



GCC and MENA In-Vitro Fertilisation (IVF) Report - 2015



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Introduction

This report will help Business development team and Investment team with KLSC understand *in vitro fertilization (IVF)* and other *assisted reproductive technologies (ART)* that have become accepted medical treatments for infertility, indicators of infertility and IVF treatments, complications of treatments, cost of treatments and market dynamics of infertility and IVF treatment in Kuwait, GCC and MENA region.

Fertility

In order to understand infertility, conventional fertility treatment, IVF and other assisted reproductive technology and how it can help infertile couples, it is important to understand how conception takes place naturally.

For traditional conception to occur, the man must ejaculate his semen, the fluid containing the *sperm*, into the woman's *vagina* around the time of *ovulation*, when her *ovary* releases an egg. Ovulation is a complex event controlled by the *pituitary gland*, which is located at the base of the brain. The pituitary gland releases *follicle-stimulating hormone (FSH)*, which stimulates *follicles* in one of the ovaries to begin growing. The follicle produces the hormone *estrogen* and contains a maturing egg. When an egg is mature, the pituitary gland sends a surge of *luteinizing hormone (LH)* that causes the follicle to rupture and release (ovulate) a mature egg.

Following ovulation, the egg is picked up by one of the *fallopian tubes*. Since fertilization usually takes place inside the fallopian tube, the man's sperm must be capable of swimming through the vagina and *cervical mucus*, up the *cervical canal* into the *uterus*, and up into the fallopian tube, where it must penetrate the egg in order to fertilize it. The fertilized egg continues travelling to the uterus and implants in the uterine lining, where it continues to develop.

Infertility

Infertility generally refers to an inability to conceive after having regular unprotected sex. Infertility can also refer to the biological inability of an individual to contribute to conception, or to a female who cannot carry a pregnancy to full term. In many countries infertility refers to a couple that has failed to conceive after 12 months of regular sexual intercourse without the use of **contraception**.

Infertility is a disease of the reproductive system that impairs one of the body's most basic functions: the conception of children. Conception is a complicated process that depends upon many factors: on the production of healthy sperm by the man and healthy eggs by the woman; unblocked fallopian tubes that allow the sperm to reach the egg; the sperm's ability to fertilize the egg when they meet; the ability of the fertilized egg (embryo) to become implanted in the woman's uterus; and sufficient embryo quality.

According to the Department of Health and Human Services, USA, approximately 10% to 15% of couples in the USA are infertile - meaning they have not conceived after at least one year of regular, unprotected sex. Many cases of apparent infertility are treatable. Infertility may have a single cause in one of the partners, or it could be the result of a combination of factors.

Chances of conceiving within one year

In Europe, North America and much of the world approximately 85% of couples will conceive within one year if they have regular unprotected sex. Averages in the UK are as follows (*National Health Service*):

20% will conceive within one month,

70% will conceive within six months

85% will conceive within 12 months

90% will conceive within 18 months

95% will conceive within 24 months.

About one-third of infertility cases can be attributed to male factors, and about one-third to factors that affect women. For the remaining one-third of infertile couples, infertility is caused by a combination of problems in both partners or, in about 20 percent of cases, is unexplained.

Risk factors of infertility

The common risk factors for infertility such as age, smoking, alcohol consumption, being obese or overweight, eating disorders, being vegan, over-exercising, not exercising, and sexually transmitted infections (STI), Exposure to some chemicals, mental stress.

Causes of infertility

There are many possible causes of infertility. Unfortunately, in about one-third of cases no cause is ever identified.

Causes of infertility in women

- **Ovulation disorders** - problems with ovulation are the most common cause of infertility in women, experts say. Ovulation is the monthly release of an egg. In some cases the woman never releases eggs, while in others the woman does not release eggs during some cycles. Ovulation disorders can be due to:
 - ✓ Premature ovarian failure.
 - ✓ PCOS (polycystic ovary syndrome)
 - ✓ Hyperprolactinemia
 - ✓ Poor egg quality
 - ✓ Overactive & Underactive thyroid gland
 - ✓ Some chronic conditions, such as AIDS or cancer.
- **Problems in the uterus or fallopian tubes**

The egg travels from the ovary to the uterus (womb) where the fertilized egg grows. If there is something wrong in the uterus or the fallopian tubes the woman may not be able to conceive naturally. This may be due to pelvic surgery, sub mucosal fibroids, endometriosis.
- **Medications** - some drugs can affect the fertility of a woman.
 - ✓ **NSAIDs (non-steroidal anti-inflammatory drugs)** - women who take **aspirin** or ibuprofen long-term may find it harder to conceive.
 - ✓ **Chemotherapy** - some medications used in **chemotherapy** can result in ovarian failure. In some cases, this side effect of chemotherapy may be permanent.
- **Radiotherapy** - if radiation therapy was aimed near the woman's reproductive organs there is a higher risk of fertility problems.
- **Illegal drugs** - some women who take marijuana or cocaine may have fertility problems.

Causes of infertility in men

Semen

Semen is the milky fluid that a man's penis releases during orgasm. Semen consists of fluid and sperm. The fluid comes from the prostate gland, seminal vesicle and other sex glands. The sperm is produced in the testicles. During orgasm a man ejaculates (releases semen through the penis). The seminal fluid helps transport the sperm during ejaculation. The seminal fluid has sugar in it - sugar is an energy source for sperm.

Abnormal semen is responsible for about 75% of all cases of male infertility. Unfortunately, in many cases doctors never find out why.

The following semen problems are possible:

- **Low sperm count** (low concentration) - the man ejaculates a lower number of sperm, compared to other men. Sperm concentration should be 20 million sperm per millilitre of semen. If the count is under 10 million there is a low sperm concentration (subfertility).
- **No sperm** - when the man ejaculates there is no sperm in the semen.
- **Low sperm mobility** (motility) - the sperm cannot "swim" as well as it should.
- **Abnormal sperm** - perhaps the sperm has an unusual shape, making it more difficult to move and fertilize an egg.

