THE PRETERM PREDICTION STUDY:

ASSOCIATION OF CAESAREAN DELIVERY WITH INCREASES IN MATERNAL WEIGHT AND BODY MASS INDEX

By

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UNIVERSITI SAINS MALAYSIA

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ABBREVATIONS:

AIM = American Institute of Medicine

B.C = Before Century

BMI = Body Mass Index

CCU = Cardiac Care Unit

CTG = Cardiotocograph

CS = Caesarean Section

ECG = Electrocardiograph

EDD = Expected Date of Delivery

HKB = Hospital Kota Baru

HUKM= Hospital Universiti Kebangsaan Malaysia

HUSM= Hospital Universiti Sains Malaysia

ICU = Intensive Care Unit

IOL = Induction of labour

IOM =Institute of Medicine

LBW = Low Birth Weight

MCH = Maternal and Child Health

MMR = Maternal Mortality Rate

NICU = Neonatal Intensive Care Unit

OR = Odds Ratio

O&G = Obstetrics and Gynaecology

PIH = Pregnancy Induced Hypertension

POA = Period of Amenorrhoea

SVD = Spontaneous Vaginal Delivery

USMK = Universiti Sains Malaysia Kelantan

VLBW = Very Low Birth Weight

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KELANTAN

AND

MATERNAL HEALTH CARE

1. KELANTAN AND MATERNAL HEALTH CARE.

1.1 INTRODUCTION TO THE STATE OF KELANTAN:

To discover the soul of Malaysia, one should visit the state of Kelantan, bordered by Thailand on the north, isolated from the west by a chain of rugged mountains and separated from the south by the oil rich state of Terengganu. The east coast state of Kelantan's exquisite silver artisan, cloth and mat weavers, and batik weavers are renowned throughout the countries. And where else but in Kelantan that you can see farmers competing in top-spinning and kite- flying, as well as watch fisherman with their beautifully painted boats pushing or landing at the same stretch of beach that has been unchanged for centuries. Peaceful, timeless fishing villages dotted the coastline, coconut palm bending out to the blue sea are common scenery that will tranquilize you as you passed the quiet coastal road in the coastal area of Kelantan.

History:. Kelantan's earliest known history dates back to the Middle Stone age between 3000 and 8000 B.C. Chinese historical reported the existence of city-states or kingdoms in the east coast of the Malay Penisula which maintained contacts with the Chinese court. The Chinese called what probably ancient Kelantan, "Ho-lan-tan" during the 5th century. Cave dwellers once roamed its interior, this important trace has been found at various places in the state, which

later emerged as an important kingdom in the days of the Malaccan sultanate and was ruled by the legendary beauty, Puteri Sa'adong, in the 17th.Century. When Islam came to the Malay world, Kelantan become one of the earliest Muslim states in the region. This was based on the finding of gold coin at Kubang Labu which on one side was written in Arabic " Al-Julus Kelantan " (seat of Kelantan Government) and on the other side, the date 577 Hijrah (about 1180 A.D). In the more modern times, Kelantan was under the shadow of its powerful northern neighbour, Thailand, and Thai or Siamese influence did not come to the end until a treaty, signed in1909 between the Thais and the British that placed Kelantan under British protection. Kelantan was under British indirect rule as a protected state till 1941. On the 8th of December 1941, the Japanese invade South Thailand and Kelantan before advancing south to capture Singapore. From December 1941 to September 1945, Kelantan was under the ruling of Japanese. Following the Japanese surrender in August 1945, British took over the ruling. In 1948, Kelantan become part of the Federation of Malaya, which gained its independence on 31st August 1957. However, Thai influences can still be seen in the Kelantan architectures, dialect, food and art forms of today. Kelantan is a place to explore. Do not hesitate to travel off the beaten track to a small fishing village. A friendly gesture will be the return of a smile, or perhaps to an invitation to tour the village where the soothing rhythms of a Malay life have endured for centuries.

