APPLICATION OF EXPERT SYSTEM ON MEDICAL MANAGEMENT OF INFERTILITY

BY

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CERTIFICATION

We certify that this project was carried out by Frank A. Fashina of the Department of Mathematics/Computer Science, Federal University of Technology, Minna.

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EXTERNAL EXAMINER

DATE

DEDICATION

This work is dedicated to my family: Jeanne, Frank, Jourdan and Martin, and to all infertility patients.

ACKNOWLEDGEMENT

I wish to express my sincere appreciation to my supervisor and Head of Department, Prof. K. R. Adeboye for the personal interest, suppport and encouragement he gave me during the project work.

I am also indebted to my course co-ordinator, Prince R. O. Badmus for all the various assistance and encouragement he gave me throughout the program.

Finally, to all my teachers in the various courses, for their commitment and dedication to teaching us the required rudiments, I say a very big thank you.

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ABSTRACT

This project deals with the development of a computerised expert system in the medical management of infertilty, and offers practicable options for general medical practioners in treating the condition in environments where specialists in the field are inadequate.

CHAPTER ONE

1.0 GENERAL PRELIMINARIES

1.1 INTRODUCTION

The computer industry began in the late forties with a very small initial investment, and has been increasing both in strength and importance. The computer technology keeps on advancing with remarkable increase in speed, accuracy and reliability. Computing in whatever field - science, business and industry is reaching directly and indirectly into various aspects of our society and this accounts for its increasing application in different parts of the world.

However, the advent of electronic computer was hailed by the world as a great revolution. Like any industrial revolution, it promised to free man from simple routine jobs of repetitive nature by providing computing power. The first to have exploited this facility was the search for scientific enquiries before any other forms of its present application. Its capability and relevance in the present day is because of its increased speed and memory capacity which is as a result of researches into its growth and development.

The growth and development of computers is regarded as computer generation with each having a distinct technological break-through. Presently, we are in the fifth generation. This generation is influenced by the advent of Artificial Intelligence, Speech Processing, Parallel Architecture, Pattern Recognition and Expert System.

Artificial Intelligence is the ability of the computer to exhibit behaviours like an intelligent person. An expert system on the other hand is an application program that has the capability of making judgement and decisions like an expert in a particular field of application. A good example of the product of the fifth generation is the industrial robots who are positioned in various industrial processing to perform one task or the other.

However, the most relevant aspect of this generation is the application of computer to medicine. This is made possible because the computers can be loaded with the knowledge of a doctor in order to prescribe the appropriate drug after performing the required diagnosis. The computer application of this nature becomes important in problem areas such as infertility where there is dearth of specialists to handle the ever-increasing number of patients.

1.2 THE CONCEPT OF EXPERT SYSTEM

An expert system is a special computer program which uses knowledge and inference to solve difficult problems that ordinarily require significant human expertise for the solution. The knowledge required to perform such a task, and the inference procedures used, can be regarded as a model of the expertise of the best specialist in the field. This means then that the expert system operates by using techniques of artificial intelligence to execute operations or solve problems that only an expert in that field would normally be able to perform. Whereas it is not designed to be able to replace human expert in the field, its advantages are readily obvious in situations where human experts are in acute shortage.

In developing an expert system, there is need to consider the software engineering as well as the required construction, acquisition and appropriate use of the knowledge. These are quite complex in structure and are best considered as components. In order to allow free flow of information between these components, an interface need be created.

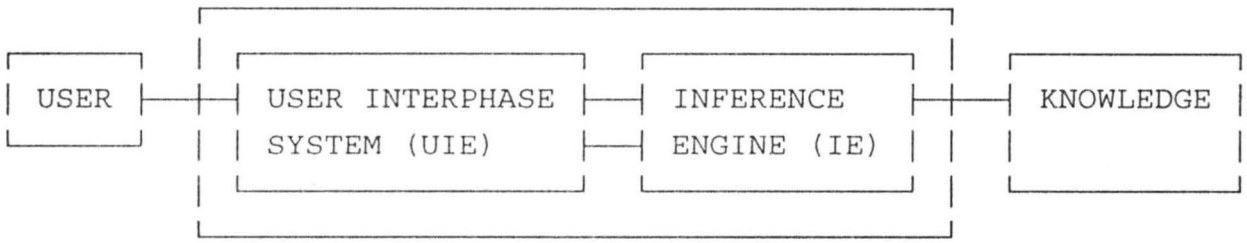
The typical structure of an expert system consists of the following:

(i) The knowledge base

(ii) The inference engine

(iii) The user interface system

The above can also be represented as shown below:



The knowledge is the centre part of the expert system. It contains rules describing relations or phenomena, methods and knowledge for solving problems in the systems are of expertise. It consists of both factorial and inferential knowledge.

The inference engine consists of operating rules and principles, and uses the knowledge base to obtain reasonably consistent conclusion (inference). It runs the

expert system by determining which rules are invoked and by accessing the appropriate rules in the knowledge base. It then executes the rules and determines when an acceptable solution has been found before passing the result to the user interphase system.

The user interphase system is the part of the expert system that comminicates information back to the user. As a user describes a problem, the interphase system passes the information to the inference engine, which in turn returns the available knowledge inferred from the knowledge base to the user interphase system in a user-readable form.

The user interphase system and inference engine together constitute what is called an expert system shell. Several shells could be created, maintained and developed on the extension of the expert system. An expert system that exhibits flexibility allows for adding and updating of knowledge base.

1.3 TYPES OF EXPERT SYSTEM

Expert systems are divided into two main types:

a. Logic-based expert system

b. Rule-based expert system

In a Logic-based expert system, the knowledge base consists of statements in terms of predicate logic clause. These clauses are of the two predicate forms - rules and conditions .The rules contain condition numbers to possible goals. After it has been

queried the pattern formed are matched with database knowledge base pattern. A system is said to be expert based on its acquisition of rules and the application of these rules in its field of expertise.

The advantage of the rule-based system over the logic-based system is that new rules could be acquired and appended to exisiting set of rules. This operation produces little or no problem as the system immediately adjusts itself to its recent amendment.

1.4 EXPERT SYSTEM MODUS OPERANDI

Knowledge is represented in an expert system in the form of rules or in the form of frames. Rule -based systems consist of sets of rules that describe how knowledge is used to reach a conclusion. Frame-based systems consist of frames, or network of nodes, organised in a hierarchy to represent knowledge.

1.5 PURPOSE OF THE STUDY

Due to the chronic inadequacy of specialists in the field of Obstetrics and Gynaecology in the country, management of infertility is commonly incomplete and ineffective, to the extent that an increased morbidity is seen in the condition. There is therefore a great need for a new system of management based on the following reasons:-

i. To reduce cost of investigations and treatment of patients usually referred to the few specialists centres available.

ii. To provide a comprehensive guide to general medical practiioners that will assist them in offering more and better services to their patients with this condition.

iii. To enhance the overall fertility of the people.

iv. To reduce the enormours frustrations and disharmony in families with this condition.

v. To allow for more concentration on research into new areas of medication without much concern on the existing ones.

1.6 JUSTIFICATION OF THE STUDY

The justification and relevance of this study are stated as follows:

i. **OPERATING ENVIRONMENT OF GENERAL MEDICAL PRACTIONERS**:- Most general medical practioners work either in government hospitals or private hospitals. Government health institutions fall into three main categories, viz: rural health centres, primary health centres, general hospitals and specilists hospitals/teaching hospitals. General medical practioners are concentrated in the primary health centres and general hospitals, and to a far less extent, Specialists and Teaching hospitals. In the set-up of most of these institutions, doctors operate under high pressure, having to see large number of patients, with poorly maintained facilities, and poor wages. It is therefore no surprise that commitment to duty is absent. The introduction of an expert

system into

these institutions will no doubt save the doctors valuable time and reduce the high financial costs and multiple visits that patient have to deal with under the present system.

ii. **AVAILABILITY OF REFERRAL CENTRES**:- On the average, there is one referral centre in every major city in the country. However, up to 85% of our population are rural dwellers. It is thus obvious why majority of referral patients have to travel long distances, through hazardous roads, at great expenses, several times before receiving necessary care.

iii. **AVAILABILITY OF EXPERTS**:- Through no fault of the patients, the country has inadequate number of experts in various medical fields, particularly in Obstetrious and Gynaecology,to provide care in all needed areas. There is therefore a need to create an expert system for use by general practioners, in order to reduce the referral cases to a minimum.

iv. **COST OF INVESTIGATIONS AND TREATMENT**:- Presently, due to the multiple visits and trial-and-error approach of treatment usually given, a lot of money is spent by innocent patients. The expert system will reduce visits to the hospital and eliminate unnecessary treatment as more accurate diagnosis can now be made.

1.7 OBJECTIVES OF THE STUDY

Expert systems already are widely used in virtually every field of study, and their applications continue to spread in information technology. This project aims to achieve the following objectives:

i. Development of expert system in the management of infertility, particularly in areas where specialists in the field are not available or adequate, such that general practitioners can benefit in the application of expert knowledge to the management of their patients in need of such care.

ii. Provision of uniformity in management of infertility for doctors in accordance with the contemporary specialists views.

iii. Provision of a large and expandable database of rapidly retrievable information with the potential for ready compilation and analysis in research.