The following may cause semen to be abnormal:

- Testicular infection, cancer, surgery
- Overheating the testicles
- Ejaculation disorders
- Varicocele
- Undescended testicle
- Hypogonadism - testosterone deficiency can result in a disorder of the testicles.
- Genetic abnormality
- Mumps Hypospadias
- Cystic fibrosis
- Radiotherapy
- Some diseases -Anaemia, Cushing's syndrome, Diabetes and Thyroid disease.
- Medications e.g. Sulfasalazine, Anabolic steroids, Chemotherapy drugs.
- Illegal drugs - consumption of marijuana and cocaine can lower a man's sperm count.

Diagnosing infertility

Most people will visit their GP (general practitioner, primary care physician) if there is no pregnancy after 12 months of trying. For anybody who is concerned about fertility, especially if they are older (women over 35), it might be a good idea to see a doctor earlier. As fertility testing can sometimes take a long time, and female fertility starts to drop when a woman is in her thirties, seeing the doctor earlier on if you are over 35 makes sense.

Before undergoing testing for fertility it is important that the couple be committed. The doctor will need to know what the patients' sexual habits are, and may make recommendations regarding them. Tests and trials might extend over a long period. Even after thorough testing, no specific cause is ever found for 30% of infertility cases.

In some countries where universal healthcare cover does not exist, evaluation and eventual treatment may be expensive.

Tests for males

- General physical exam
- Semen analysis
- Blood test
- Ultrasound test
- Chlamydia test

Tests for females

- General physical exam
- Blood test (progesterone test).
- Hysterosalpingography
- Laparoscopy
- Ovarian reserve testing
- Genetic testing
- Pelvic ultrasound
- Chlamydia test
- Thyroid function test.

Treatment options for infertility

This will depend on many factors, including the age of the patient(s), how long they have been infertile, personal preferences, and their general state of health. Even if the woman has causes that cannot be corrected, she may still become pregnant.

Frequency of intercourse

The couple may be advised to have sexual intercourse more often. Sex two to three times per week may improve fertility if the frequency was less than this. Some fertility experts warn that too-frequent sex can lower the quality and concentration of sperm. Male sperm can survive inside the female for up to 72 hours, while an egg can be fertilized for up to 24 hours after ovulation.

Fertility treatment for women

- **Ovulation disorders** - if the woman has an ovulation disorder she will probably be prescribed fertility drugs which regulate or induce ovulation. These include:
 - ✓ **Clomiphene** (Clomid, Serophene) - this medication helps encourage ovulation in females who do not ovulate regularly, or who do not ovulate at all, because of polycystic ovary syndrome (PCOS) or some other disorder.
 - ✓ **Metformin** (Glucophage) - women who have not responded to Clomiphene may have to take this medication. It is especially effective for women with PCOS, especially when linked to insulin resistance.
 - ✓ **Human menopausal gonadotropin**, or hMG, (Repronex) - this medication contains both FSH and LH. It is an injection and is used for patients who don't ovulate on their own because of a fault in their pituitary gland.
 - ✓ **Follicle-stimulating hormone** (Gonal-F, Bravelle) - this is a hormone produced by the pituitary gland that controls **estrogen** production by the ovaries.
 - ✓ **Human chorionic gonadotropin** (Ovidrel, Pregnyl) - this medication is used together with clomiphene, hMG and FSH. It stimulates the follicle to ovulate.
 - ✓ **Gn-RH (gonadotropin-releasing hormone) analogs** - for women who ovulate prematurely, before the lead follicle is mature enough during hMG treatment.
 - ✓ **Bromocriptine** (Parlodel) - this drug inhibits prolactin production. Prolactin stimulates milk production in breast feeding mothers.

- **Surgical procedures for women**

- ✓ **Fallopian tube surgery** - if the fallopian tubes are blocked or scarred surgery may repair them, making it easier for eggs to pass through them.
- ✓ **Laparoscopic surgery** - a small incision is made in the woman's abdomen. A thin, flexible microscope with a light at the end (laparoscope) is inserted through the incision.

Fertility treatment for men

- **Erectile dysfunction or premature ejaculation** - medication and/or behavioural approaches can help men with general sexual problems, resulting in possibly improved fertility.
- **Varicocele** - if there is a varicose vein in the scrotum, it can be surgically removed.
- **Blockage of the ejaculatory duct** - sperm can be extracted directly from the testicles and injected into an egg in the laboratory.
- **Retrograde ejaculation** - sperm can be taken directly from the bladder and injected into an egg in the laboratory.
- **Surgery for epididymis blockage** - if the epididymis is blocked it can be surgically repaired. The epididymis is a coil-like structure in the testicles which helps store and transport sperm.

Assisted conception

- **IUI (intrauterine insemination)** - a fine catheter is inserted through the cervix into the uterus to place a sperm sample directly into the uterus. The sperm is washed in a fluid and the best specimens are selected. This procedure must be done when ovulation occurs. The woman may be given a low dose of ovary stimulating hormones.

IUI is more commonly done when the man has a low sperm count, decreased sperm motility, or when infertility does not have an identifiable cause. The procedure is also helpful for males suffering from severe **erectile dysfunction**.

- **IVF (in vitro fertilization)** - sperm are placed with unfertilized eggs in a Petri dish; the aim is fertilization of the eggs. The embryo is then placed in the uterus to begin a pregnancy. Sometimes the embryo is frozen for future use (cryopreserved). Louise Joy Brown, born in England in 1978, was the world's first IVF baby. Before IVF is done the female takes fertility drugs to encourage the ovaries to produce more eggs than normal.

In Vitro Fertilisation (IVF)

It's one of the treatment method of infertility. IVF has received a great deal of media attention since it was first introduced in 1978, but it actually accounts for 2-5 percent of all infertility treatment. There are many factors that can prevent the union of sperm and egg.