The state: Kelantan situated in the northeastern part of Peninsula Malaysia and covers an area of 14,922 square kilometers with 1,314,900 inhabitants. The state

of Kelantan is one of the thirteen states in Malaysia. Kelantan consists of ten districts namely Kota Bharu, Bachok, Machang, Pasir Puteh, Pasir Mas, Tanah Merah, Tumpat, Kuala Krai, Jeli and Gua Musang. The state capital, Kota Bharu is located at the bank of the Kelantan River and situated 627 kilometres from the Federal Capital, Kuala Lumpur. It was granted the title " Darul Naim" which means " the peaceful state" in July 1916.

Its people: The population of Kelantan is just over a million people in the last population census done in 1990, with an annual growth rate of 2.5%. The distribution of the population differs from one district to another with 86% of the population living in the northern districts (except Kuala Krai and Gua Musang) which contribute only about 26% of total land area. The majority of its population are Malays, which constitute 93%, while the Chinese, Indian and the Siamese make up for the other 7% of the total population. The Malays traditionally lives in the outskirts of the town areas, kampong and the coastal villages, while the Chinese and Indian are mostly concentrated in the town areas.

Economy: Kelantan gross economic product has grown steadily. The GDP grew from RM. 1,463 million in 1985 to RM. 2,485 million in 1993.This growth has been attributed to a strong commitment by both the public and private sector. The per capita income in 1995 is RM. 2,081. The economic growth rate for 1994-95 is 6.4%. Agriculture and fishing industries form the backbone of the Kelantan economy. It accounts about 35% of the state GDP in the past years. The opening

of East-West Highway, bringing Kelantan into closer contact with the west coast, promises to accelerate the state's economic development.

Tourism: With its rich cultural and traditional heritage, Kelantan is one of the most interesting and unique destinations for a vacation. The long stretches of clean sparkling white virgin beaches, with the blue seas in the background are great for swimming and picnic. Kelantan's traditional pastimes games of top spinning, kite flying, drum beating and traditional singing (dikir barat) are well and alive in spite of the modernization of its people. The handicraft are superb for example the hand printed ***batik*** cloth, ***songket*** and exquisite silverware are renown and popular with the tourist, whether local or foreign. The craftsmen of Kelantan are truly gifted and skilled which contributed to Kelantan's rich cultural heritage and liven to its ' **soul of Malaysia**' reputation.

1.2 MATERNAL HEALTH CARE IN KELANTAN

1930 saw the beginning of maternal healthcare in the state of Kelantan with the building of their first General Hospital. Midwifery training was initiated then with its upgrading in 1946. Ten years later, the National Rural Health Development started extensive development of health infrastructure facilities program. Programs in the form of Rural Health Units were organized on a 3-tier system of referral for Maternal and Child Health (M.C.H.) care.

The 2nd Malaysian Plan (1971-1975) decided to change the 3-tier system (1 Main Health Center for 50 000 population, 1 Sub Health Center for 10 000 population and 1 Midwife clinic for 2 000 population) to a 2-tier system, which consists of 1 Health Center for 20 000 populations. The various maternal health care provided free of charge by the government including antenatal care, domiciliary midwifery, postnatal care and family planning. Despite the provision of all these facilities, problems arose during the domiciliary intrapartum period. Up to this day the role of the Kampong Tok Bidan (Traditional midwives) remains supreme amongst the predominantly rural thinking community.

Over the past ten years, the state's medical and health services have improved tremendously with the opening of districts hospitals and health centers along with substantial social, educational and economic improvement. The medical and health services for the state are provided by nine hospitals; 2 in Kota Bharu district and one each in each except for the district of Bachok and Jeli. There

are also 55 government Health Clinics (Klinik Kesihatan) and 230 Government Health Clinics (Klinik Desa).

The Kota Bharu General Hospital (HKB), which located in the state capital of Kota Bharu was the only referral center for the state and the northern part of the adjoining state of Terengganu till 1984, when Hospital Universiti Sains Malaysia (HUSM) began to function. The department of Obstetrics and Gynaecology of HKB become apart of HUSM from the 15th of July 1985 and subsequently moved back to its former premises at the General Hospital on the 1st of January 1989 and now functions as a sister hospital to the Universiti Hospital.