1.8 SCOPE AND LIMITATION OF THE STUDY

This study, as stated earlier, would analyse and evaluate the causes of infertility in order to know the appropriate solution to the problem. Given this background, a computerised procedure would be designed where the various causes and solutions would be programmed into the computer. Therefore, the resultant expert system would be expected to be used for managing various cases of human infertility.

However, this study would be limited to a computerised management of infertility where the response of the computer would rely on the information entered

as regards the case involved. This, in essence, implies that the diagnosis will be manually carried out instead of by computer application. The computer-based application to diagnosis is not possible because of lack of necessary facilities for the research.

In addition, the study would delve into the existing causes of infertility. As research continues and other ideas come out, the software design of this study would need to be updated to reflect the new findings.

1.9 METHODS OF INVESTIGATION AND FACT FINDING

The purpose of this is to fully understand the existing system and to identify the basic information required. Specifically, the tools used for the study are as follows:-

i. **INTERVIEWING**:-This involves arranging interviews with medical practitioners and specialists in the area about their method of work-up and management of the interfile couples.

ii. **RECORD REVIEW**:- This implies reviewing the medical records, where available, of such patients with a view to understanding the completeness of the doctors assessment and the outcome of care given.

iii. **TEXT REVIEW**:- Medical books were also gone through in order to ascertain and exhaust the various causes of infertility and their expected solutions.

iv. Finally, interviews were conducted with various infertility patients at a busy General Hospital and some private hospitals run by general medical practioners to obtain first hand information about their various difficulties with the present system.

Facts that were evaluated consisted of the following:-

1. Age of patient
2. Sex
3. Occupation
4. Period of marriage
5. Previous pregnancies and outcome
6. Past medical history
7. Past surgical history
8. Details of previous investigations and treatment
9. History of present complaints
10. Physical examination
11. Laboratory investigations
12. Other necessary procedures
13. Diagnosis
14. Treatment
15. Follow-up

CHAPTER TWO

2.0 REVIEWING THE CONCEPT OF INFERTILITY

2.1 DEFINITION OF INFERTILITY

Infertility is defined as inability to conceive after one year of regular coitus without contraception. It may be classified as primary when there is no history of pregnancy having occurred, or secondary, when inability to conceive occurs after one or more successful pregnancies.

Approximately, 18% of couples in Nigeria are infertile and the condition is becoming an increasingly more serious medical and social problem. Because of the widespread practice of criminal abortions for unwanted pregnancy and the high prevalence of sexually transmitted diseases, the incidence continues to rise in the society.

Infertility is a disorder of couples and both partners must be evaluated. The man is responsible in about 30% of cases, the woman in about 40% of cases, and both in the remainder.

Fecundability, that is, the possibility of conception, is strongly influenced by the ages of the parties, the frequency of coitus, and the duration of sexual activity without contraception. In women, fecundability is maximal at about the age of 24. At age 24 - 30, there is a slight decline, and after age 30, the decline is quite rapid. In men, fecundability is also maximal at age 24-25. Coital frequency at about 4 - 5 times per week is associated with maximal fecundability. The longer the couple have been

trying to produce a child without success, the greater the progressive decline in the conception rate. This is independent of the age of the parties or the frequency of coital exposure.

2.2 PSYCHOLOGICAL ASPECTS OF INFERTILITY

Because of her psychological upbringing in our society, the woman usually assumes initial responsibility for failure to produce a child and is therefore usually the first to seek medical care. In contrast, the man may demonstrate his inability to face the possibility of being infertile by avoiding examination.

A number of feelings are common to infertile patients. Initially, this may be surprise, denial, and isolation, followed by anger, guilt, depression, and even grief. With appropriate resolution of these reactions, the condition may be accepted, but it is essential that the therapist recognise the powerful emotional impact of the realisation that one is unable to produce an offspring. Too frequently, the couple are simply left uninformed. After a thorough infertility evaluation, the therapist should carefully and honestly counsel the couple concerning their chances for conception.

Infertility has important effects on sexuality, self-image, and self-esteem, for men as well as for women. Some women may regard child bearing as the ultimate expression of their biological identity as women, and there is no doubt that some men regard fathering children as the supreme affirmation of their masculinity. Being confronted with the knowledge that they are unable to produce a child may thus have psychological consequences for one or both partners that reach deeper than simple

childlessness and absence of nurturing function to affect their concepts of themselves as valid human beings.

Additional problems may arise during the evaluation period. Having intercourse according to the schedule prescribed by the doctor may remove desirable spontaneity in love-making. Moreover, the knowledge that intercourse may involve a subsequent post-coital examination may result in impotence. Excessive pre-occupation with a basal body temperature chart can make married life unnecessarily tedious. The physician must take care to maintain and support the relationship between the husband and wife regardless of the type of infertility therapy being used.

2.3 FUNCTIONAL CLASSSIFICATION OF CAUSES OF INFERTILITY

2.3.1 TIME

Contrary to popular opinion, unprotected intercourse, even during the pre-ovulation period, does not usually result in conception. In couples who do not take contraception, about 25% of women will be pregnant in the first month, at least 60% in 6 months, about 75% in 9 months, 80% in a year, and approximately 85% in 18 months. When all conditions for conception are ideal, 42% of menstrual cycles result in no conception, 16% produce abortive ova, and 42% produce normal fertilised ova. If the woman misses her period, her chances of having normal pregnancy are 72%, and the chance of aborting, 28%.

However, since not all of these abortions cause clinically recognisable symptoms, several such episodes may occur before the woman is at risk for conception only if coitus occurs during her fertile period; only those months in which

there has been adequate coital exposure can be included in an assessment of infertility.

2.3.2 SEMEN

In order for conception to occur, the semen must produce a sufficient number of normal, motile spermatozoa in an ejaculate made up of appropriate secretions from the accessory genital glands.

2.3.3 OVA

Conception cannot occur without ovulation of an oocyte that is successfully implanted and then supported by an adequately functioning Corpus Inteum.

2.3.4 TRANSPORT

Transport mechanisms of spermatozoa and semen in human reproduction are complex. Spermatozoa and seminal fluid must both traverse the accessory reproductive ducts of the male and be appropriately ejaculated from the penis. Coitus must also occur so that the semen is deposited in or near the cervix. In the female, initial transport of sperm occurs in the cervical mucus, which is profoundly altered by the presence or absence of estrogens and progesterone.

The fallopian tubes transport sperm towards the ovary while simultaneously moving ova in the opposite direction. This function is easily disturbed by an antecedent infection with resulting adhesions or by inflammatory processes such as endometriosis.

2.3.5 THE INCUBATOR

In virtually all pregnancies carried to term, the endometrial cavity serves as the "incubator" of the fertilized ovum. Endometrial infections or an inability of the endometrium to respond appropriately to endocrine stimulation of the ovary may result in infertility. Distortion of the endometrial cavity by submucous fibroid, synechiae, or congenital uterine anomalies is an uncommon cause of infertility, but a frequent cause of spontaneous abortion in the first trimester.

2.3.6 OTHER PROBLEMS

Generalised endocrine disorders, e.g. hypothyroidism or severe adrenocortical hyper - or hypofunction, may result in infertility. In most of these disorders, associated anovulation causes infertility. Systemic diseases such as severe or poorly controlled diabetes are associated with decreased fertility, often for reasons not clearly understood.

TABLE I. CAUSES OF INFERTILITY

GENERAL	DEVELOPMENTAL	ENDOCRINE	GENITAL DISEASES
FEMALE:			
Dietary disturbance	Uterine absence, Hypoplasia, Uterine anomalies	Pituitary failure	Pelvic inflammations
Severe anaemia	Gonadal dysgenesis	Thyroid disturbances	Tuberculosis., Tubal obstruction
Anxiety. Fear		Adrenal hyperplasi	Endometriosis
		Ovarian failure	Fibroids
		Polycystic	Sexually transmitted diseases
MALE			
Fatigue. Excess smoking. Alcohol	Undescended testes. Testicular germinal aplasia	Pituitary failure. Thyroid deficiency. Adrenal hyperplasia	Mumps orchitis. Sexually transmitted diseases. Prostatitis
Fear. Impotence	Hypospadia. Klinefelter's syndrome		
FEMALE & MALE			
Marital problems. Sex problems. Ignorance. Low fertility index. Immnnologic incompatibility			

TABLE II. FUNCTIONAL CLASSIFICATION OF CAUSES OF INFERTLITY

TIME
Timing of coitus. Frequency of coitus

SEMEN
Sperm.Other components of ejaculate

OVA
Growth & development of viable ova. Ovulation. Implementation. Adequacy of corpus luteum

TRANSPORT
Male.Coital.Female:Cervical transport failure. Uterine transport failure. Tubal transport failure

"**INCUBATOR**" (Endometrical dysfunction).

OTHER PROBLEMS
Generalised endocrine disorders. Systematic diseases (e.g. diabetes mellitus)

CHAPTER THREE

3.0 SYSTEM ANALYSIS AND DESIGN

3.1 INTRODUCTION

System analysis is the logical process of collecting and evaluating an existing system in order to properly understand the operations involved. A good task in this regard will aid building a strong background for the new system design. System design, on the other hand, is the transformation of the analysis and evaluation done earlier to the form understandable by the computer. It is always done with the ultimate aim of meeting the desire need.