IVF is a method of assisted reproduction in which a man's sperm and a woman's eggs are combined outside of the body in a laboratory dish. One or more fertilized eggs (*embryos*) may be transferred into the woman's uterus, where they may implant in the uterine lining and develop. Excess embryos may be *cryopreserved* (frozen) for future use. Initially, IVF was used to treat women with blocked, damaged, or absent fallopian tubes.

Today, IVF is used to treat many causes of infertility, such as *endometriosis* and *male factor*, or when a couple's infertility is unexplained.

The basic steps in an IVF treatment cycle are:

- ✓ Ovarian stimulation
- ✓ Egg retrieval
- ✓ Fertilization
- ✓ Embryo culture.
- ✓ Embryo transfer.

Techniques that may be used with IVF

IVF, or in vitro fertilization, follows a similar path for most couples. First, the ovaries are stimulated with fertility drugs, after which the eggs are retrieved and put together with sperm in the lab. Then, any resulting fertilized eggs are transferred to the woman's uterus.

That said, a variety of additional assisted reproductive technology treatments are available in addition to basic IVF. They may be used depending on a couples specific fertility problems, goals, age, and past success or failure rates.

Techniques used in Fertilisation steps

ICSI

ICSI stands for Intra Cytoplasmic sperm Injection, With ICSI, an individual sperm is injected directly into an egg using a specialized needle. ICSI may be used in severe cases of male infertility, like when the sperm shape is impaired (aka abnormal sperm morphology) or in cases of very low sperm count. ICSI must be used if testicular sperm extraction (TESE) is used.

IVM

IVM stands for in vitro maturation, is a relatively new assisted reproductive technology, where the immature eggs, or oocytes, are placed in a special solution of hormones, to enable the eggs to fully mature in the lab. With IVM, the woman either takes no fertility drugs, or very low doses, and then, immature eggs are retrieved. IVM is considered safer for the mother, because the risk of developing OHSS is lower.

Micro-IVF

Micro-IVF, or mini-IVF, is a brand new version of IVF treatment, meant to be more affordable. It's significantly cheaper than typical IVF, but it is not for couples who need full IVF treatment. Compared to regular IVF, micro-IVF uses lower doses of medications, and less monitoring of the developing embryos. For couples considering IUI treatment, micro-IVF may be a good choice. However, few studies have been done to prove the effectiveness of micro-IVF.

GIFT

GIFT stands for gamete intrafallopian transfer. With GIFT, instead of having the egg and sperm fertilized in the lab, and the resulting embryo transferred to the woman's uterus, the egg and sperm are transferred into the woman's fallopian tubes. Fertilization then takes place inside the woman's body. GIFT is more invasive than regular IVF, as it requires laparoscopic to transfer the egg and sperm into the fallopian tubes. GIFT may be used if a couple has religious objections to having fertilization take place outside the body. It's rarely used, with only 1% of all assisted reproductive procedures involving GIFT.

Techniques used in embryo culture steps

Cryopreservation

Cryopreservation, when used as an assisted reproductive technology, is when embryos, eggs, ovarian tissue, or sperm are frozen for later use. Sperm freezing has a better rate of success than embryo freezing, and embryo freezing is more successful than egg freezing. If there are extra embryos created during an IVF treatment cycle, you may want to freeze them for a later cycle. Sperm or egg may be frozen prior to IVF treatment as back up or prior to cancer treatment.

Autologous Endometrial Coculture

Autologous endometrial co culture, or AEC, is an assisted reproductive technology that involves placing a fertilized egg on top of a layer of endometrial cells. The endometrial cells (or uterine lining cells) are taken during an endometrial biopsy. The cells are then treated and frozen, until they are need during the IVF treatment. AEC may be used for couples who have repeated IVF failures, poor implantation, or poor embryo quality.

Techniques used in embryo transfer steps

FET (Frozen Embryo Transfer)

A frozen embryo transfer is significantly less expensive than a full IVF treatment cycle, though success rates vary. Some studies have found FET is less effective than fresh embryo transfer, while other studies have found it more effective. For an FET, the woman takes hormones to help prepare the uterine lining for implantation, and at the right time, the frozen embryos are thawed and transferred to the woman's uterus. Sometimes the frozen embryos do not survive the freezing and thawing process.

Blastocyst Transfer

A fertilized egg is known as an embryo, and it begins as just a collection of cells, which divide and multiply. By the fifth day, a fluid cavity forms, and the tissues that will become the placenta and the fetus begin to separate. This is known as the blastocyst stage, and in some cases, a doctor may decide to wait until the cells reach the blastocyst stage before transferring them to the uterus.

Assisted Hatching (AH)

Assisted hatching (AH) involves making a tiny hole in the outer layer of the embryo, known as the zona pellucid. The hole may be made with acid or with a laser. This is done before the embryo is transferred to the woman's uterus, in hopes that it will help the embryo implant into the uterine wall after transfer. Assisted hatching may be recommended for older women, or if previous IVF treatment cycles have failed. With the exception of these two groups, assisted hatching does not seem to improve the pregnancy rates.

ZIFT

ZIFT stands for zygote intrafallopian transfer. With ZIFT, fertilization takes place in the lab, but the fertilized egg (or zygote) is transferred to the fallopian tube, instead of the uterus. It also requires laparoscopic surgery, and is rarely used. Only 1.5% of assisted reproductive treatments involve ZIFT.

Other techniques used in IVF

PGD

PGD stands for pre-implantation genetic diagnosis. During PGD, one or two cells are taken from an embryo, and tested for genetic diseases, before transferring the embryos to the woman's uterus. PGD may be used in cases of recurrent miscarriage or to avoid passing on a deadly genetic disease, specifically for couples with a high-risk.