Improvement of medical and health services in the state is clearly reflected by increasing in numbers of hospital deliveries, reduction in perinatal mortality and maternal mortality. The maternal mortality rate (MMR) in Kelantan has declined from 1.1 per 1000 live births in 1980 to 0.55per 1000 live births in 1995 there were 24 maternal deaths in 1993, 19 in 1994 and 18 in 1995. the districts with the higest mortality rates were Kuala Krai and Machang. The rates were also high in Pasir Mas and Gua Musang in 1993 but in 1995 the rates in both districts dropped to 0.

The perinatal mortality rate per 1000 live birth in Kelantan had dropped from 22.76 in 1985 to 12.92 in 1994. in comparison to the state average, districts of Gua Musang, Kuala Krai, Tanah Merah, Jeli, Pasir Mas and Tumpat had higher perinatal mortality rate in1994.

2. THE SCHOOL OF MEDICAL SCIENCES UNIVERSITI SAINS MALAYSIA.

2.1: THE HOSPITAL UNIVERSITI SAINS MALAYSIA (HUSM)

Universiti Sains Malaysia (USM), the third University in Malaysia was established in 1969 in Penang. Subsequently, in 1983 and 1985 it set up two branch campuses, the first in Kelantan followed by the second in Perak. USM Perak Branch houses the various schools of engineering while USM Kelantan Branch; to date has its School of Medical Sciences (SMS) and the Hospital Universiti Sains Malaysia (HUSM) which acts as a teaching hospital.

From the beginning and true to its name, USM is given the mandate to provide, promote and develop higher education in the fields of Natural Sciences, Applied Sciences, Pharmaceutical Sciences, Building Science and Technology, Social Science, Humanities and Education. Emphasis of is given to research and advancement of knowledge and the dissemination such knowledge in these fields of study. The University has not departed from these terms of reference and is proud of its innovative approach in tertiary education.

This Campus started to develop in 1983 when the Ministry of Health Malaysia handed over a newly completed hospital building to USM to act as a teaching hospital for its medical undergraduates. Then the campus only accommodated the 4th and 5th year students, and academic staff from the clinical disciplines. Years 1, 2 and 3 students remained at the Main Campus in Penang together with their lecturers and the administrative machinery of the School. The medical Complex, the sports complex and the animal house were built under Phase 1

landmark of the campus or because of its direct involvement with the community. HUSM is headed by a Director and assisted by two Deputy Directors. The various heads of department and heads of units also assist him.

The Hospital opened its doors to patients in October 1983. It provides medical services like any other hospitals in the country but unlike the others. It also acts as a teaching hospital for the medical and dental undergraduates and final year pharmacy students of USM.

With the presence of specialists and consultants in the various fields of medicine and related disciplines it is able to be the referral center for the East Coast states of Peninsular Malaysia.

Services offered by HUSM can be categorized into two, namely the outpatient service and the In-patient service. Outpatient service consists of Community Medicine Clinic that is open on all working days from 08.30 to 16.30, the Specialist clinics that are open from Saturday to Wednesday and see cases by referrals and appointments. The third outpatient clinic is Accident and Emergency Unit that is open round the clock to attend to all kinds of urgent case.

In-patient service provides treatment in one of the 28 wards of HUSM. The wards are divided into various disciplines like Obstetrics and Gynecology, Surgery, Orthopedic, Psychiatry, Ophthalmology, Otorinolaryngology, Pediatric, Medical, Oncology, ICU, CCU and NICU. There are a total of 675 beds.

At the moment, a five storeyed building meant for dental faculty is in progress.

As a teaching hospital and a referral center, HUSM undertakes to provide the best, in patient service. Specialists who are also lecturers of SMS act as consultants to all cases in HUSM.

Support services come from the many departments and units that make up this Hospital. Services from the Radiology Department, Nuclear Medicine Unit, and laboratories help doctors decide the best treatment regime for patients. The blood bank supplies blood and blood components as well as other hematological tests and screening. The Haemodialysis Unit provide the necessary therapies for certain patients. The Dietetics Unit prepares food for all in-patients and does diet counseling service. The laundry Unit ensures constant supply of linen to the wards while the Housekeeping Unit is responsible to the cleanliness of all general areas in the hospital.

2.2.THE DEPARTMENT OF OBSTETRICS AND GYNAECOLOGY

In year 2000, the department of Obstetrics and Gynecology was staffed by ten consultants / lecturers, six registrars (final year masters students), fourteen medical officers / trainee lecturers (12 third years and one second years and one fist years and seven house officers. The postgraduate program was started in 1991 and the first Master of Medicine candidates graduated in June 1995.

