, the other has a higher abortion ratio. A given abortion rate corresponds to a higher abortion ratio in a country with a low birth rate, than in one with a high birth rate.

It is impossible at present to produce a reliable estimate of the total number of induced abortions throughout the world. Various figures have been published, each being merely a more or less informed guess. In recent years, induced abortions have exceeded live births in several countries with low birth rates. In many less-developed countries with high birth rates, abortion ratios per 1000 live births are thought to be low, but abortion rates per 1000 population may be as high as, or higher than, in some developed countries.

7.4.1 *Abortion rate and birth rate*

The relationship between the abortion rate and the birth rate is complicated by the fact that the impact of each abortion on the number of births depends on the extent and effectiveness of contraceptive practice in the population. Contraceptive practice determines the duration of one component of the interval between two successive conceptions. This interval has three components : (*a*) the pregnancy itself; (*b*) an anovulatory

phase following the pregnancy, during which conception is impossible; and (c) an ovulatory phase during which the monthly probability of conception is more than zero but less than unity. Abortion reduces components (a) and (b) because the duration of pregnancy is shortened from about 9 to about 3 months, and the subsequent anovulatory phase is shortened by several months depending on the extent and average duration of breast feeding following live birth. The average time required for conception during the ovulatory period (c) is presumably not affected.

With breast feeding of moderate to long duration, and without contraception, (b) is comparatively long and (c) is short, the net effect being that at least two and perhaps three abortions are required to reduce the number of births by one. If any method of contraception is practised widely with even moderate effectiveness, (c) is extended relative to (a) and (b). As a result, only slightly more than one abortion is required to avert one birth.

By way of illustration, the uncontrolled fertility of a human population may be represented by an annual birth rate of, say, 50 per 1000 population, corresponding to a pregnancy rate, including those pregnancies ending in spontaneous abortions, of about 60 per 1000. To reduce the birth rate of this hypothetical population to 25 per 1000 by means of induced abortion alone, without contraception, would require 50–75 induced abortions per 1000 population and would raise the pregnancy rate to between 85 and 110 per 1000 population (i.e., birth rate plus induced abortion rate plus spontaneous abortion rate), without making allowance for implicit increases in spontaneous fetal deaths.

If, on the other hand, a population had reduced its birth rate to 25 per 1000 by the use of contraception, a further decrease to 20 would require only slightly more than 5 induced abortions per 1000 population, with an approximately equal increase in the pregnancy rate.

7.4.2   Induced abortion and contraception

The relationships between induced abortion and contraception are complex in other ways also. Both practices have as their objective the prevention of unwanted births. In populations in which some couples attempt to restrict the number of children they produce, while others do not, it has been found that couples who practise contraception also have higher rates of induced abortion per 1000 women, as well as higher ratios per 1000 pregnancies, than those who do not attempt to limit the size of their family. Those couples who adopt contraception early and practise it consistently are likely to have lower rates of induced abortion per 1000 women than those who start contraception late and practice it haphazardly, despite a high abortion ratio per 1000 pregnancies, resulting from contraceptive failure, in the former group.

7.4.3 *Maternal age and marital status*

There is only fragmentary information on the patterns of induced abortion, by maternal age and marital status. Available sources are (a) official statistics for a few countries where most induced abortions, although not all, are performed legally by qualified medical practitioners and reported to the authorities, and (b) special surveys, of varying scope and completeness, in a few other countries. Few generalizations are possible.

In a homogeneous population, using induced abortion primarily for limiting the ultimate size of the family, rather than for spacing births, the ratios of induced abortions per 1000 pregnancies or births, within marriage, tend to increase with the number of previous pregnancies, births, or surviving children, and therefore with maternal age also. This pattern has been observed in several developing countries with high birth rates.

In developed countries with low birth rates, another pattern of abortion ratios occurs. It is characterized by a relatively low ratio of induced abortions per 1000 births among women without previous births or with only one child, a higher ratio among women with a moderate number of previous births, and a lower ratio among mothers of larger families. This pattern can be explained either by a preference within the population for a smaller family, with willingness to seek abortion, or by differences in reproductive behaviour between successive cohorts of women.