Using an Egg, Sperm or Embryo Donor

Gamete donation is an option for IVF treatment. A sperm or egg donor may be used in cases of severe male or female infertility, or if a single woman wants to have a child. Embryo donation is also an option.

Using a Surrogate

Surrogacy is another potential option. Sometimes, a woman's uterus is unable to carry a pregnancy (or the uterus has been removed because of cancer or some other medical problem), but she may still have her ovaries. In this case, the couple can use the woman's eggs, the man's sperm, and have the resulting embryos transferred into the surrogate's uterus. Sometimes, the surrogate mother's own eggs are used. In this case, IUI may be used to transfer the man's sperm to the surrogate's uterus.

Indicators of IVF

In rough terms, about one-third of infertility cases can be attributed to male factors, and about one-third to factors that affect women. For the remaining one-third of infertile couples, infertility is caused by a combination of problems in both partners or, in about 20 percent of cases, is unexplained. The following conditions / situations warrant the implementation of **IVF**

Female Partner

✓ **Tubal factor**

- Tubal blockage due to infection and associated complications.
- Patent but non-functional tubes.
- Previously sterilized and in those whom recanalization is not feasible.
- Congenital absence of tubes.

✓ **Unexplained infertility**

- Age of the women is more than 36 years, IVF is an earlier option.
- Following six or more failures with intrauterine insemination (IUI).

✓ **Polycystic ovarian disease**

If there is persistent elevation of LH, failure of six or more attempts of intrauterine Insemination or following a poor response to conventional ovulation inducing agents.

✓ **Endometriosis**

In cases of severe endometriosis and in those cases of mild to moderate where Conventional treatment regimens have failed (as in unexplained).

✓ **Cervical factor/immunological infertility**

Presence of Antisperm antibodies either in the cervical mucous or in serology.

Male Partner

- ✓ Unexplained infertility
- ✓ Immunological infertility
- ✓ Severe oligoasthenozoospermia
- ✓ Azoospermia – if the couple are unwilling for therapeutic donor insemination
- ✓ Any congenital conditions requiring sperm retrieval procedures from the epididymis or testis

Complications of infertility treatment

▪ Ovarian hyper stimulation syndrome (OHSS)

The ovaries become very swollen, leaking excess fluid into the body. The ovaries produce too many follicles (small fluid sacs in which an egg develops). OHSS usually occurs as a result of taking medications to stimulate the ovaries, such as clomiphene and gonadotropins, and can also develop after IVF. Symptoms can include:

- Bloating
- Constipation
- Dark urine
- Diarrhoea
- Nausea
- Pain in the abdomen
- Vomiting.

In most cases symptoms are mild and easy to treat. On very rare occasions the patient may develop a blood clot (thrombosis) in an artery or vein, liver or kidney problems, and respiratory distress. In very severe cases OHSS can be potentially fatal.

▪ Ectopic pregnancy

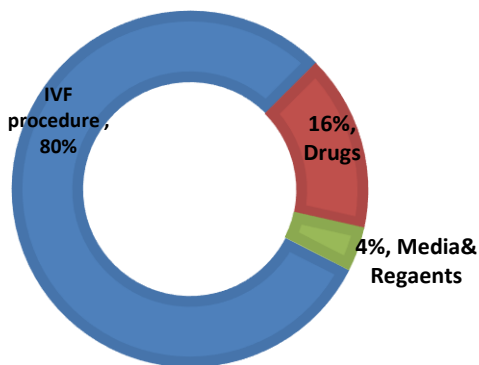
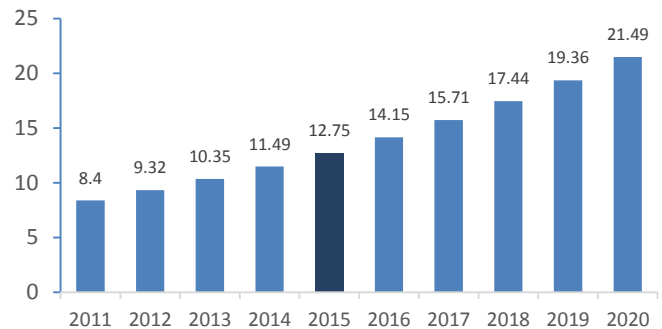
This is a pregnancy when the fertilized egg does not implant in the womb - in most cases the fertilized egg grows in the fallopian tube. If it stays in the fallopian tube the mother will usually miscarry before complications develop, such as the rupture of the fallopian tube. Women receiving fertility treatment have a slightly higher risk of having an ectopic pregnancy. An ultrasound scan can detect an ectopic pregnancy.

▪ Coping mentally

As it is impossible to know how long treatment will go on for and how successful it will be, coping and persevering can be stressful. The emotional toll on both partners might be considerable and can have an impact on their relationship. Some people find that joining a support group helps - being able to talk to others who share similar problems, aspirations and **anxieties** can be uplifting. It is important to tell your doctor if you are suffering mentally and/or emotionally. Most fertility doctors have access to counsellors, as well as other people and professionals who can offer helpful support.