Since 1995 the department of Obstetrics and Gynaecology occupied the first and second floors of the main hospital building. There were two gynaecology wards on the second floor with 56 beds and two obstetrics wards on the fist floor with 72 beds.

The departments had a major transfer on 27th June 1997. The new block has a Labor Room, the antenatal ward and the postnatal ward. The Labor Room (2 Berlian) is currently on the first floor of the new block. It consists of 8 labor suites, 1 admission room, 2 bedded pre eclampsia room for patients requiring intensive care, 2 bedded premature Labor Room, 1 operating theatre and 1 ultrasound room. This floor becomes full operational on June 28 1997.

The Labor Room is equipped with an ultrasound machine, five cardiotocograpy (CTG) machines, dynamaps, ECG monitors, infusion pumps, two resuscitation trolleys, an arterial blood gas machine and central oxygen supply and blood warmer.

Adjacent to the Labor Room is neonatal resuscitation room with is equipped with a resuscitation trolley, warmer and incubators. There is an operation theatre situated within the Labor Room, which is opened during office hours for emergency obstetrics procedures such as caesarean and repair of third and fourth degree vaginal tear or cervical tear and manual removal of placenta.

There is an anaesthetic medical officer posted to the Labor Room during office hour for providing epidural services and emergency procedures. The Neonatal Intensive Care Unit (NICU) is housed behind the Labor Room and is equipped with facilities for the care of problem newborns.

There is one registrar and one medical officer posted in Labor Room during office hours. After office hours the on call team takes charge of running the Labor Room.

Table 2.2.1. Basic Statistic of Obstetrics and Gynaecology, Hospital Universit Sains Malaysia.

Year	1995	1996	1997	1998	1999	2000
Total Deliveries	8804	7669	7712	6930	7778	7487
Mode of Deliveries (%)						
1) SVD	80.1	79.3	79.3	81.1	82.6	82.7
2) Vaccum	2.9	3.4	2.9	2.2	2.4	1.2
3) Forcep	1.2	1.5	1.8	1.1	1.0	1.1
4) CS	11.3	10.7	12.4	13.6	11.8	11.6
5) Breech	2.7	2.8	2.6	2.1	2.0	2.4
6) Twin	1.0	1.0	1.0	0.9	1.2	1.0
Still Birth (per 1000)	13.3	14.5	13.0	15.2	11.6	10.6
PMR (per 1000)	19.1	23.1	21.9	23.9		
MMR (per 1000)	35.16	52.2	12.96			

The antenatal ward (2 Baiduri and 2 Arked) is situated on the 2nd floor and has 20 beds each and the postnatal ward (2 Topaz) has 40 beds. The gynaecological wards were shifted to the 1st floor of the old hospital block and have a total of 62 beds.

The obstetrics and gynaecology clinic is situated on the ground floor of the same building and is equipped with two-ultrasound machines, cardiotocograpy (CTG) machine and a colposcope. The clinic runs as follows in Table

Table 2.2.2. O&G Clinic Schedule in HUSM

DAY	MORNING	AFTERNOON
Saturday	Booking Antenatal Clinic	Booking Antenatal Clinic
Sunday	Antenatal Outpatient Clinic	Gynaecology Outpatient Clinic
Monday	Menopause Clinic Combined Clinic Outpatient Ultrasound	Molar and Oncology Clinic
Tuesday	Antenatal Outpatient Clinic	Gynaecology Outpatient Clinic
Wednesday	Fertility Augmentation Clinic	Postnatal Clinic
Thursday	Staff Pap Smear Clinic	Department Presentation

The doctors are rosteredequally into four teams to these clinics as well as the wards and duties during normal working days as well as on call days. This system had been well accepted.