In both developing and more developed countries, the age-specific rates of induced abortion per 1000 married women reflect the interplay between rates of pregnancies or births and corresponding abortion ratios, in successive age groups.

In many societies, pregnancy out of wedlock is associated with a high abortion ratio per 1000 pregnancies or births. The abortion rate per 1000 unmarried women depends on many factors, including their age distribution, the extent of their heterosexual activities, their access to and use of contraception, and their willingness and ability to resolve the problem of their pregnancy by marriage. For most countries it is impossible even to make a reasonable guess as to the proportions of married and unmarried women among those undergoing induced abortion. For legal abortions, however, higher abortion rates tend to be associated with a higher proportion of married women.

The age pattern of abortion ratios for the entire population reflects the pattern for both married and unmarried women. As a rule, the ratios per 1000 pregnancies or births tend to increase with age; they may, however, be higher among the youngest women than among the next higher age group, if premarital pregnancies represent a large fraction of the total, and especially if age is stated with respect to time of birth or abortion rather than conception (see section 4.1). Abortion rates per 1000 women,

on the other hand, tend to reach a peak among women in their late twenties and early thirties.

7.4.4 Social factors

Information on differences between socio-economic and cultural groups in the use of induced abortion is scanty and permits few generalizations. It has been suggested that the abortion rate per 1000 women reaches a maximum in populations that are at an early stage of transition from uncontrolled to controlled fertility. At a later stage, when contraception is effectively practised by a majority of couples, the abortion rate, but not necessarily the abortion ratio per 1000 pregnancies, decreases. This hypothesis is supported by scattered data from Latin America and other developing areas. In general, abortion ratios per 1000 deliveries or pregnancies appear to be higher in urban than in rural areas, and the same may be true for abortion rates per 1000 population or per 1000 women of reproductive age.

7.5 Techniques for inducing abortion

Because most complications of abortion are associated with induced abortions, the techniques must be considered by which abortion may be initiated and performed. Among the medical profession, one-stage methods appear to be most popular during the first 12–14 weeks of pregnancy. Dilatation of the cervical canal, followed by evacuation of the uterus and curettage, is still probably the most common and widely used method. In recent years, it has been increasingly superseded in many countries by vacuum aspiration, which requires less time.

For pregnancies that have advanced beyond the first trimester, abdominal or vaginal hysterotomy are the most widely used methods; the former is the method of choice when abortion is combined with surgical sterilization.

Two-stage methods can be used at various gestational ages. The most popular substance for this purpose appears to be 20% sodium chloride solution, which is injected intra- or extra-amniotically. Less often, 50% glucose solution is used. Pastes or medicated soaps, introduced into the uterus through a small cervical cannula, have a long history but are used less frequently. In Japan, abortions in mid-pregnancy are usually initiated by methods involving mechanical stimulation of the uterus, such as the introduction of a metreurynter or a bougie. In all two-stage methods the conceptus is usually expelled within a day or two. In a minority of cases the abortion has to be completed by surgical means.

Attempts by lay persons to induce abortion, including self-abortion, range from spells and incantations, through a variety of traditional medica-

tions, which tend to be ineffective and/or toxic, to grossly traumatizing procedures designed to damage or destroy the conceptus, leaving its expulsion to the forces of nature. The most widely used procedure is probably the insertion of a foreign body into the uterus. Twigs, roots, metal rods, hooks, wires, rubber tubes (catheters), and other objects have been used for this purpose. In some countries, injections of soapy water or readily available household disinfectants are also popular.

Little laboratory or clinical work has been done on systemic abortifacients.[1] Although some compounds have been studied in animals and a few have been tested in small numbers of human subjects, there is at present no safe systemic abortifacient, i.e., no drug that is reasonably effective in producing abortion, reliably non-toxic for the woman in effective dosage, and reliably non-teratogenic for the fetus in non-effective dosage. Efforts to develop such drugs will probably increase as more countries come to accept induced abortion.

8. CONSEQUENCES OF ABORTION

8.1 Early complications

Abortion may impair a woman's health through a variety of complications. These may occur at the time of or soon after the abortion, or be discovered much later, perhaps in connexion with another pregnancy or with efforts to become pregnant again. The complications may result in death of the woman.

The frequency and severity of complications tend to increase with the duration of pregnancy, being significantly greater in the second than in the first trimester.