Global Market overview

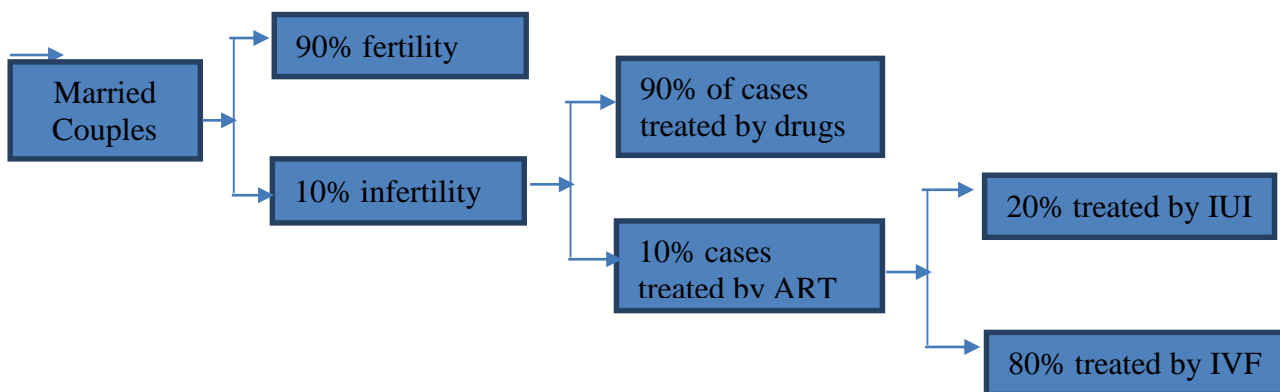
According to market research reports¹ the global IVF market was valued at \$9.3 billion in 2012 and is expected to grow up to \$21.5 billion by 2020 with CAGR 11%. As per CAGR the estimated current market value of global IVF is \$12.75 Bn USD on 2014.



IVF market is categorised as ART procedure (IVF cycle) including diagnosis, Instruments, Media & reagents and Drugs. In which IVF procedure accounts 80%, Instruments accounts 4%, media & reagents accounts 5% and drugs accounts 16% of the global market.

The most common IVF (treatment) technique is ICSI. Overall, ICSI accounts for around two-thirds of all treatments worldwide, and conventional IVF around one-third. However, these proportions vary greatly between countries, even though outcome rates with each technique are comparable.

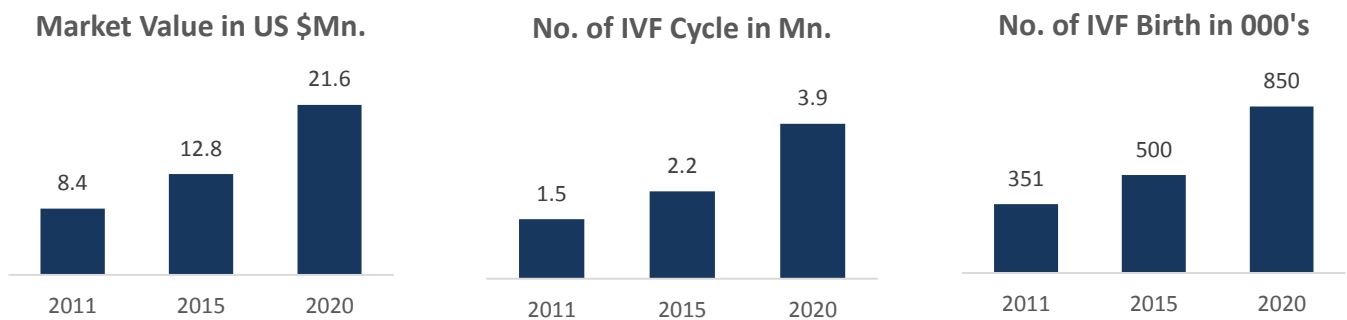
The current prevalence of infertility lasting for at least 12 months is estimated to be around 9- 10% worldwide² for women aged 20-44. 90% of which may get pregnancy in between first to third year, the remaining 10% cases will go for infertility treatment. 80-90% of which treated and get pregnancy by drugs, 10-20% of which treated by ART procedure. 20% of which treated by IUI and remaining 80% cases treated by IVF.



Though the IVF cases lesser (1-2%) in percentage than total infertility cases (8-9%), it is account more value than other conventional treatments like drugs and IUI, because of cost of per cycle,

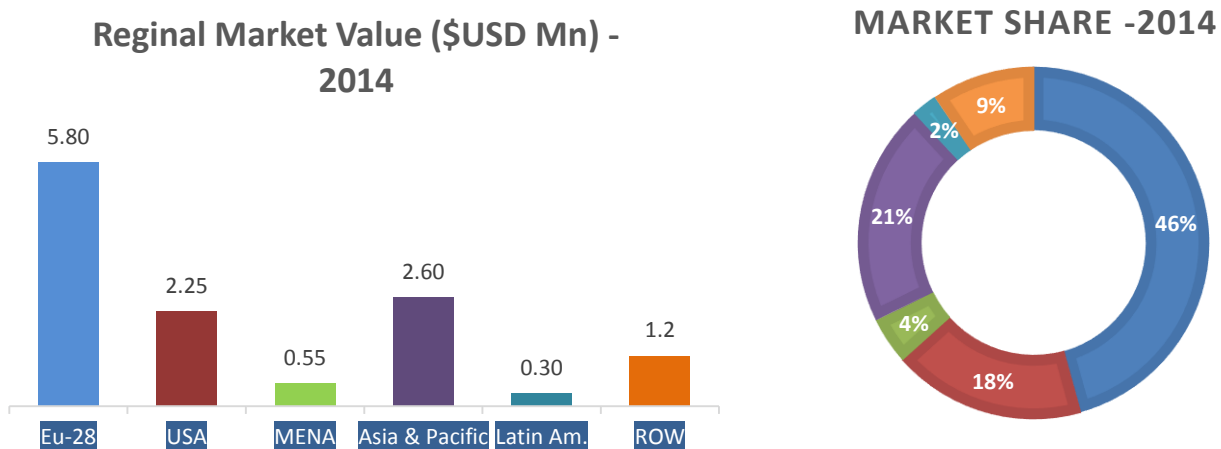
The IVF cost will be varies between countries and regions, US³ top with average cost per cycle is 12000 USD, then Europe⁴ with average cost per cycle is 7000 USD, GCC with average cost per cycle is between 4000 to 8000 USD and India with lowest average cost per cycle is 2500 USD.

An estimated 3,000 fertility clinics⁵ operate worldwide, out of which 650 clinics⁶ are located in India and XX clinics⁷ are located in GCC. It is now estimated that more than 5 million babies⁸ have been born worldwide since the first IVF baby was born in 1978. Around 1.5 million ART cycles⁹ are performed each year worldwide, with 350,000 babies born¹⁰.