However, one major concern of this chapter would be to carry out the feasibility study in the form of analysing and evaluating the various causes of infertility and the method required in carrying out the diagnosis. After the completion of this, the design of the required software would be performed such that the stated objectives of the expert system is met.

3.2 DIAGNOSTIC EVALUATION

In the woman, evaluation should begin with a thorough history and physical examination. The history should include the duration of infertility, coital frequency, menstrual pattern, duration and frequency of menses, premenstrual molimina, past history of virginal discharge, cervicitis, pelvic infections, surgery or accidents, as well as general physical condition, illness, allergies, drug intake, or significant family history. During the physical examination, special attention should focus on secondary

sex characteristics: body contour, hair distribution, breast development, external and internal genitalia.

Baseline laboratory studies should consist of a serologic test for syphilis, blood count, sedimentation rate, urinalysis, serum TSH by radioimmunoassay to rule out hypothyroidism, and other specific test to rule out suspected systemic disease.

In the man, the evaluation should begin with semen analysis, preferably at least 2 samples. In the presence of a normal semen analysis, most other abnormalities of the man are probably inconsequential, and no further evaluation is necessary. However, if the semen analysis is abnormal, further evaluation is in order. The history should record mumps orchitis, diabetes mellitus, herniorrhapy, and exposure to x-rays or toxic susbstances (e.g. lead, iron, zinc, copper). Men who lead sedentary indoor lives are markedly obese, are exposed to high environmental temperatures, or wear tight underclothing may have abnormal spermatogenesis. Frequent or prolonged bathing in hot tubs or whirlpool baths causing elevated testicular temperature often result in diminished semen quality.

Physical exmainations should note the existence of systemic diseases and endocrinopathy; the presence of secondary male sex characteristics, variococele, or hydrocele, and congenital abnormalities such as hypospadias or crytorchidism.

Initial laboratory examination should consist of a serologic test for syphilis, complete blood count, sedimentation rate, urinalysis, examination of the prostatic secretion for prostatic inflammation, and serum TSH by radiommunoassay. Additional

examination of the testicular and pituitary endocrine function, including testicular blopsy, may be warranted.

3.3 EVALUATION OF THE CAUSES OF INFERTILITY

3.3.1 EVALUATION OF SEMEN

The semen should be obtained by masturbation or coitus interruptus into a clean, well-rinsed, dry jar or disposal plastic container. Three or five days should have elapsed between the day of collection and the last ejaculation. Initial evaluation should always be based on the analysis of two specimens obtained in a one to two week interval. At least, two and frequently three to four samples should be examined before the physician reaches a conclusion. The sample should be delivered to the laboratory within one hour after collection and should not have been cooled or warmed. The entire ejaculate should be contained in the specimen jar for microscopic analysis.

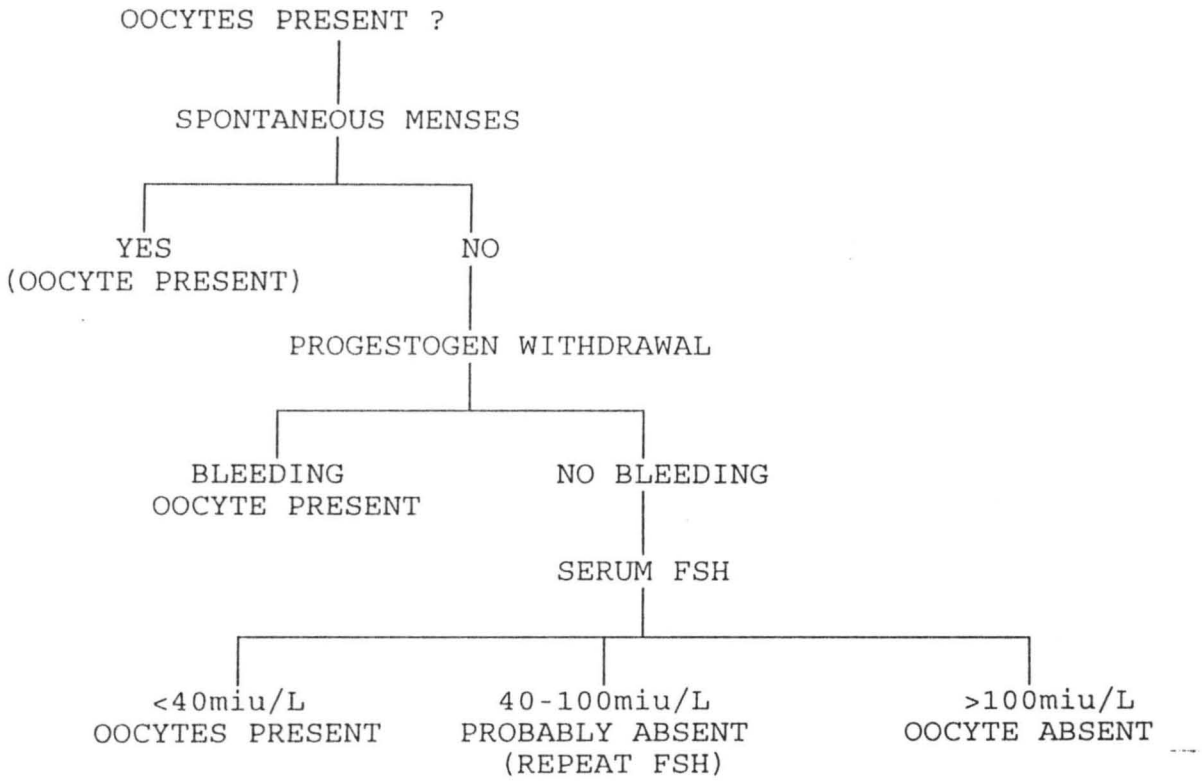
MICROSCOPIC SEMEN ANALYSIS

PARAMETERS	NORMAL VALUE
Abstinence	3 to 7 days
Collection	Masturbation/Coitus interruptus
Volume	2-6ml
Viscosity	Full liquifaction within 60minutes
Sperm density	40 - 250million/ml
Sperm motility	
Progressive	Good - very good
Quantitative	1st hour > =60%; 2-3 hours > = 50%

Vitali ty	< 35% dead cell
Morphology	> = 60% with normal configuration
Acid phosphetase	25,000 - 60,000 iu/ml

3.3.2 EVALUATION OF OVA

i. PRESENCE OF OOCYTES:- Without oocytes, ovulation and normal corpus luteum function, pregnancy is impossible. The flowchart for determining presence or absence of oocytes is as follows:



ii. OVULATION:- This is the release of a ripened oocyte from the ovarian follicle. Indicators of ovulation are as follows:

a. BASAL BODY TEMPERATURE:- The temperature obtained immediately upon awakening every morning and before any activity has occurred. The luteal phase rise, which is usually slightly greater than 0.3°c (0.6°f) and which accounts for the biphasic nature of the curve, is due to progesterone secretion by the corpus luteum.

b. SECRETORY ENDOMETRIUM:- By examining a mid luteal phase endometri al biopsy, a pathologist can determine within 12 days the day in the cycle on which the endometrium was obtained.

c. PREMENSTRUAL MOLIMINA:- These are signs and symptoms which indicate that a period is imminent, e.g. bloating, cramping, acne, swelling of hands and feet, emotional tension.

d. THICK CERVICAL MUCUS:- Prompt development of thick cervical mucus following a flow of clearly identifiable estrogen-stimulated mucus is useful.

e. VAGINAL CYTOLOGY:- Progesterone exerts clearly recognisable changes on the exfoliated cells of the vaginal mucosa.

iii. CORPUS LUTEAUM FUNCTION:- After ovulation has occured, the corpus luteum is responsible for the production of estrogen and progesterone.

3.3.3 EVALUATION OF TRANSPORT

(i) MALE TRANSPORT:- This is evaluated by semen analysis.

(ii) COITAL TRANSPORT:- This is evaluated by a postcoital test, an excellent screening test. A normal postcoital test signifies normal sperm production, normal male transport, normal coital techniques, and normal cervical transport.

The steps in performing a post-coital test are as follows:-

1. Schedule the test for time of peak spontaneous cervical mucus flow or give exogenous estrogen to induce mucus flow if spontaneous and reasonably regular ovulation does not occur.
2. Require at least 2 days of ejaculatory abstinence before the test.
3. Proscribe douches for 24 hours before coitus and the use of vaginal creams or lubricants during coitus.
4. Time coitus to occur the night before or on the morning of the postcoital test
5. Expose the cervix with a speculum, gently wipe away excess mucus from the portio. Leave clear, shiny mucus in the internal os.
6. Remove sample of cervical mucus from the cervical canal using a polyethylene catheter attached to a syringe. (After drawing mucus into the catheter, it is helpful to clamp the catheter close to the mucus with a clamp).
7. Expel mucus from the catheter onto a glass slide.
8. Note amount of mucus (Mucus column in the catheter should be at least 2cm long).
9. Note spinbarket ("Stretchability") of the mucus. (It should be at least 6cm long).
10. Cover mucus on a slide with a coverslip and examine microscopically using both low- and then high-power objectives. (There should be at least 2 normal motile sperms per high-power field in the mucus from near the internal os. In most normal tests there will be more than 5 normal motile sperms per high-power field. Very few white cells and no red cells should be present).