Table 2.2.3. The Number of Outpatients Seen from 1995 till 2000

YEAR	GYNAECOLOGY OUTPATIENT	OBSTETRICS OUTPATIENT
1995	4174	10296
1996	4725	10146
1997	5319	11741
1998	5666	11826
1999	6026	9854
2000	5945	9144

ABSTRACT

OF

DISSERTATION

3. ABSTRACT OF DISSERTATION

3.1 BAHASA MALAYSIA VERSION.

KAJIAN RAMALAN PRAMASA: KAITAN DIANTARA KELAHIRAN SECARA CAESAREAN DENGAN BERAT BADAN IBU DAN INDEKS JISIM BADAN.

Objektif: Tujuan kajian ini ialah untuk menilai samada berat badan dan indeks jisim badan yang tinggi sebelum atau semasa mengandung mengakibatkan kenaikkan kadar kelahiran secara caesarean. Kajian ini juga cuba untuk menilai samada pertambahan berat badan semasa mengandung menyebabkan kenaikkan kadar kelahiran secara caesarean. Objektif ketiga ialah mendapatkan satu nilai BMI atau kenaikkan berat badan yang menyebabkan pertambahan kadar caesarean.

Metodologi: Kajian ini dijalankan di Jabatan Obstetriks dan Ginekologi Hospital Universiti Sains Malaysia, Kubang Kerian bermula 1hb. Ogos 1999 hingga 31 hb. Julai 2000. Ia merangkumi semua wanita mengandung yang membuat pemeriksaan(booking) di klinik antenatal HUSM serta bercadang bersalin di Hospital ini. Selain itu, kriteria memilihan adalah mengandung tunggal, tempoh hamil kurang daripada 32 minggu atau jangka bersalin sebelum 31 Julai 2000. Kriteria penolakkan pula ialah kandungan kembar, anak meninggal, kecacatan fetus, masalah medical atau pembedahan serta rekod kesihatan yang tidak lengkap. Dalam masa setahun seramai 631 wanita yang memenuhi criteria kajian dan mempunyai rekod yang lengkap. Berat badan dan ketinggian sebelum

mengandung direkod berdasarkan ingatan calon. Parameter kedua diukur diantara 27 hingga 31 minggu.

Keputusan: Kadar bersalin secara CS meningkat dengan berat badan sebelum mengandung melebihi 79kg (OR=1.744, p=0.001). Bagi berat badan melebihi 79kg pada trimester ketiga, OR=1.227 (p=0.002). Nilai BMI sebelum mengandung dan pada trimester ketiga diantara 26.1-29 memberikan OR=1.408 (p=0.08) dan OR=1.291 (p=0.022). Bagi nilai BMI sebelum dan trimester ketiga mengandung melebihi 29, memberikan OR=3.042 (p=0.001) dan OR=1.361 (p=0.014). Kenaikan berat badan diantara 15.9-18.2kg juga menyebabkan kenaikkan kadar CS (OR=4.225, p=0.003). Kenaikkan melebihi 18.2kg memberikan OR=4.331(p=0.01). Berat lahir bayi melebihi 4kg memberikan OR=2.000(p<0.001). Analisis secara univariasi juga mengesahkan calon yang berusia kurang dari 20 tahun (OR=3.61, p=0.027) atau melebihi 39 tahun (OR=2.582, p=0.005) mempunyai risiko bersalin secara CS. Analisis menggunakan multivariate stepwise logistic regression mengesahkan kaitan diantara umur, berat dan BMI sebelum mengandung, kenaikkan berat badan dan berat lahir bayi dengan CS.

Kesimpulan: Risiko CS adalah berkaitan dengan umur, berat dan BMI sebelum mengandung, kenaikkan berat badan dan berat lahir bayi. Kajian ini mengesahkan kaunseling sebelum mengandung tentang berat badan optimal dan kawalan berat badan semasa mengandung dapat mengurangkan kadar CS.

3.2 ENGLISH VERSION.

THE PRETERM PREDICTION STUDY: ASSOCIATION OF CAESAREAN DELIVERY WITH INCREASES IN MATERNAL WEIGHT AND BODY MASS INDEX.

Objectives: The purpose of this study was to evaluate whether maternal weight and body mass index measured before or during pregnancy are associated with an increased risk of caesarean delivery. This study also try to determine whether greater weight gain during pregnancy is associated with increased risk of caesarean delivery.