Regional Market Value and Share

The below chart representing the current market value and market share of each region.



Market dynamics

As per market research report, the global IVF market is projected to grow at 11% CAGR¹¹ to US\$ 21.63 billion by 2020 from an estimated US\$ 12.75 billion in 2015. IVF procedure, drugs and media & reagents markets are expected to account for 80%, 16% and 4% respectively, of the overall market size. Europe is projected to remain the largest global market. Asia & Pacific and Latin America are expected to be the fastest growing markets, going forward. The demand for number of IVF cycles is expected to be 3.9 Mn in 2020, an addition of 2.2 Mn IVF cycles from 2014.

Market Drivers

Delayed pregnancy in women is regarded as the key driver of the overall IVF market, because the chances of conceiving decrease with age. Other important market drivers include an increase in infertility rates, rising prevalence of fertility related diseases, changing lifestyles, among others. The number of couples suffering from infertility issues was found that 48.5 million in 2010.

- ✓ Age
- ✓ Infertility rate
- ✓ Advancement in technology
- ✓ Increase in success rate
- ✓ Average income

Restraints

The high treatment cost and the low awareness in the developing countries represent the main restraints to the IVF market growth.

- ✓ Physical & emotional impacts
- ✓ Cost of treatment
- ✓ Ethical and legal issues
- ✓ Multiple pregnancies
- ✓ Low awareness level

Opportunities

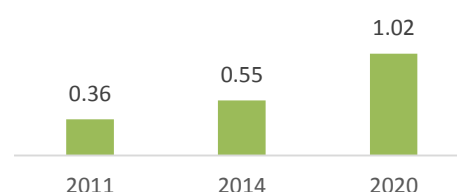
Expanding medical tourism in tandem with the increasing availability of low cost IVF treatments will likely improve awareness of people.

IVF Market in MENA Region

According to Middle East fertility Society Journal, 97 IVF centers¹² from 14 countries in the Middle East in 2000 and they have performed around 14,562 ICSI cycles¹² and only 1,778 IVF cycles¹². There are three centers performing more than 1,000 cycles per year, seven large centers performing from 500 to 999 cycles per year and nine medium centers performing from 200-499 cycles per year, nine small centres performing from 100-199 cycles per year and four even smaller centers performing less than 100 cycles per year.

The estimated current market value of MENA region is 550 Mn USD and it will be expected to reach 1.02 Bn on 2020. UAE , KSA and Kuwait are expected to be the fastest growing markets, going forward. The demand for number of IVF cycles is expected to be 170,000 in 2020, an addition of 110,000 IVF cycles from 2014. The average cost of IVF Cycle is 2,500 -8,000 USD. The lowest cost in Iran at 2500 USD and Highest in GCC at 5,000-8,000 USD.

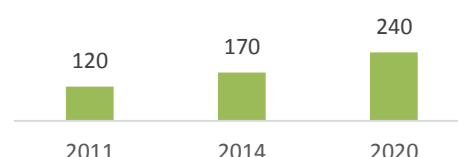
Market Value (US \$ Bn)-
MENA Region



IVF Market in GCC

The estimated current market value of GCC is 170 Mn USD and it will be expected to reach 240 Mn on 2020. UAE , KSA and Kuwait are expected to be the fastest growing markets, going forward. The demand for number of IVF cycles is expected to be 70,000 in 2020, an addition of 35,000 Mn IVF cycles from 2014. The average cost per IVF cycle is 4,000-8,000 USD.

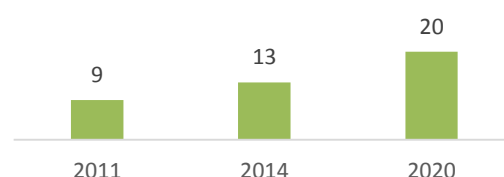
Market Value (US \$Mn) -
GCC



IVF market in Kuwait

The estimated current market value of Kuwait is 13 Mn USD and it will be expected to reach 20 Mn on 2020. The demand for number of IVF cycles is expected to be 5,000 in 2020, an addition of 2,500 Mn IVF cycles from 2014. The estimated average cost per IVF cycle is 5,000-8,000 USD.

Market value (US \$ Mn)-
Kuwait



The Potential for IVF in the GCC

The IVF market in the GCC is fully dependent on the number of infertile couples (male/female). According to the WHO the global infertility rate (couples include those who are not getting pregnant within 12 months of marriage) is 10%. From this 10%, 90% of couples will be cured by natural conception or with the aid of medicaments. The remaining 10 % or 1% of all couples, will seek assisted reproductive technology (ART) such as IVF and IUI.

The estimated IVF market size of the GCC is 30% or 170 US\$ Mn from the overall market of 550 US\$ mn of MENA IVF market in 2014.

According to the Middle East Fertility Society Journal, there are 97 IVF centers from 14 countries in the Middle East in operation since the year 2000. It is the calculation of this report that there are at least some 200 IVF centers providing treatment in 2014, from which 60-80 of are located in GCC countries, to around 25 to 30 couples each, according to Prof. Dr. Human M. Fatemi, Consultant - IVF, at the IVF Centre at Burjeel Hospital.

Dr. Fatemi mentions there is also a huge demand for IVF treatment due to the high rate of consanguineous marriage in the GCC which varies between 40 and 60 % Lifestyle also has an impact on infertility levels, obesity decreases the quality of eggs, it decreases the receptivity of the uterus and it reduces significantly the quality of the sperm. The other problem with men is smoking. It severely decreases the sperm concentration and mobility and the morphology, which is the shape of the sperm. All these factors will lead infertility in couples according to Dr. Fatemi. Fertility treatment is also the most popular procedure for medical tourists in Dubai.