Interpretation of abnormal findings in postcoital test:

FINDING	CAUSE
* Thick yellow mucus with poor spinn. barke it	Test performed at inappropriate time of cycle
* Inadequate amount of clear mucus	Insufficient estrogen stimulation; inadequate number of mucus-secreting glands, e.g following cervical conisation
* Multiple white cells	Cervicitis
* No sperm	Azoospermia Failure of male transport Failure of coital transport
* Inadequate number of motile sperm	Oligospermia; Inadequate cervical mucus immunologic incompatibility.

(iii) FEMALE TRANSPORT

1. Cervical transport is best evaluated by a postcoital test and careful examination of the cervix.

2. Ulterine and tubal transport are always examined simultaneously:

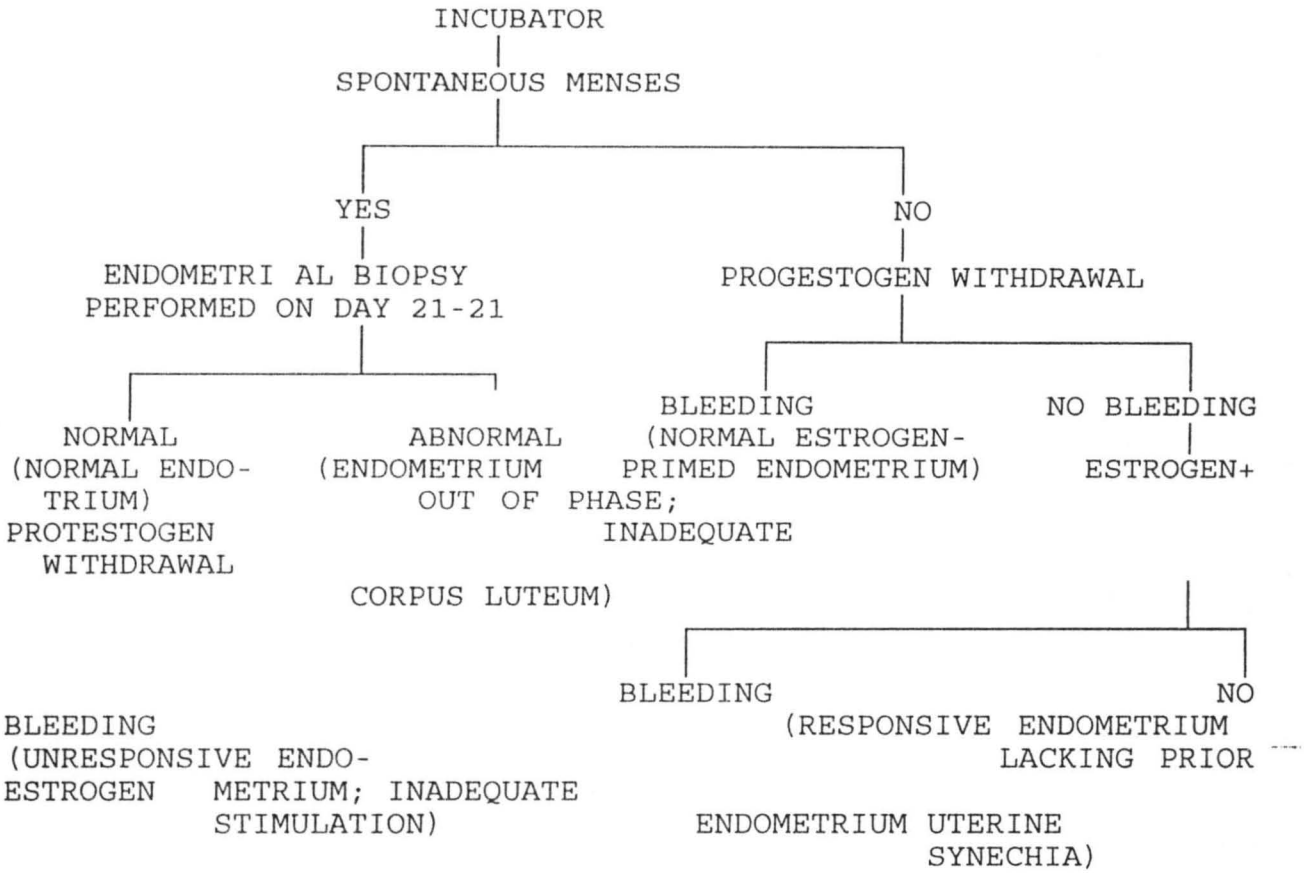
a. UTEROTUBAL CARBON DIOXIDE INSUFFLATION:- This test should be performed during the early follicular phase.

b. HYSTEROSOLPINGOGRAM:- This test permits examination of the internal surface of the uterus and tubes for anatomic abnormalities.

c. LAPAROSCOPY WITH DYE INSTILLATION:- This shows not only whether the tubes are blocked or patent but also enables the physician to perform a direct examination of the peritoneal surfaces of the internal reproductive organs, and to diagnose endometriosis and adhesions.

3.3.4 EVALUATION OF THE INCUBATOR

The function of the uterus as "incubator" of the fertilized egg is evaluated according to the flow chart presented below:



3.4 THERAP Y

Specific therapies are aimed at specific identified causes:

3.4.1 PROBLEM OF TIME

A. <u>OPTIMAL TIME FOR CONCEPTION</u>

If, upon brief history, no readily identifiable cause of inability to conceive is found, e.g. amenorrhea, the couple should be instructed in reproductive physiology,

about the importance of adequate coital exposure during the woman's fertile period, and counselled to return if they are still unsuccessful after 6 months.

B. COITAL FREQUENCY & TIMING

A coital frequency of roughly every other day during the fertile period (3-4 days) results in maximal fertility. It is important to identify the woman's fertile period, particular for couples who cannot sustain the recommended coital frequency for an entire cycle.

In women with reasonably regular cycles, the fertile period can be estimated by subtracting the number of days of the luteal phase (usually 13 +/- 3 days) from the estimated date of next menstrual flow. If menstrual cycle occurs regularly every 28 days, ovulation will occur most often on menstrual cycle day 16 and usually between days 13 and 19. (The first day of the menstrual cycle is the first day of bleeding. The last day of the classic menstrual cycle, day 28, is the day before the onset of another bleeding).

3.4.2 PROBLEMS OF SEMEN

A. SPERM

Azoospermia secondary to lack of gonadotrophins is remedied by administration of human memopansal gonadotrophins. There is no treatment for azospermia associated with elevated serum concentration of follicle-stimulating hormone and due to congential anomalies or chromosomal abnomalities.

If oligospermia is diagnosed to be secondary to varicocele, ligation of the involved spermatic vein should be considered. If it is secondary to hythpothyroidism, thyroid treatment should be given.

Patients with oligospermia should be counselled regarding general measures that may be helpful. They should avoid excessive consumption of alcohol, tobacco, and caffeine and should refrain from excessive coitus. They should obtain adequate sleep and regular exercise, and adequate diet that includes weight reduction for the obese patients. Men should avoid excessive and prolonged exposure of the scrotum to heat by avoiding hot baths, jockey shorts, or prolonged sitting in a hot environment.

B. SEMINAL FLUID

Treatment of acute and chronic infection should be given with appropriate antibiotics and anti-inflammatory drugs.

3.4.3 **PROBLEMS OF OVA**

A. LACK OF OOCYTES

There is no known therapy for the lack of oocytes.

B. ANOVULATION

This is treated by the induction of ovulation using chromiphene citrate in gradually increasing doses. After a maximum dose of 25mg./d for 5 days, adjuvant human chorionic gonadotrophic hormone injection, up to 5000i.u. may be administered intramuscularly at the peri-ovulatory period.

CORPUS LUTEUM ABNOMALITIES

Progestrone is the principal agent for treatment of corpus luteum insufficiency. It should be started 3 days after the Basa l Body Temperature rise and should be administered in physiologic doses, i.e 25mg. suppositories twice daily, or 12.5mg in oil intramuscularly, daily for 2 weeks. Suppositories are preferred treatment.

If the cause of the inadequate corpus luteum is inadequate FSH in the antecednet follicular phase, chomiphene citrate may be given.

3.4.4 PROBLEMS OF TRANSPORT

A. MALE TRANSPORT

Hypospadias may be surgically repaired with good results.Blockage of the male transport usually occurs in the vas deferens, and may be corrected by meticulous surgical technique and deligent postoperative care.

B. COITAL TRANSPORT

Coital transport problems are managed by education and counselling regarding coital techniques. Where satisfactory response is not seen, the following may be considered:

(i) ARTIFICIAL INSEMINATION BY A DONOR (A. I. D.):- This is indicated in any abnomality of the male that does not respond satisfactory to treatment or if the male is a carrier of a dominant genetic abnormality. Insemination is performed during the immediate preovulatory period as determined by a cervical mucus flow or another suitable indicator. Generally, at least 2 inseminations should be performed about 48hours apart. The donor sperm can be introduced into the

uterine cavity, the endocervical canal, the vagina, or a cervical cup placed against the cervix.