Early and late complications may be associated with both induced and spontaneous abortions. They occur far more frequently, however, and tend to be more severe and more often fatal, after abortions induced by untrained persons, or by the pregnant woman herself, than after abortions performed by qualified medical practitioners under favourable circumstances, or after spontaneous abortions.

The most frequent and usually the only complication of spontaneous abortion is uterine bleeding, which is rarely profuse in the first trimester. Infection is relatively infrequent and usually mild. Perforation of the uterus may occur during treatment.

In induced abortion, bleeding is more often profuse and may result in shock. Infection ranges from mild endometritis to severe salpingitis, peritonitis, and septicaemia, leading sometimes to pelvic thrombophlebitis,

[1] *Wld Hlth Org. techn. Rep. Ser.*, 1969, No. 424, p. 22-24.

septicaemic shock, and/or renal failure. The most lethal forms of infection are those caused by the anaerobic organisms *Clostridium perfringens* and *Clostridium tetani.* Coliform organisms are also important.

The most potentially dangerous type of injury associated with induced abortion is perforation of the uterus, which may lead to peritonitis. Neighbouring organs such as the intestines may be traumatized. The intestines or bladder may also be injured if the abortion is done by transabdominal amniocentesis. Of less concern, although probably far more numerous, are injuries to the cervix.

Less common early complications of abortions induced by methods customarily used by medical practitioners include the following : (a) effects on the central nervous system and/or kidneys of hypertonic salt solution entering the bloodstream, directly or via the peritoneal cavity; (b) embolization by air, most commonly, or by particulate matter (fat, placental products, amniotic fluid) in the heart, pulmonary artery, brain, and other organs; and (c) anaesthetic complications. The early complications from methods used mainly by lay abortionists include : (d) renal failure resulting from the use of poisons, such as saponated cresol solution; and (e) other systemic or local effects of toxic or corrosive agents.

8.1.1 Mortality from legal abortions

The most adequate statistical information available on the frequency of early complications relates to fatal complications of abortions legally performed in hospitals, since only in these cases can the numerator (maternal deaths) as well as the denominator (abortions legally performed in hospitals) be determined with a high degree of accuracy.

Mortality associated with induced abortions performed in hospitals has dropped to exceedingly low values, according to reports from several parts of eastern Europe that have reliable vital statistics. Out of approximately 2 564 000 legal abortions in Hungary, Czechoslovakia, and Slovenia during the period 1957–67, only 73 women died, corresponding to a mortality rate of 3 per 100 000 such abortions. A computation for Japan, on the basis of the 278 deaths attributed to legal abortion in national cause-of-death statistics, and the 6 860 000 legal abortions reported in 1959–65, gives a rate of 4 per 100 000. For comparison, the maternal mortality rate, excluding abortion, is about 20 per 100 000 pregnancies in developed countries with good obstetric services, and over 200 per 100 000 in many less-developed countries.

In northern Europe, legal abortion in hospital carries a substantially higher mortality rate; this was about 40 per 100 000 in two countries during the early 1960s (21 deaths among 52 300 legal abortions). The higher death rates in northern Europe may partly be due to the fact that many of these abortions were performed in 'he second trimester

of pregnancy, whereas in eastern Europe and Japan almost all legal abortions are performed in the first trimester. Furthermore, a greater proportion of legal abortions in northern Europe are performed on medical grounds, whereas in eastern Europe and Japan the overwhelming majority of women undergoing legal abortion are presumably in good health.

There is little up-to-date information on mortality associated with legal abortion in countries that have restrictive legislation, owing to the small number of abortions performed and the absence of national systems for reporting them. The fragmentary data available suggest relatively high mortality rates, including many deaths attributable to the condition for which the abortion was performed. Higher mortality is generally encountered, moreover, in areas where the medical profession is less familiar with operative techniques.

8.1.2 Morbidity from legal abortions

Information is far less adequate on the frequency of non-fatal early complications of legal abortions than on fatal early complications, because of disagreement among investigators as to the severity of the signs and symptoms to be defined as complications.

It is difficult to relate morbidity to different techniques of abortion owing to the fact that some techniques are used mainly or exclusively during the early months of gestation, and others during later months. The selection of patients for particular techniques may reflect the operator's experience with these procedures.