Study design : This is a cross-sectional study conducted in the Obstetrics and Gynaecology Department, Hospital Universiti Sains Malaysia, Kubang Kerian Kelantan from 1st August 1999 till 31st July 2000. Candidates for this study are antenatal patient who came for booking and planned to deliver in HUSM with singleton pregnancy at period of amenorrhoea of 32 weeks or less and their EDD must be before 31st July 2000. During this one year 1359 pregnant women came for booking. Cases with multiple fetuses, stillbirth, fetal anomalies, selected medical and surgical complications, and those with incomplete medical record were excluded. 631 cases remained for analysis. Maternal weight and height were prospectively recorded. The prepregnancy weight was based on self-reporting and third trimester weight taken between 27 to 31 week. Both weight and height were used to calculate the body mass index, and its contribution to the risk of caesarean delivery was determined.

Results: There is an increased in CS rate for prepregnancy maternal weight more than 79kg, OR=1.744(p=0.001). For third trimester weight more than 79kg, the odds ratio is 1.227 with p value of 0.002. Prepregnancy BMI of 26.1-29, the odds ratio is 1.408 (p=0.08). Patients with prepregnancy BMI more than 29 have higher CS rate. The odds ratio is 3.042 (p=0.001). Third trimester BMI of 26.1-29 gives an odds ratio of 1.291 (p=0.022). For third trimester BMI more than 29, the odds ratio is 1.361 (p=0.014). Weight gain within 15.9-18.2kg is also associated with increased risk of CS. The odds ratio is 4.225 (p=0.003). Greater weight gain(>18.2kg) gives higher CS rate, odds ratio is 4.331 (p=0.01). Univariate analysis of risk factors for caesarean delivery in 631 eligible women revealed an increased risk of caesarean section with maternal age less than 20 years and more than 39 years, OR=3.61(p=0.027) and OR=2.582(p=0.005). Birth weight more than 4kg is also associated with higher rate of CS. It gives odds ratio of 2.000 (p<0.001). Multivariate stepwise logistic regression analysis confirmed the association of age, prepregnancy weight, prepregnancy BMI, weight gain and baby birth weight as significance variables contributing to caesarean delivery risk.

Conclusion: The risk of CS is associated with age, prepregnancy weight and BMI, maternal weight gain and baby birth weight. Prepregnancy counselling about optimising maternal weight and monitoring weight gain during pregnancy to decrease risk of CS are indicated by this study.

INTRODUCTION

4. INTRODUCTION

Caesarean birth has become the most common hospital-based operative procedure in the United State, accounting for more than 25 percent of all live births (Rutkow 1986). The increase has been attributed to the liberalization of indications for "fetal distress" and breech presentations, as well as elective repeat caesarean sections (Shiono PA, Mc Nelis D, Rhoads GS, 1987). In many medical centers the overall rate would be significantly higher if there had not been a change in attitude facilitating acceptance of vaginal birth after caesarean section (Phelan JP, Clark SL, Diaz F et al, 1987). Despite its dramatic impact on society, little attention has been focused on the cumulative consequences of this major operative procedure with its implications not only for the current pregnancy but also for future reproduction. Caesarean delivery is associated with maternal mortalily rate of approximately 20 per 100,000 births in the United States (Petiti DB, 1985). As isolated end points, it is obviously infrequent complication. However, there are no reliable data regarding the cumulative long-term morbidity associated with caesarean birth. Caesarean delivery has many possible untoward consequences: an increased risk for postpartum infectious morbidity, despite antibiotic prophylaxis; an increased risk of significant blood loss and need for transfusion with the associated problems with blood and blood product replacement; and an increased risk of anesthetic accidents.

HISTORY OF CAESAREAN SECTION

The origin of the term "caesarean section" for the abdominal delivery of a child by cutting through the abdominal wall and the uterus is likely the product of two separate report in 1581 and 1598.The former making reference to "caesarean" and the second to "section". However the origin of the term "caesarean" is somewhat more uncertain. The hypothesis that Julius Caesar was the product of a caesarean birth is unlikely to be true in view of the probability of fatality associated with this procedure in ancient times and the observation that his mother corresponded with him during his campaigns in Europe many years later. The term may have as its origin in Latin verb cadere, to cut; the children of such birth were referred to as caesones. It is also possible that the term stems from the Roman law known as Lex Regis, which mandated post-mortem operative delivery so that the mother and child could be buried separately; the specific law is referred as Lex Cesare (Horley JMG, 1980).