As mentioned previously, we can expect that 70 IVF centres on average are active in the GCC, of which 10 centers produce 1000 cycle per year, 15 centers produce 500 cycles per year, 25 centers produce 200 cycles per year and 20 centers produce 100 cycles per year. These centres are also forecasted to produce a further 10 to 20% increases year on year.

Calculation of the Market Potential

The number of IVF cycle calculated by extrapolation of birth rate of respective countries with % of expected IVF births, this expected value considered by % value of developed countries (UK-2.3%, US-1.24%, Japan-3.14%) and developing countries (e.g. India -0.2%, Mexico- 0.2%). Based on this the expected % IVF birth rate will be varying with GCC countries.

Calculation based on birth rate

Birth rate as per UNICEF statistics -2012						Extrapolation of IVF Birth rate							
S. No	Country Name	Population in 000's	Births in 000's	Birth Rate	Total Births	*IVF Birth % 0.2-5%	IVF Birth	IVF cycle		Per Cycle Cost 2000-8000	Total Cost in USD		
								2	4		Minimum	Maximum	Average (Mn)
1	Bahrain	1318	20	1.53%	20100	1.00%	201	402	804	5,000	2,010,000	4,020,000	3.0
2	Kuwait	3251	67	2.06%	67100	1.00%	671	1342	2684	7,000	9,394,000	18,788,000	14.1
3	Oman	3314	72	2.18%	72300	0.50%	362	723	1446	4,000	2,892,000	5,784,000	4.3
4	Qatar	2050	22	1.09%	22300	1.00%	223	446	892	5,000	2,230,000	4,460,000	3.3
5	KSA	28288	565	2.00%	564700	0.50%	2824	5647	11294	5,000	28,235,000	56,470,000	42.4
6	UAE	9205	131	1.43%	131200	2.00%	2624	5248	10496	7,500	39,360,000	78,720,000	59.0
7	Israel	7644	156	2.04%	156000	4.00%	6240	12480	24960	2,500	31,200,000	62,400,000	46.8
8	Egypt	80721	1898	2.35%	1898000	0.30%	5694	11388	22776	2,500	28,470,000	56,940,000	42.7
9	Iran	76424	1454	1.90%	1454000	0.30%	4362	8724	17448	2,500	21,810,000	43,620,000	32.7
10	Jordan	7009	191	2.73%	191000	0.20%	382	764	1528	2,500	1,910,000	3,820,000	2.9
11	Lebanon	4647	62	1.33%	62000	0.20%	124	248	496	2,500	620,000	1,240,000	0.9
12	Algeria	38481	946	2.46%	945900	0.20%	1892	3784	7567	2,500	9,459,000	18,918,000	14.2
13	Morocco	32521	738	2.27%	738000	0.20%	1476	2952	5904	2,500	7,380,000	14,760,000	11.1
14	Iraq	32778	1036	3.16%	1036000	0.20%	2072	4144	8288	2,500	10,360,000	20,720,000	15.5
15	Syrian	21889	529	2.42%	529000	0.20%	1058	2116	4232	2,500	5,290,000	10,580,000	7.9
16	Tunisia	10874	189	1.74%	189000	0.20%	378	756	1512	2,500	1,890,000	3,780,000	2.8
17	Libya	6154	130	2.11%	130000	0.20%	260	520	1040	2,000	1,040,000	2,080,000	1.6
18	Yemen	23852	752	3.15%	752000	0.20%	1504	3008	6016	2,000	6,016,000	12,032,000	9.0
19	Afghanistan	29824	1053	3.53%	1053000	0.20%	2106	4212	8424	2,000	8,424,000	16,848,000	12.6
20	Pakistan	179160	4603	2.57%	4603000	0.20%	9206	18412	36824	2,000	36,824,000	73,648,000	55.2
								48464	77704		254,814,000	509,628,000	382.2

The estimated average IVF cycles done at MENA is 50,000 to 78,000 with value of 255 mn to 510 mn USD on 2012. Of which GCC contains 14,000 to 28,000 cycles with value of 85 mn to 170 mn USD. The estimated average market value of MENA is 380 mn in 2012. With a projected 10% CAGR the market value will be increased YOY.

IVF treatment cost in Kuwait

In Kuwait, the most advanced IVF technologies are used in hospital such as Royal Hayat, New Mouwasat, Al Salam International, Alia International, London Hospital and Al Rashid Hospital. These hospitals also provide other facilities like PGD, Semen & Embryo freezing. Only Al Seef, Al Zuhair and Tomusu clinic provide IUI and IVF treatment.

S. No.	Costing Particulars	Hospital/Medical Center Name with Cost*(KWD) of treatments								
		Royale Hayat	New Mowasat	Al Salam Int.	Alia Int.	London	Al Zuhair	Rashid	Al Seef	Tomusu
1										
	1st cycle									
	Consultation fee	25	25	25	25	25	25	25	25	25
	Preliminary Diagnosis-Ultrasound	10	10	10	10	10	10	10	10	10
	IVF-ICSI*	1400	1500	1300	950	1400	1600	1100	1200	1000
	Drugs per cycle	600	500	450	400	400	500	450	400	400
	Diagnostics tests per cycle	260	300	250	250	200	300	250	250	300
	Total cost per cycle	2295	2335	2035	1635	2035	2435	1835	1885	1735
	Total cost per cycle in USD	7574	7706	6716	5396	6716	8036	6056	6221	5726
2	2nd cycle onwards									
	IVF-ICSI per cycle	1000	1200	1000	800	1100	1300	900	1000	800
	Drugs per cycle	600	500	450	400	400	500	450	400	400
	Diagnostics tests per cycle	260	300	250	250	200	300	250	250	300
	Total cost per cycle	1860	2000	1700	1450	1700	2100	1600	1650	1500
	Total cost per cycle in USD	6138	6600	5610	4785	5610	6930	5280	5445	4950
	Additional facilities									
	IUI *per cycle	130	500	250	150	300	100	150	200	200
	PGD*	900	800	650	700	750	-	-	-	-
3	Sperm freezing	100	100	100	100	100	-	-	-	-
4	Embrvo freezing	200	200	150	150	200	-	-	-	-

*Cost- Data collected from personal communications.