In spite of these difficulties it appears that, of the two methods most widely employed for the termination of pregnancy during the first trimester, vacuum aspiration is less traumatic, and associated with less blood loss and fewer early complications, than the classical method of dilatation, evacuation, and curettage. With regard to abortions in the second trimester, it is impossible to make a definitive comparison between hysterotomy and the instillation of hypertonic salt solution, since each method has a different pattern of complications. Fatal complications have been reported with these methods and with the intra-uterine injection of pastes. The waiting period, associated with all two-stage methods, between the instillation or injection and the expulsion of the conceptus may cause severe emotional strain in the woman.

8.1.3 Mortality and morbidity from illegal abortions

It is generally recognized that mortality and morbidity are much higher with abortions that are self-induced or induced by other untrained persons, than with those legally performed in hospitals. It is impossible, however, to quantify these higher rates. Mortality, in particular, reflects

not only the skill of the persons performing or initiating the illegal abortions, but also the availability and utilization of medical and hospital services, and the quality of care, if life-threatening complications develop.

It is possible, and indeed likely, that in some large communities the mortality rate reaches or exceeds 1000 per 100 000 illegal abortions. For most countries, taken as a whole, the risk is certainly much lower, especially if many of the illegal abortions are performed by qualified medical practitioners and/or if adequate hospital care is readily available. Under these circumstances, the mortality rate is probably less than 50–100 per 100 000 illegal abortions.

While most deaths allocated to categories 640–645 of the eighth revision of the ICD (see section 2.7) are probably due to abortions induced by lay persons, including self-induced abortions, it is not possible to estimate the number of such abortions from the number of deaths. During the early 1960s the annual mortality rate from abortion, as reported in national cause-of-death statistics, ranged from less than 1.0 per 100 000 women aged 15–44 years, in most of the developed countries, to more than 10 per 100 000 in one country in Latin America. A special study sponsored by the Pan American Health Organization revealed rates higher than 10 per 100 000 in three out of ten cities in Latin America.[1] For most of Asia and Africa only fragmentary information is available. Mortality rates appear to reflect the completeness and correctness of cause-of-death registration and the general level of health services in each country, at least as much as national legislation concerning abortion, the number of illegal abortions, and the skill of the persons inducing or performing them.

8.2 Late complications

8.2.1 Physical sequelae

The late physical effects of abortion are dominated by the sequelae of infection. These include chronic pelvic inflammatory disease, peritoneal adhesions, ectopic pregnancy, and secondary sterility. Infection is associated far more frequently with illegal (including self-induced) abortion than with legal or spontaneous abortion. The same is true for the sequelae of infection. The overall incidence of these complications has not been satisfactorily determined for any country, but there is no doubt that they cause a great amount of human suffering.

On the other hand, when termination of pregnancy is performed competently it rarely produces serious physical sequelae. Menstrual disturbances are usually only temporary. Amenorrhoea may occasionally

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[1] Puffer, R. R. & Griffith, G. W. (1967) *Patterns of urban mortality : Report of the inter-American investigation of mortality*. Pan American Health Organization, Washington, D. C., p. 294–317.

be caused by intra-uterine synechiae, which may persist if untreated. An increased tendency to ectopic pregnancy, placenta praevia, and premature separation of the placenta has been postulated but not established. Endometriosis may develop in scar tissue following hysterotomy. Incompetent cervix frequently follows injuries to the cervical canal, some of which may have occurred during the performance of legal abortion.

Several large studies have failed to show whether secondary sterility occurs more frequently after legal abortion than after delivery. Nor has it been established whether a woman who has had several induced abortions is more likely to become sterile than a woman in the same age group who has had only one induced abortion.

Sensitization of Rh-negative women has been observed after induced abortion as early as the second month of gestation. However, as the primary antigenic stimulus to initiate sensitization depends on the number of fetal red cells entering the maternal circulation, the risk of clinically significant Rh immunization after a spontaneous or even an induced abortion during the first trimester has been judged to be small but far from negligible.

Studies in Hungary and Japan have shown that premature birth (low birth weight) tends to occur more frequently among women who have had induced abortions. This appears to be true regardless of age, parity, employment, and other maternal characteristics, although additional co-variables cannot be completely excluded. Prematurity tends to increase in frequency with the number of previous induced abortions.