(ii) ARTIFICIAL INSEMINATION BY THE HUSBAND (A. I. H.):- This is indicated and unequivocally effective when the cause of infertility is anatomic inability of the male to place sperm against the cervix, and when semen analysis and evaluation of the female are normal. This may occur when hypospadias, retrograde ejaculation, or male sexual dysfunction is diagnosed. It is also an effective treatment in oligospermia, hypomotility, hyperviscosity, hyper-or hypovolemia, clumping or agglutination of sperm, and in hostile cervical mucus.

C. **FEMALE TRANSPORT**

(i). CERVIX

(a). IMMUNOLOGICALLY BASED INFERTILITY:- Condom therapy is the most effective therapy for this disorder. In this treatment, a condom must be used for all coitus until the sperm antibody titer is negative of significantly lowered. Therafter, a condom should be used except when intercourse occurs during the woman's fertile period. The woman is thus exposed to semen only at time when conception can occur.

(b). INSUFFICIENT CERVICAL MUCUS:- This should be treated by the preovulatory administration of estrogen, which should begin on about the eight or tenth day of the cycle. Doses can be increased every other day until a sufficient outpairing of clear, watery, slippery mucus is noted. Estrogen should be continued until the Basal Body Temperature rises.

(ii). UTERUS

Endo metrial cavity adhesions are best treated by careful dilatation of the endocervix and endometrial cavity, gentle endo metrial currentage, and insertion of an intra-uterine device followed by administration of large doses of estrogen, e.g conjugated estrogen, 2.5mg orally daily. The device should remain in place for 3-6 months, during which time the endo metrium should regenerate throughout the newly re-created endometrial cavity.

(iii). TUBES

The only effective treatment for tubal blockage is surgical operation. Surgical procedures must be tailored to separate the adhesions and relieve the scarring. Where the tubal problem is due to endometriosis, treatment is medroxyprogestrone acetate, 30mg/d for 90 days; or Danazol 800mg/d for 6 months. Where the patient prefers, or can afford the cost, in vitro useful in couples with obstruction of the fallopian tubes. Successful in vitro fertilization requires recovery of oocytes by ovarian aspiration, in vitro fertilization, and implementation of the conceptus in utero. The initial step involves induction of follicular maturation with clomiphene citrate, human menopausal gonadotrophine hormone, a combination of the two. Serial estrogen blood levels are monitored and ultrasound measurements of follicular diameter are recorded in order to determine the effects of this therapy. When the follicle is mature, chorionic gonadotrophin hormone is adminstered to induce final maturation of the oocyte. Approximately, 34-36 hours later, suction-guided laparoscopy is used to recover the oocytes. Percutaneous transabdomoinal

CHAPTER FIVE

5.0 SYSTEMS DOCUMENTATION AND CONCLUSION

5.1 SYSTEMS DOCUMENTATION

Documentation is the description of how a system works. This is done to ensure better understanding of the system by the users incase of any problem. Therefore, in documenting the proposed system, the mode of starting the new system and its method of operation would be stated.

5.1.1 STARTING THE SYSTEM

As stated earlier, the new system was developed using dBASE IV. For the system to work at all, there is need to install dBASE IV on the computer to be procured. If this is done, the program would be started by typing "DO EXPERT" and the operation of the system begins.

5.1.2 DESCRIPTION OF THE NEW SYSTEM

The execution of the new system begins by displaying various historical overview of an infertility patient from which the user would be expected to select the relevant information which have been found present in the patient. On the selection of this, the physical examination associated with the history is presented as well as the necessary investigations. At this point, relevant diagnosis is established and an

aspiration under ultrasound control has also been successful in oocyte recovery. After the oocytes have been held for a few hours in a special culture medium, specially prepared sperm are added. If fertilization occurs, either a 2-pronuclei stage or 2-cell conceptus is seen about 24 hours later. The conceptus is then transfered after about 48-60 hours of fertilization into the endometrial cavity by means of a transcervical catheter. Ovum Transfer technique is used where In Vitro Fertilization technique is not feasible. Here, an appropriate female donor is found and following synchronization of her expected time of ovulation with the wife's, the donor is inseminated with the husband's sperm. The conceptus remains in the donor for 5 days. Lavage is then used to recover the conceptus, which is immediately transfered to the wife's uterus via a transcervical catheter. Apart from its usefulness in managing women who have surgically irreparable tubes, this technique is also useful in women who are carriers of genetic disorders, in patients with unexplained infertility, premature ovarian failure, or castration.

3.4.5 PROBLEMS OF THE "INCUBATOR"

A. INFECTION

Tuberculosis endometritis should be treated using standard antituberclosis therapy.

B. ANATOMIC ABNORMALITIES

Congenital anomalies and uterine myoma generally do not usually result in infertility, but where they do, appropriate surgery is helpful.

3.4.6 OTHER PROBLEMS

Treatment of the other endocrine or systemic diseases associated with infertility is specific for the underlying disease.

3.5 SYSTEMS DESIGN

The design of the new system is intended to take care of all the causes of infertility and their respective treatment described in sections 3.3 and 3.4 above. This is done such that once the user selects the appropriate information, the diagnosis is displayed as well as the recommended treatment. All these were achieved through the use of Database Management System (DBMS).

3.6 FEATURES OF DBMS

A database is an organised collection of related information designed to meet the various needs of an organisation or establishment. DBMS is a package of computer programs and its documentation used to create, maintain, organise and retrieve information from a database. It is a software package that help establishments or institutions to manage their data resources.

Database management software is of various types which include dBASE, Foxbase, Informix, Paradox, Oracle and a host of others. dBASE is also of different versions such as dBASE II, dBASE III, dBASE III+, dBASE IV and the latest dBASE V. dBASE IV which is the particular dBASE program used in the development of this system has capabilities for programming.

CHAPTER FOUR

4.0 SYSTEM IMPLEMENTATION

4.1 INTRODUCTION

The implementation stage is required to aid in actualising the proposed system. this is done with specific reference to the environment that will be suitable for the prop er execution of the new system. the mode of testing and method of conversion required are also highlighted.

4.2 HARDWARE CONFIGURATION

The newly developed systen is designed to work on a microcomputer of not less than a 486 micropropcessor. pecifically, the recommended configuration is as follows:

* Pentium 166MHZ
* 16 MB RAM
* 1.7 GB hard Disk
* 3.5 Floppy disk drive
* SVGA monitor
* Keyboard installed.

The importance of the above features is required in order to aid quick reponse of the system to enquiry made by the user. This is considered necessary in case of emergency.

appropriate treatment is recommended. This treatment would be expected to be administered on the patient for appropriate result.

The program output as presented in Appendix A is the result of executing the new system. On execution of the system, a brief introduction to the system is displayed and it is followed by the presentation of the method of working with the new system as contained in figures 1 & 2. After this, the system displays the history of the patient, the relevant physical examination and invetigations are also presented. This is then followed by the cause and treatment of the problem. All these are represented by figures 3 & 4 in the Appendix. Similarly, other problems are also presented in the same manner as represented by other figures in the Appendix.

5.2 RECOMMENDATION

The use of artificial intelligence in the medical field is an area of great potential in Nigeria and other third world countries. Although the initial investment into such a system will be great, the long term benefiits to the government in aleviating or reducing the morbidity of this medical problem in the society makes the investment worthwile. Where the system is tried and found workable, it will also save the government great funds in training medical experts in the field.

In order to achieve the objectives of the new system, the following recommendation should be observed:

(i) A computer with speed not less than 100MHZ should be used with the system. This is needed in order to ensure that the users get prompt response from the system.

(ii) The installation of the new system still require the use of a doctor in performing some roles. For instance, a medical doctor needs to observe the patient and carry out and interprete necessary investigations. In addition, the treatments recommended in the system are also presented in medical terms which makes supervision or monitoring essential by a medical doctor.

(iii) A thorough assessment of the patient needs to be carried out in order to get a good result from the system.

5.3 CONCLUSION

There is no doubt that in a society where medical expertise in the area of gyneocology is inadequate, an expert system in the management of infertility will provide greater availability of required services to the masses, through use by general medical practioners, and so reduce the morbidity of infertility in the society, its use also offers non-specialist doctors an avenue to understand more fully an expert's principles of management of infertility.

Furthermore, its use will promote the effectiveness and efficiency by healthcare providers, and also improve record keeping.

Moreover, it offers a certain degree of psychological re-assurance to the patients that their problems are being managed in a systematic manner that offers the

thoroughness required by an expert. Certainly, the psycological factor in medical treatment is an aspect that has been well-studied and found to be useful in patients' response to treatment.

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APPENDIX A (PROGRAM OUTPUT)

EXPERT SYSTEM ON THE MANAGEMENT OF INFERTILITY

SOFTWARE DEVELOPED FOR THE REQUIREMENT OF THE AWARD OF POST-GRADUATE DIPLOMA IN COMPUTER SCIENCE OF FEDERAL UNIVERSITY OF TECHNOLOGY

MINNA

BY

DR. FRANK FASHINA
PGD/MCS/242/96

PRESS ANY KEY TO CONTINUE !!!