*ICSI-Intra Cytoplasmic Sperm Injection

*IUI-Intra Uterine Insemination

*PGD-Pre diagnostic Genetic diseases

IVF-ICSI cost* without Medication										
	1st cycle cost (USD)	4600	5000	4300	3100	4600	5300	3600	4000	3300
	2nd cycle cost (USD)	3300	4000	3300	2600	3600	4300	3000	3300	2600
IVF-ICSI cost *with Medication										
	1st cycle cost (USD)	7500	7700	6700	5400	6700	8000	6000	6200	5700
	2nd cycle cost (USD)	6100	6600	5600	4800	5600	7000	5300	5400	5000

*cost -rounded value

Appendix-1: IVF clinics in GCC

S. No.	Country	IVF Clinic/Hospital Name
1	Qatar	Assisted Conception Unit
2		Al Ahli hospital
3	Oman	New life fertility center
4		Advanced fertility & genetics center
5	Bahrain	Bahrain specialty hospital
6		International hospital of Bahrain
7		AL jawhara center
8	UAE	Conceive gynecology & fertility center
9		Health plus
10		Fakih fertility clinic
11		The British clinic
12		Al Noor hospital group
13		Eve fertility center
14		Dr Husnia gargash fertility center
15		Jawn Murad fertility clinic
16		New life medical center
17	KSA	Almana general hospital
18		Mowasat medical services
19		SAAD specialist hospital
20	Kuwait	Royal Hayat hospital
21		Al seef hospital
22		New Mowasat hospital
23		AL salaam international hospital
24		Dar Al saha polyclinic
25		London hospital
26		Tomsu clinic
27		Alia International Clinic
28		Al Rashid hospital
29		Al Zuhair medical center
30		Taiba hospital
31		International clinic

Appendix-2: About Leading IVF centers in GCC

About Bourn Hall Clinic:

Bourn Hall Clinic was originally founded in Bourn, Cambridge, England, and is the world's leading centre for the treatment of infertility. TVM capital group partnered with Bourn Hall clinic and launched first Bourn hall IVF center in UAE on 2011.



It was founded in 1980 by IVF pioneers Mr. Patrick Steptoe and Professor Robert Edwards, who were responsible for the conception of Louise Brown, the world's first IVF or test-tube baby in 1978. Since its foundation the UK clinic has assisted in the conception of over 13,000 babies.

Nobel Prize - Co-founder of Bourn Hall Clinic, Professor Edwards, known affectionately as "the father of IVF", was awarded the Nobel Prize in Medicine in 2010.

With a team of research scientists and doctors they developed the treatment and associated procedures that are now used at clinics worldwide. Many of which have been established by embryologists and doctors that were trained at Bourn Hall.

About Fakih IVF Fertility Center

Fakih IVF Fertility Center is one of the leading Infertility, Gynaecology, Obstetrics, Genetics and IVF centers in the GCC Region.



Fakih IVF Fertility Center opened the first private IVF center in Dubai in 2011. The second UAE location was opened in Abu Dhabi in April 2013. In 2014, Fakih IVF Fertility Center's medical partner's Fakih Medical Center, opened in Abu Dhabi, Al Ain and Dubai. Fakih IVF Fertility Center is the only IVF center in the Middle East with a full service Genetics Laboratory - the only Genetics Laboratory in the UAE.

Fakih IVF Fertility Center started with the vision of Dr. Michael Fakih, a Consultant in Reproductive Endocrinology and IVF who began his career in 1987. Dr. Fakih prides his staff on their original and innovative approach in treating all cases of infertility.



At Fakih IVF Fertility Center, each couple is assessed and a treatment plan is designed specifically for them. Fakih IVF Fertility Center continually strives to improve medical protocols and invests in the newest technologies in order to excel in their commitment to help families grow and ultimately achieve the highest success rates.

Facilities including with an in-house Genetics Laboratory, MicroTESE, Fakih IVF Fertility Center is the first center in the UAE to achieve an ongoing pregnancy for a Single Gene Disorder and HLA Matching for a leukemia sibling looking for a bone marrow donor.

About Eugen Clinica

Based in Barcelona and founded in 1999, Eugen is amongst the largest European providers of fertility treatments, in terms of the number of cycles performed annually, and has the largest egg bank in Europe providing c.10% of donor IVF treatments in Europe. The Company is also the leader in cross-border fertility treatments in Europe. In 2014, the clinic treated more than 5,000 patients and carried out over 8,000 cycles. Across all its three locations, Clinica Eugen has performed over 11,000 cycles in 2014. The clinic offers a full range of fertility treatments including intra-uterine insemination (IUI), in-vitro fertilisation (IVF), intra-cytoplasmic sperm injection (ICSI), fertility preservation and genetic screening.



Over 95% of Eugen's patients are referred from outside Spain with France (55%), Italy (17%), Switzerland (4%), MENA (3%) and the UK (2%) representing the main countries of origin for the patients. Almost all of Eugen's revenues are derived from privately insured or cash pay patients.

For the twelve months ended 31 December 2014, Eugen reported revenues of €34.3m, EBITDA of €14.0m and EBITDA margins of 41.0%. As of 31 December 2014, Eugen had gross assets of €59.0m and approximately 230 employees.

The UAE based NMC Health care the leading integrated private healthcare provider operating across the United Arab Emirates that it has entered into an agreement to acquire 86.4% of issued share capital of Clinica Eugen ('Eugen'), a leading global fertility treatment provider based in Barcelona, Spain, for an Enterprise Value of €143m on 2014.