8.2.2 Psychological sequelae

Information on the psychological sequelae of induced abortion is as inadequate as that on late physical complications. There is no doubt that the termination of pregnancy may precipitate a serious psychoneurotic or even psychotic reaction in a susceptible individual. The emotional stress that an induced abortion produces in a woman may be closely connected with other factors than the termination of pregnancy per se, such as the time of gestation, the type of operation, the procedures for obtaining legal permission, the attitudes of society and of the persons investigating the indications for abortion, etc. Some people, including psychiatrists, have expressed the view that every abortion is a stressful experience fraught with major risks to mental health; others have pointed out that most women undergoing abortion continue to lead essentially normal lives, and that the adverse psychological reaction to abortion may be less serious than the reaction to having an unwanted child.

Recent medical literature contains several studies that attempt a quantitative evaluation of the psychiatric sequelae of induced abortion. These studies are concerned with women who have had legal abortions

in hospitals, mainly for psychiatric reasons. They show that serious mental disorders arise more often in women with previous emotional problems; thus the very women for whom legal abortion is considered to be justified on psychiatric grounds are the ones who have the highest risk of post-abortal psychiatric disorders.

Interpretation of the results is made difficult by the lack of uniform standards for the assessment of psychological impairment, and of suitable control groups of women who are refused abortion and thus forced to give birth to an unwanted child. For a study to be statistically valid, permission for and refusal of abortion would have to be allocated at random within a group of applicants. It is unlikely that a study meeting this requirement will ever be made.

Careful and competent counselling, taking into account the woman's entire life situation, probably reduces the risk of unfavourable reaction whether abortion is induced or the pregnancy is carried to term. In few countries, if any, is such counselling available to the majority of women considering abortion.

8.3 Comparative risks to life associated with the avoidance of unwanted pregnancies

Even the small risk to life associated with artificial termination of pregnancy under the most favourable circumstances can be avoided by the successful practice of a safe method of contraception. In developed countries with adequate medical services, the risk to life resulting from the use of highly effective modern methods of contraception (ovulation suppressants and intra-uterine devices) is estimated to be of the same order of magnitude as the risk incurred by preventing unwanted births exclusively by abortion in hospital, without any contraceptive efforts. The risk to life associated with the avoidance of unwanted pregnancies is greatly reduced by the moderately effective use of methods of contraception that are entirely free from fatal side-effects, combined with the termination in hospital of those pregnancies that occur through failure of the method or through its improper or inconsistent use.

It has not been established whether the latter statement applies to developing countries with inadequate medical services.

8.4 Effects of changes in availability of abortion on mortality and morbidity due to abortion

Evaluation of the probable effect of changes in the availability of abortion on mortality and morbidity due to abortion is a legitimate concern of public health. The following assessment is based mainly on *a priori* reasoning, supported in part by the experience of countries

where major changes in abortion practice have occurred. A number of countries have abandoned their restrictive legislation, and permit abortion on request or for broadly interpreted social indications. In none of these countries had contraceptive services been developed by the health authorities, nor were " modern " contraceptive methods available, when abortion was legalized. In all such countries that have published statistics on legal abortions their number increased rapidly, followed in most cases by stabilization at high levels with minor annual variations.

TABLE 2. INDUCED ABORTIONS IN CZECHOSLOVAKIA, 1953–68, AND IN HUNGARY, 1950–68 *

Year	Czechoslovakia			Hungary		
	Number (thousands)	Rate per 1000 women 15–44 years	Ratio per 1000 live births	Number (thousands)	Rate per 1000 women 15–44 years	Ratio per 1000 live births
1950	—	—	—	1.7	0.8	8.7
1951	—	—	—	1.7	0.8	8.9
1952	—	—	—	1.7	0.8	9.1
1953	1.5	0.5	5.5	2.8	1.3	13.5
1954	2.8	1.0	10.5	16.3	7.5	73.0
1955	2.1	0.8	8.0	35.4	16.3	168.2
1956	3.1	1.2	11.9	82.5	38.3	427.9
1957	7.3	2.7	28.9	123.4	58.0	737.9
1958	61.4	22.8	261.3	145.6	68.7	918.9
1959	79.1	29.3	365.1	152.4	72.1	1008.0
1960	83.3	32.5	406.3	162.2	76.5	1107.2
1961	94.3	34.0	431.8	170.0	79.4	1211.1
1962	89.8	31.5	413.0	163.7	75.2	1258.4
1963	70.5	24.1	298.9	173.8	78.4	1313.6
1964	70.7	23.6	293.0	184.4	82.2	1395.2
1965	79.6	26.3	343.5	180.3	80.0	1355.3
1966	90.3	29.4	435.5	186.8	82.8	1348.5
1967	96.4	31.4	446.9	187.5	83.1	1259.5
1968	99.7	32.3	466.5	201.1	88.8	1301.2