EXPERT SYSTEM ON THE MANAGEMENT OF INFERTILITY

MODE OF OPERATION

STEP 1 - Select appropriate HISTORY OF PATIENT

STEP 2 - Confirm PHYSICAL EXAMINATION

STEP 3 - Carry out appropriate INVESTIGATION

STEP 4 - Administer the recommended TREATMENT displayed

DO YOU WANT TO CONTINUE [Y/N]:

HISTORY OF THE PATIENT

POOR SOCIOECONOMIC HISTORY

MALNUTRITION

FOOD FADISM

ARE ALL THE ABOVE APPLICABLE TO THE PATIENT (Y/N):

ON PHYSICAL EXAMINATION THE PATIENT MUST POSSESS ONE OR MORE OF THE FOLLOWING:

POORLY DEVELOPED

POORLY NOURISHED

PALE

DRY SKIN

IS THE ABOVE CONFIRMED (Y/N):

ON INVESTIGATION ONE OR MORE OF THE FOLLOWING CAN BE OBSERVED:

FBC & DIFFERENTIAL

ESR

SEMENALYSIS

USS

URINE ANALYSIS & MICROSCOPY

IS THE ABOVE CONFIRMED (Y/N):

MAJOR CAUSES:
* ANOVULATION

TREATMENT:
* CORRECT DIET

HISTORY OF THE PATIENT

OVERLY ANXIOUS ABOUT COITUS AND FERTILITY

PALPITATIONS

INSOMNIA

DIFFICULTY IN SUSTAINING ERECTION

EASILY STRESSED

IRRITABILITY

ARE ALL THE ABOVE APPLICABLE TO THE PATIENT (Y/N):

ON PHYSICAL EXAMINATION THE PATIENT MUST POSSESS ONE OR MORE OF THE FOLLOWING:

APPEAR TENSE

HIGH BLOOD PRESSURE

HIGH PULSE

IS THE ABOVE CONFIRMED (Y/N):

ON INVESTIGATION ONE OR MORE OF THE FOLLOWING CAN BE OBSERVED:

FBC & DIFFERENTIAL

SEMENALYSIS

USS

URINE ANALYSIS & MICROSCOPY

IS THE ABOVE CONFIRMED (Y/N):

MAJOR CAUSES:

* ANXIETY NEUROSIS

TREATMENT:

* PSYCHOTHERAPY
* SEDATIVES
* CORRECT BLOOD PRESSURE

HISTORY OF THE PATIENT

INADEQUATE COITAL EXPOSURE

IS THE ABOVE APPLICABLE TO THE PATIENT (Y/N):

ON PHYSICAL EXAMINATION THE PATIENT MUST POSSESS ONE OR MORE OF THE FOLLOWING:

APPEARS NORMAL

IS THE ABOVE CONFIRMED (Y/N):

ON INVESTIGATION ONE OR MORE OF THE FOLLOWING CAN BE OBSERVED:

FBC & DIFFERENTIAL

SEMENALYSIS

USS

URINE ANALYSIS & MICROSCOPY

IS THE ABOVE CONFIRMED (Y/N):

MAJOR CAUSES:

* IGNORANCE

TREATMENT:

* SEX EDUCATION

* REASSURANCE

HISTORY OF THE PATIENT

AMENORRHEA

ABNORMAL MENSES

WATERY SPERM

DIFFICULTY IN ERECTION

ARE ALL THE ABOVE APPLICABLE TO THE PATIENT (Y/N):

ON PHYSICAL EXAMINATION THE PATIENT MUST POSSESS ONE OR MORE OF THE FOLLOWING:

APPEARS NORMAL

IS THE ABOVE CONFIRMED (Y/N):

ON INVESTIGATION ONE OR MORE OF THE FOLLOWING CAN BE OBSERVED:

- FBC & DIFFERENTIAL
- SEMENALYSIS
- USS
- URINE ANALYSIS & MICROSCOPY

IS THE ABOVE CONFIRMED (Y/N):

MAJOR CAUSES:

* UNDESCENDED TESTES
* TESTICULAR GERMINAL APLASIA

TREATMENT:

* SURGERY:
  EXCISION OF UNDESCENDED TESTIS IF DAMAGED,
  or TRANSLOCATION IF FUNCTIONAL
* AID
* ADOPTION

HISTORY OF THE PATIENT

ABNORMAL MENSES

HIRSUTISM

OBESITY

ARE ALL THE ABOVE APPLICABLE TO THE PATIENT (Y/N):

ON PHYSICAL EXAMINATION THE PATIENT MUST POSSESS ONE OR MORE OF THE FOLLOWING:

OBESE

HIRSUTE

NORMAL

IS THE ABOVE CONFIRMED (Y/N):

ON INVESTIGATION ONE OR MORE OF THE FOLLOWING CAN BE OBSERVED:

ROUTINE

USS - ENLARGED OVARIES (POLYCYSTIC)

HORMONAL ASSAY
- Prl - normal
- FSH - increased
- Pit - reduced

IS THE ABOVE CONFIRMED (Y/N):