* Sources : Czechoslovakia :

  1953–58 : Vojta, M. (1961) Die Abortsituation in der Tschechoslowakischen Sozialistischen Republik [The situation as regards abortion in the Czechoslovak Socialist Republic]. In : Mehlan, K.-H., ed., Internationale Abortsituation, Abortbekämpfung, Antikonzeption [The international situation as regards abortion, abortion control and birth control], Leipzig, Thieme

  1959–67 : Frejka, T. & Koubek, J. (1968) Les avortements en Tchécoslovaquie [Abortions in Czechoslovakia], Population et Famille, 16, 1

  1968 : David, H. P. (1969) Family planning and abortion in the socialist countries of central and eastern Europe, Washington

  Hungary :

  1950–67 : Hungary, Central Statistical Office (1968) Demografiai evkonyv 1967 [Demographic yearbook 1967], Budapest

  1968 : Same as for Czechoslovakia

Table 2 illustrates the trend in two eastern European countries with good statistics. In Japan, the number of reported abortions reached a peak in the middle 1950s and has since declined. The experience of northern European countries is less relevant, because relatively few abortions have been performed for the indications authorized by the laws of these countries.

The effect of increased availability of legal abortion on the frequency of illegal abortion cannot be definitely established, because the numbers of illegal abortions before and after the change are not known. Nevertheless, three tentative generalizations are possible : (a) extension of medical indications and recognition of eugenic and humanitarian indications involve comparatively few pregnancies and have, therefore, little effect on a high rate of illegal abortions; (b) performance of legal abortions at the request of the pregnant woman or on broadly interpreted social indications substantially reduces the frequency of illegal (including self-induced) abortions, as evidenced by declining numbers of septic abortions admitted to hospitals; but (c) illegal (including self-induced) abortions have not disappeared, even in countries where abortion on request has been available for more than a decade. This stubborn survival of practices detrimental to health probably reflects, at least in part, dissatisfaction with the manner in which the official abortion services are organized, especially as regards the protection of privacy.

Greater availability of legal abortion reduces the frequency of illegal abortions but tends to increase the total frequency of legal plus illegal abortions. Some pregnancies are aborted that would otherwise be carried to term, and these women will be able to conceive again earlier than after delivery at term. The motivation to practise contraception may also be reduced, at least temporarily. There is no evidence as to what response may be anticipated in a population experiencing greater availability of abortion, after having become accustomed to the use of modern contraceptive methods and with effective contraceptive services available. In several of the more developed countries, increased availability of legal abortion has been no obstacle to expanded contraceptive usage.

In summary, the changes in the relationships of contraceptive usage and induced abortion that have taken place in a number of countries are extremely difficult to interpret, because many variables, such as the ratio of illegal to legal abortions, cannot be readily determined. In trying to predict the effect of increased availability of abortion on mortality and morbidity due to abortion, a priori reasoning leads to the conclusion that a consideration of crucial importance is an expected higher total of induced abortions, combined with a reduced mortality and morbidity associated with abortions performed in hospitals as compared with those performed or initiated clandestinely. In developed countries, an overall downward trend in mortality and morbidity due to abortion may be expected.

An opposite effect, i.e., an increase in mortality and morbidity due to abortion, could occur if the total number of induced abortions were to increase greatly. This is most likely to occur if a permissive abortion policy is adopted in a situation in which the initial frequency of illegal (including self-induced) abortion is comparatively low, contraception

is not practised widely or effectively, and adequate contraceptive education and services are not available. Even in this situation, assuming that the abortions are performed by reasonably well-trained personnel, a possible increase in mortality and morbidity due to abortion will almost certainly be compensated by a corresponding decrease in maternal mortality and morbidity associated with unwanted pregnancies or births.