MAJOR CAUSES:
* POLYCYSTIC OVARIES

TREATMENT:
* OVULATION INDUCERS:
  - CLOMIPHENE CITRATE
  - CYCLOPHENIL
  - HUMAN CHORIONIC GONADOTROPHIN HORMONE
  - GONADOTROPHIN RELEASING HORMONE ANALOGUES

```
   exit
  endi
endd
retu


PROC HISTORY4

clea
@ 2,12 to 21,67 doub
@ 4,27 to 6,52
@ 5,29 say 'HISTORY OF THE PATIENT'
@ 8,27 to 16,52
@ 9,29 say 'AMENORRHEA'
@ 11,29 say 'ABNORMAL MENSES'
@ 13,29 say 'WATERY SPERM'
@ 15,29 say 'DIFFICULTY IN ERECTION'
@ 19,14 say 'ARE ALL THE ABOVE APPLICABLE TO THE PATIENT (Y/N):'
do whil .t.
  ch = ' '
  @ 19,65 get ch pict '!'
  read
  if ch $ 'YN'
    exit
  endi
endd
retu
```

```
PROC HISTORY5

clea
@ 3,12 to 20,67 doub
@ 5,27 to 7,52
@ 6,29 say 'HISTORY OF THE PATIENT'
@ 9,30 to 15,48
@ 10,32 say 'ABNORMAL MENSES'
@ 12,32 say 'HIRSUTISM'
@ 14,32 say 'OBESITY'
@ 18,14 say 'ARE ALL THE ABOVE APPLICABLE TO THE PATIENT (Y/N):'
do whil .t.
  ch = ' '
  @ 18,65 get ch pict '!'
  read
  if ch $ 'YN'
    exit
  endi
endd
retu


PROC HISTORY6

clea
@ 4,12 to 20,67 doub
@ 6,27 to 8,52
```

```
@ 7,29 say 'HISTORY OF THE PATIENT'
@ 9,30 to 15,49
@ 11,32 say 'PALPITATION'
@ 13,32 say 'HEAT INTOLERANCE'
@ 18,14 say 'ARE ALL THE ABOVE APPLICABLE TO THE PATIENT (Y/N):'
do whil .t.
  ch = ' '
  @ 18,65 get ch pict '!'
  read
  if ch $ 'YN'
    exit
  endi
endd
retu


PROC HISTORY7

clea
@ 2,12 to 21,67 doub
@ 4,27 to 6,52
@ 5,29 say 'HISTORY OF THE PATIENT'
@ 8,30 to 16,49
@ 9,32 say 'THICK VOICE'
@ 11,32 say 'SOMNOLENCE'
@ 13,32 say 'ABNORMAL MENSES'
@ 15,32 say 'COLD INTOLERANCE'
@ 19,14 say 'ARE ALL THE ABOVE APPLICABLE TO THE PATIENT (Y/N):'
do whil .t.
```

```
 ch = ' '
 @ 19,65 get ch pict '!'
 read
 if ch $ 'YN'
   exit
 endi
endd
retu



PROC HISTORY7

clea
@ 2,12 to 21,67 doub
@ 4,27 to 6,52
@ 5,29 say 'HISTORY OF THE PATIENT'
@ 8,29 to 16,50
@ 9,31 say 'VAGINAL DISCHARGE'
@ 11,31 say 'PELVIC PAIN'
@ 13,31 say 'ABNORMAL MENSES'
@ 15,31 say 'UNULTRA DISCHARGE'
@ 19,14 say 'ARE ALL THE ABOVE APPLICABLE TO THE PATIENT (Y/N):'
do whil .t.
 ch = ' '
 @ 19,65 get ch pict '!'
 read
 if ch $ 'YN'
   exit
```

```
  endi
endd
retu


PROC HISTORY9

clea
@ 2,12 to 23,67 doub
@ 4,27 to 6,52
@ 5,29 say 'HISTORY OF THE PATIENT'
@ 8,27 to 18,52
@ 9,29 say 'HEAVY MENSES'
@ 11,29 say 'MENSTRUAL IRRGULARITY'
@ 13,29 say 'MENSTRUAL PAINS'
@ 15,29 say 'PELVIC PAINS'
@ 17,29 say 'COITAL PAINS'
@ 21,14 say 'ARE ALL THE ABOVE APPLICABLE TO THE PATIENT (Y/N):'
do whil .t.
  ch = ' '
  @ 21,65 get ch pict '!'
  read
  if ch $ 'YN'
    exit
  endi
endd
retu
```

```
PROC PHYSIC1

 clea
 @ 2,12 to 22,67 doub
 @ 4,18 to 7,61
 @ 5,20 say 'ON PHYSICAL EXAMINATION THE PATIENT MUST'
 @ 6,20 say 'POSSESS ONE OR MORE OF THE FOLLOWING:'
 @ 9,30 to 17,49
 @ 10,32 say 'POORLY DEVELOPED'
 @ 12,32 say 'POORLY NOURISHED'
 @ 14,32 say 'PALE'
 @ 16,32 say 'DRY SKIN'
 @ 20,24 say 'IS THE ABOVE CONFIRMED (Y/N):'
 do whil .t.
  ch1 = ' '
  @ 20,54 get ch1 pict '!'
  read
  if ch1 $ 'YN'
    exit
  endi
 endd
 retu


PROC PHYSIC2

 clea
 @ 2,12 to 22,67 doub
```

```
@ 4,18 to 7,61
@ 5,20 say 'ON PHYSICAL EXAMINATION THE PATIENT MUST'
@ 6,20 say 'POSSESS ONE OR MORE OF THE FOLLOWING:'
@ 10,28 to 16,51
@ 11,30 say 'APPEAR TENSE'
@ 13,30 say 'HIGH BLOOD PRESSURE'
@ 15,30 say 'HIGH PULSE'
@ 20,24 say 'IS THE ABOVE CONFIRMED (Y/N):'
do whil .t.
 ch1 = ' '
 @ 20,54 get ch1 pict '!'
 read
 if ch1 $ 'YN'
  exit
 endi
endd
retu
```

```
PROC PHYSIC3

clea
@ 2,12 to 22,67 doub
@ 4,18 to 7,61
@ 5,20 say 'ON PHYSICAL EXAMINATION THE PATIENT MUST'
@ 6,20 say 'POSSESS ONE OR MORE OF THE FOLLOWING:'
@ 10,28 to 16,51
@ 13,33 say 'APPEARS NORMAL'
@ 20,24 say 'IS THE ABOVE CONFIRMED (Y/N):'
```

```
do whil .t.
  ch1 = ' '
  @ 20,54 get ch1 pict '!'
  read
  if ch1 $ 'YN'
    exit
  endi
endd
retu
```

```
PROC PHYSIC4

clea
@ 2,12 to 22,67 doub
@ 4,18 to 7,61
@ 5,20 say 'ON PHYSICAL EXAMINATION THE PATIENT MUST'
@ 6,20 say 'POSSESS ONE OR MORE OF THE FOLLOWING:'
@ 10,28 to 16,51
@ 13,33 say 'APPEARS NORMAL'
@ 20,24 say 'IS THE ABOVE CONFIRMED (Y/N):'
do whil .t.
  ch1 = ' '
  @ 20,54 get ch1 pict '!'
  read
  if ch1 $ 'YN'
    exit
  endi
```

```
endd
retu


PROC PHYSIC5

clea
@ 3,12 to 21,67 doub
@ 5,18 to 8,61
@ 6,20 say 'ON PHYSICAL EXAMINATION THE PATIENT MUST'
@ 7,20 say 'POSSESS ONE OR MORE OF THE FOLLOWING:'
@ 10,33 to 16,46
@ 11,36 say 'OBESE'
@ 13,36 say 'HIRSUTE'
@ 15,36 say 'NORMAL'
@ 19,24 say 'IS THE ABOVE CONFIRMED (Y/N):'
do whil .t.
  ch1 = ' '
  @ 19,54 get ch1 pict '!'
  read
  if ch1 $ 'YN'
    exit
  endi
endd
retu
```

```
PROC PHYSIC6

 clea
 @ 3,12 to 22,67 doub
 @ 5,18 to 8,61
 @ 6,20 say 'ON PHYSICAL EXAMINATION THE PATIENT MUST'
 @ 7,20 say 'POSSESS ONE OR MORE OF THE FOLLOWING:'
 @ 10,28 to 18,51
 @ 11,31 say 'NORMAL'
 @ 13,31 say 'BULGING EYES'
 @ 15,31 say 'SINNS TACCHYCARDIA'
 @ 17,31 say 'HYPERTENSION'
 @ 20,24 say 'IS THE ABOVE CONFIRMED (Y/N):'
 do whil .t.
  ch1 = ' '
  @ 20,54 get ch1 pict '!'
  read
  if ch1 $ 'YN'
    exit
  endi
 endd
 retu


PROC PHYSIC7

 clea
 @ 3,12 to 21,67 doub
 @ 5,18 to 8,61
```

```
 @ 6,20 say 'ON PHYSICAL EXAMINATION THE PATIENT MUST'
 @ 7,20 say 'POSSESS ONE OR MORE OF THE FOLLOWING:'
 @ 10,33 to 16,49
 @ 11,36 say 'OBESITY'
 @ 13,36 say 'HYPERTENSION'
 @ 15,36 say 'GOITRE'
 @ 19,24 say 'IS THE ABOVE CONFIRMED (Y/N):'
 do whil .t.
  ch1 = ' '
  @ 19,54 get ch1 pict '!'
  read
  if ch1 $ 'YN'
   exit
  endi
 endd
 retu
```

```
PROC PHYSIC8
```

```
 clea
 @ 3,12 to 21,67 doub
 @ 5,18 to 8,61
 @ 6,20 say 'ON PHYSICAL EXAMINATION THE PATIENT MUST'
 @ 7,20 say 'POSSESS ONE OR MORE OF THE FOLLOWING:'
 @ 10,23 to 16,56
 @ 13,25 say 'CERVICAL IRRITATION TENDERNESS'
 @ 19,24 say 'IS THE ABOVE CONFIRMED (Y/N):'
 do whil .t.
```

```
  ch1 = ' '
  @ 19,54 get ch1 pict '!'
  read
  if ch1 $ 'YN'
    exit
  endi
endd
retu


PROC PHYSIC9

 clea
 @ 3,12 to 22,67 doub
 @ 5,18 to 8,61
 @ 6,20 say 'ON PHYSICAL EXAMINATION THE PATIENT MUST'
 @ 7,20 say 'POSSESS ONE OR MORE OF THE FOLLOWING:'
 @ 10,25 to 18,54
 @ 11,27 say 'ABNORMAL P.V. DISCHARGE'
 @ 13,27 say 'INCREASE TENDENCY IN TASTE'
 @ 15,27 say 'PELVIC MASS'
 @ 17,27 say 'PELVIC TENDERNESS'
 @ 20,24 say 'IS THE ABOVE CONFIRMED (Y/N):'
 do whil .t.
  ch1 = ' '
  @ 20,54 get ch1 pict '!'
  read
  if ch1 $ 'YN'
    exit
```

```
PROC INVEST2

 clea
 @ 3,12 to 22,67 doub
 @ 5,18 to 8,61
 @ 6,20 say 'ON INVESTIGATION ONE OR MORE OF THE'
 @ 7,20 say 'FOLLOWING CAN BE OBSERVED:'
 @ 10,23 to 18,55
 @ 11,26 say 'FBC & DIFFERENTIAL'
 @ 13,26 say 'SEMENALYSIS'
 @ 15,26 say 'USS'
 @ 17,26 say 'URINE ANALYSIS & MICROSCOPY'
 @ 20,24 say 'IS THE ABOVE CONFIRMED (Y/N):'
 do whil .t.
  ch1 = ' '
  @ 20,54 get ch1 pict '!'
  read
  if ch1 $ 'YN'
    exit
  endi
 endd
 retu


PROC INVEST3

 clea
 @ 3,12 to 22,67 doub
 @ 5,18 to 8,61
```

```
 @ 6,20 say 'ON INVESTIGATION ONE OR MORE OF THE'
 @ 7,20 say 'FOLLOWING CAN BE OBSERVED:'
 @ 10,23 to 18,55
 @ 11,26 say 'FBC & DIFFERENTIAL'
 @ 13,26 say 'SEMENALYSIS'
 @ 15,26 say 'USS'
 @ 17,26 say 'URINE ANALYSIS & MICROSCOPY'
 @ 20,24 say 'IS THE ABOVE CONFIRMED (Y/N):'
 do whil .t.
  ch1 = ' '
  @ 20,54 get ch1 pict '!'
  read
  if ch1 $ 'YN'
   exit
  endi
 endd
 retu


PROC INVEST4

 clea
 @ 3,12 to 22,67 doub
 @ 5,18 to 8,61
 @ 6,20 say 'ON INVESTIGATION ONE OR MORE OF THE'
 @ 7,20 say 'FOLLOWING CAN BE OBSERVED:'
 @ 10,23 to 18,55
 @ 11,26 say 'FBC & DIFFERENTIAL'
 @ 13,26 say 'SEMENALYSIS'
```

```
 @ 15,26 say 'USS'
 @ 17,26 say 'URINE ANALYSIS & MICROSCOPY'
 @ 20,24 say 'IS THE ABOVE CONFIRMED (Y/N):'
 do whil .t.
  ch1 = ' '
  @ 20,54 get ch1 pict '!'
  read
  if ch1 $ 'YN'
   exit
  endi
 endd
 retu
```

PROC INVEST5

```
 clea
 @ 2,12 to 22,67 doub
 @ 4,20 to 7,58
 @ 5,22 say 'ON INVESTIGATION ONE OR MORE OF THE'
 @ 6,22 say 'FOLLOWING CAN BE OBSERVED:'
 @ 9,20 to 18,59
 @ 10,22 say 'ROUTINE'
 @ 12,22 say 'USS - ENLARGED OVARIES (POLYCYSTIC)'
 @ 14,22 say 'HORMONAL ASSAY'
 @ 15,27 say 'Prl - normal'
 @ 16,27 say 'FSH - increased'
 @ 17,27 say 'Pit - reduced'
```

```
@ 20,24 say 'IS THE ABOVE CONFIRMED (Y/N):'
do whil .t.
 ch1 = ' '
 @ 20,54 get ch1 pict '!'
 read
 if ch1 $ 'YN'
  exit
 endi
endd
retu
```

PROC INVEST6

```
clea
@ 4,12 to 20,67 doub
@ 5,20 to 8,58
@ 6,22 say 'ON INVESTIGATION ONE OR MORE OF THE'
@ 7,22 say 'FOLLOWING CAN BE OBSERVED:'
@ 10,28 to 16,51
@ 11,30 say 'ROUTINE'
@ 13,30 say 'HORMONAL ASSAY'
@ 14,35 say 'TSH - increase'
@ 15,35 say 'TRH - increase'
@ 18,24 say 'IS THE ABOVE CONFIRMED (Y/N):'
do whil .t.
 ch1 = ' '
 @ 18,54 get ch1 pict '!'
 read
```

```
    clea
    do summary8
    if ch = 'Y'
      exit
    endi
    cnt = cnt + 1
  endi
  if cnt = 9
    clea
    do summary9
    if ch = 'Y'
      exit
    endi
  endi
  exit
endd
retu
```

```
PROC SUMMARY1

clea
@ 7,27 to 17,52
@ 9,32 say 'MAJOR CAUSES:'
@ 10,34 say '* ANOVULATION'
@ 12,28 to 12,51
@ 14,32 say 'TREATMENT:'
@ 15,34 say '* CORRECT DIET'
retu
```

PROC SUMMARY2

```
clea
@ 6,20 to 20,59
@ 8,24 say 'MAJOR CAUSES:'
@ 9,27 say '* ANXIETY NEUROSIS'
@ 11,21 to 11,58
@ 13,24 say 'TREATMENT:'
@ 14,27 say '* PSYCHOTHERAPY'
@ 16,27 say '* SEDATIVES'
@ 18,27 say '* CORRECT BLOOD PRESSURE'
retu
```

PROC SUMMARY3

```
clea
@ 7,25 to 19,54
@ 9,31 say 'MAJOR CAUSES:'
@ 10,34 say '* IGNORANCE'
@ 12,26 to 12,53
@ 14,31 say 'TREATMENT:'
@ 15,34 say '* SEX EDUCATION'
@ 17,34 say '* REASSURANCE'
retu
```

PROC SUMMARY4

```
clea
@ 3,13 to 21,66
@ 5,15 say 'MAJOR CAUSES:'
@ 6,19 say '* UNDESCENDED TESTES'
@ 8,19 say '* TESTICULAR GERMINAL APLASIA'
@ 10,14 to 10,65
@ 12,15 say 'TREATMENT:'
@ 13,18 say '* SURGERY:'
@ 14,21 say 'EXCISION OF UNDESCENDED TESTIS IF DAMAGED,'
@ 15,21 say 'or TRANSLOCATION IF FUNCTIONAL'
@ 17,18 say '* AID'
@ 19,18 say '* ADOPTION'
retu
```

PROC SUMMARY5

```
clea
@ 5,13 to 19,66
@ 7,15 say 'MAJOR CAUSES:'
@ 8,19 say '* POLYCYSTIC OVARIES'
@ 10,14 to 10,65
@ 12,15 say 'TREATMENT:'
@ 13,18 say '* OVULATION INDUCERS:'
@ 14,21 say '- CLOMIPHENE CITRATE'
```

```
  if ch1 $ 'YN'
    exit
  endi
endd
retu
```

```
PROC INVEST7

clea
@ 4,12 to 20,67 doub
@ 5,20 to 8,58
@ 6,22 say 'ON INVESTIGATION ONE OR MORE OF THE'
@ 7,22 say 'FOLLOWING CAN BE OBSERVED:'
@ 10,28 to 16,51
@ 11,30 say 'ROUTINE'
@ 13,30 say 'HORMONAL ASSAY'
@ 14,35 say 'TRH - decrease'
@ 15,35 say 'TSH - decrease'
@ 18,24 say 'IS THE ABOVE CONFIRMED (Y/N):'
do whil .t.
  ch1 = ' '
  @ 18,54 get ch1 pict '!'
  read
  if ch1 $ 'YN'
    exit
  endi
endd
```

```
retu


PROC INVEST8


 clea
 @ 2,12 to 23,67 doub
 @ 4,20 to 7,58
 @ 5,22 say 'ON INVESTIGATION ONE OR MORE OF THE'
 @ 6,22 say 'FOLLOWING CAN BE OBSERVED:'
 @ 9,28 to 19,51
 @ 10,30 say 'FBC - difference'
 @ 12,30 say 'HS'
 @ 14,30 say 'UA/MCS'
 @ 16,30 say 'HVS/MCS'
 @ 18,30 say 'SEMENANALYSIS/C & S'
 @ 21,24 say 'IS THE ABOVE CONFIRMED (Y/N):'
 do whil .t.
  ch1 = ' '
  @ 21,54 get ch1 pict '!'
  read
  if ch1 $ 'YN'
    exit
  endi
 endd
 retu
```

```
PROC INVEST9

 clea
 @ 4,12 to 20,67 doub
 @ 5,20 to 8,58
 @ 6,22 say 'ON INVESTIGATION ONE OR MORE OF THE'
 @ 7,22 say 'FOLLOWING CAN BE OBSERVED:'
 @ 10,30 to 16,49
 @ 11,32 say 'FBC - difference'
 @ 13,32 say 'HS'
 @ 15,32 say 'UA/MICROSCOPY'
 @ 18,24 say 'IS THE ABOVE CONFIRMED (Y/N):'
 do whil .t.
  ch1 = ' '
  @ 18,54 get ch1 pict '!'
  read
  if ch1 $ 'YN'
   exit
  endi
 endd
 retu


PROC SUMMARY

if cnt = 0
 cnt = 1
endi
clea
```

```
ch = ' '
do whil .t.
 if cnt = 1
   do summary1
   if ch = 'Y'
     exit
   endi
   cnt = cnt + 1
 endi
 if cnt = 2
   clea
   do summary2
   if ch = 'Y'
     exit
   endi
   cnt = cnt + 1
 endi
 if cnt = 3
   clea
   do summary3
   if ch = 'Y'
     exit
   endi
   cnt = cnt + 1
 endi
 if cnt = 4
   clea
   do summary4
   if ch = 'Y'
```

```
    exit
  endi
  cnt = cnt + 1
endi
if cnt = 5
  clea
  do summary5
  if ch = 'Y'
    exit
  endi
  cnt = cnt + 1
endi
if cnt = 6
  clea
  do summary6
  if ch = 'Y'
    exit
  endi
  cnt = cnt + 1
endi
if cnt = 7
  clea
  do summary7
  if ch = 'Y'
    exit
  endi
  cnt = cnt + 1
endi
if cnt = 8
```

```
@ 15,21 say '- CYCLOPHENIL'
@ 16,21 say '- HUMAN CHORIONIC GONADOTROPHIN HORMONE'
@ 17,21 say '- GONADOTROPHIN RELEASING HORMONE ANALOGUES'
retu
```

PROC SUMMARY6

```
clea
@ 2,20 to 22,59
@ 3,25 say 'MAJOR CAUSES:'
@ 5,28 say '* UNDESCENDED TESTES'
@ 7,28 say '* TESTICULAR GERMINAL APLASIA'
@ 9,21 to 9,58
@ 11,25 say 'TREATMENT:'
@ 12,28 say '* ANTITHYROID MEDICATION'
@ 13,31 say '- PHENOBARBITAL'
@ 14,31 say '- PROPRANOLOL'
@ 15,31 say '- PROPYLTHISURAL'
@ 16,31 say '- METHIMAZOLE'
@ 18,28 say '* SURGERY (EXCISION)'
@ 20,28 say '* RADIOACTIVE IODINE'
retu
```

PROC SUMMARY7

```
clea
@ 7,19 to 17,60
@ 9,23 say 'MAJOR CAUSES:'
@ 10,26 say '* HYPOTHYROIDISM'
@ 12,20 to 12,59
@ 14,23 say 'TREATMENT:'
@ 15,26 say '* THYROID REPLACEMENT THERAPY'
retu
```

PROC SUMMARY8

```
clea
@ 7,19 to 17,60
@ 9,23 say 'MAJOR CAUSES:'
@ 10,26 say '* STD'
@ 12,20 to 12,59
@ 14,23 say 'TREATMENT:'
@ 15,23 say '* APPROPRIATE ANTIBIOTICS DETERMINED'
@ 16,23 say '  BY CULTURE RESULT'
retu
```

PROC SUMMARY9

```
clea
@ 7,23 to 17,56
@ 9,27 say 'MAJOR CAUSES:'
```

```
@ 10,30 say '* FIBROIDS'
@ 12,24 to 12,55
@ 14,27 say 'TREATMENT:'
@ 15,30 say '* SURGERY (MYOMECTOMY)'
retu
```