9. RESEARCH RECOMMENDATIONS [1]

9.1 Spontaneous abortion

Studies should be initiated or expanded in the following areas : [2]

(1) Criteria for differentiating between spontaneous and induced abortions (2.5).

(2) Methodology of retrospective and prospective surveys, with special attention to interviewing techniques for obtaining complete and correct information and to techniques for estimating the magnitude of omissions and errors (3.3 and 3.4).

(3) Prospective surveys of pregnancies, with differentiation between spontaneous and induced abortions, by means of single- and multiple-decrement life tables (3.4.2).

(4) Evaluation of clinical and laboratory tests for the early diagnosis of pregnancy (3.4.2).

(5) Morphology of fertilized human ova recovered from the fallopian tubes or uterine cavity at known intervals following coitus (5.1).

(6) Reported incidence of spontaneous abortion in selected samples of women from various regions and countries, with attention to such possible determinants as parental age, pregnancy order, climate, altitude, ethnic origin, socio-economic status, dietary and smoking habits, etc. (5.1).

(7) Incidence by fetal age, evaluated by life table methods (5.1.1).

(8) Frequency and nature of chromosomal anomalies in abortuses, in relation to fetal age and possible etiological factors including prior use of ovulation suppressants (5.2.1).

(9) Infectious diseases, in relation to fetal age and with special attention to the role of mycoplasma infection in mid-pregnancy (5.2.2).

(10) Ionizing radiation, in relation to fetal age and with attention to the origin, type, and total dose of radiation, and the duration of exposure (5.2.3).

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[1] For convenience, the recommendations appear in the order in which the subject is treated in the text. The figures in parenthesis refer to sections in the text.

[2] Numbers (9)–(19) inclusive refer particularly to possible etiological factors.

(11) Chemical agents, including therapeutic substances and habit-forming drugs (5.2.3).

(12) Pregnancy in the presence of an intra-uterine contraceptive device (5.2.3).

(13) Immunological incompatibility, with attention to various blood group systems, e.g., the ABO, Rh, and MNS systems (5.2.4).

(14) General malnutrition and specific vitamin deficiencies (5.2.4).

(15) Endocrine deficiencies, with special attention to the ovary and placenta (5.2.4).

(16) Haemoglobinopathies, with special attention to sickle-cell anaemia and α-thalassaemia (5.2.4).

(17) Cervical trauma and other causes of cervical incompetence (5.2.4).

(18) Multiple pregnancy, in relation to fetal age, with special attention to differences between monozygotic and dizygotic twins (5.2.4).

(19) Paternal sperm count, sperm morphology, and chemistry of seminal fluid (5.2.4).

(20) Relationship between etiological factors and morphology of conceptus (5.2.5).

(21) Empirical determination, in selected populations, of the probability of spontaneous abortion in the current pregnancy for women with specified pregnancy histories, such as a sequence of three spontaneous abortions (5.3).

(22) Clinical studies of habitual abortion, involving "double-blind" therapeutic trials (5.3).

(23) Fetal sex, in relation to fetal age and genetic and other possible etiological factors (5.4).

(24) Comparative evaluation of various methods for determining fetal sex (5.4).

9.2 Ectopic pregnancy and hydatidifom mole

Studies should be initiated or expanded in the following areas :

(1) Incidence of ectopic pregnancy in various regions and countries, with attention to such factors as parental age, pregnancy order, ethnic origin, socio-economic status, etc. (6.1).

(2) Morphological and cytological studies on ectopic conceptuses (6.1).

(3) Incidence of hydatidiform mole in various regions and countries, with attention to such factors as parental age, pregnancy order, ethnic origin, socio-economic status, etc. (6.2).

(4) Cytological findings, viral infections, immunological factors, and nutritional deficiencies associated with hydatidiform moles (6.2).

9.3 Induced abortion

Recommendations (1) to (4) in section 9.1 are equally applicable to induced abortion. Studies on induced abortion should also be initiated or expanded in the following areas :

(1) Psychological factors associated with abortion-seeking, with special attention to failure to use available contraceptive methods and services, and ineffective use of contraception (7.1).

(2) Medical indications for the legal termination of pregnancy, considered valid in different countries and localities at different times, with special attention to available medical facilities and the woman's living conditions (7.2.1).

(3) Assessment of possible physical or mental impairment of the child to be born, by genetic and statistical methods (7.2.2).

(4) Early identification of fetal damage, by clinical and laboratory methods (7.2.2).

(5) Procedures employed in various countries and localities, at different times, in determining eligibility for legal termination of pregnancy, with special attention to differences between public and private medical practice and with reference to women of different socio-economic status (7.3).

(6) Numbers of legally induced abortions in various countries, at different times, with special attention to the type of statutory regulation and the degree of enforcement of the statute (7.3).

(7) Reported incidence in selected samples of women from various regions and countries, with attention to such possible determinants as parental age, marital status, pregnancy order, ethnic origin, religion, socio-economic status, sex education, contraceptive usage, etc. (7.4).

(8) Patterns of illegal (including self-induced) abortion in various regions and countries, with special attention to the kinds of persons actively and passively involved and the methods employed (7.5).

(9) Development of a safe, systemic abortifacient (7.5).

(10) Comparative frequency and severity of early complications following the use of various methods of inducing abortion, in relation

to gestational age, with special attention to random assignment of methods to pregnancies of appropriate duration (8.1.1 and 8.1.2).

(11) Comparative frequency and severity of early complications following the use of various methods of inducing abortion in the first trimester, by length of hospitalization (including ambulatory treatment) and qualifications of person performing the abortion; with special attention to the feasibility of training paramedical personnel for this task and the amount of training and supervision they would require (8.1.1 and 8.1.2).

(12) Estimation of the number of deaths due to abortion, but not registered as such, in various regions and countries (8.1.3).

(13) Frequency and severity of late complications of various methods of inducing abortion, determined by prospective follow-up; with special attention to secondary sterility, complications of subsequent pregnancies and/or deliveries, and possible damage to later children (8.2).

(14) Sensitization of Rh-negative women after abortion (8.2.1).

(15) Psychological reaction to induced abortion as compared with the reaction to having an unwanted child (8.2.2).

(16) Comparison of risks to life and health associated with alternative methods of avoiding unwanted births, and with availability of several methods; with special attention to mortality in countries that have inadequate medical services, and to morbidity in developed and developing countries (8.3).

(17) Changes in the incidence of illegal (including self-induced) abortions and in the mortality and morbidity associated with them, with special attention to changes in the availability of legal abortion (8.4).

9.4   Services to research

In addition to the types of studies recommended above, there is a need for a reference centre concerned with various aspects of spontaneous and induced abortion. The proposed centre's services to research would include the following :

(1) Assistance in developing an internationally comparable definition and terminology of abortion (2.1 and 2.5).

(2) Assistance in developing an internationally comparable definition of the duration of pregnancy, possibly related to the estimated time of fertilization or implantation (2.3).

(3) Assistance in developing methods for the tabulation of multiple conditions related to mortality and morbidity associated with abortion (2.7).

(4) Collection and periodic publication of internationally comparable statistics on abortions induced for medical and other legal indications, and of fatal and non-fatal complications reported in association with these abortions (3.1).

(5) Collection and periodic publication of internationally comparable statistics on patients admitted to, or discharged from, hospital with a diagnosis of abortion; distinguishing, if possible, patients admitted to hospital for the performance of a legal abortion from those admitted for aftercare or because of complications (3.2).

(6) Collection and periodic publication of internationally comparable statistics on deaths attributed to abortion, tabulated by cause of death based on the registration of vital events (3.5.1).

(7) Collection, evaluation, and periodic publication of case records relating to deaths associated with abortions induced for medical and other legal indications, including a summary of the clinical history and of the findings at autopsy, if available (8.1.1).

(8) Assistance in developing an internationally comparable terminology describing the severity of common early complications of induced abortion (8.1.2).

(9) Compilation and periodic publication of an annotated, international bibliography relating to abortion, including books, papers presented at scientific meetings, articles in scientific journals, reports on legislative, administrative, and judicial actions, etc.

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