Though there is a reference to postmortem caesareans in the Susruta Samhita (Rao 1952) and in the Talmud, it was not till the nineteenth century that the operation was done on the living with reasonable chances for the woman's survival. Caesarean birth has been technically refined and rendered safe for both mother and fetus during the twentieth century. Kaufman (1995) describes eight caesarean sections performed in Edinburgh between 1737 and 1820 mainly for gross pelvic contraction caused by osteomalacia. In all cases, the mothers died within 48 hours, and the child survived only in two. Fayrer (1870) describes in

detail two cesarean sections done in purdah for severe osteomalacia in early 1854 in Lucknow, India in consultation with Dr Bonsfield. A longitudinal uterine incision was made in each case but the mothers died due to hemorrhage and sepsis within two days. Eduardo Porro performed the first successful cesarean section with better results as the uterus was removed during the operation in 1876 (Harris RP, 1880). The Porro procedure combined subtotal cesarean hysterectomy with marsupilization of the cervical stump. It was only in 1882 that Max Sanger in Leipzig published his work explaining the principles and technique of cesarean section, including aseptic preparation, with special emphasis on a two-step uterine closure using silver wire and silk and careful attention to hemostasis. Sanger felt that the employment of this approach would obviate the growing tendency for caesarean hysterectomy because fear of hemorrhage and infection. It is interesting to note that Sanger attributed much of the early development of suture material to American frontier surgeons, including Frank Polin of Springfield, Kentucky, who in 1852 had reported the use of silver wire sutures in surviving patients who undergone caesarean delivery (Eastman NJ, 1932). The introduction of suture material, which enabled the surgeon to control bleeding, was of monumental importance in the evolution of the procedure. Nevertheless, death from peritonitis remained a major threat.

The extraperitoneal operation described by Frank (1907) and subsequently modified by Latzkos (1909) and revived 30 years later by Waters (1940) failed to gain popularity. Subsequently, Kronig (1912) realized that extraperitoneal cesarean birth not only minimized the effects of peritonitis but also allowed access

to the lower uterine segment through a vertical midline incision, which could then be covered with peritoneum, an approach that led to the modern-day low vertical procedure. Later, Beck (1919) and DeLee (1922) modified the Kronig approach and introduced it in the United States. Finally, Munro Kerr (1926) developed the low transverse incision, which is proved to be much safer and has been universally accepted since then.

Today, caesarean birth is performed in 15-20% of all deliveries in most developed countries, with an associated maternal mortality of less than 1:10000. The safety of the lower uterine segment technique, the development of skilled anesthesia (general and regional), the availability of blood products and antibiotics, the broadening of indications for the operation, the recognition of the fetus as a patient, the feasibility of vaginal delivery following caesarean section and the acceptance of this procedure by women have characterized the operation in the twentieth century. These factors have all contributed to the rise in the incidence of caesarean birth over the past 50 years.

The lower uterine segment operation, pioneered by Munro Kerr in 1926 is now performed in over 90% of caesarean operations. This procedure is enable many women to achieve a vaginal delivery in a subsequent pregnancy. It is important to remember that a caesarean section is a major surgical procedure and that peri-operative complications remain a significant source of maternal morbidity and mortality.

THE CHANGING RATE OF CAESAREAN SECTION

During the 1970s and early 1980s, the caesarean delivery rate progressively increased throughout the world, though more dramatically in some countries than in others. In 1984, caesarean delivery become the number one in-hospital operative procedure in the USA and accounted for 21% of all live births. In 1988, this figure climbed to 24.7% and, although initially projected to reach 30% by the year 2000, has stabilized in incidence, being 22.8% in 1993. The rise of CS rates has not been limited to developed countries alone but has spread to developing countries too. The institutional rates in Women's Hospitals, Madras, which were as low as 1-2% from 1930 to 1960, gradually rose to 3% in 1970, 10% in 1980 and peaked to 20% in 1992. The institutional rates in the Middle East (Kuwait, Saudi Arabia, and Egypt) are about 10%. The rates for teaching hospitals in South and Southeast Asia are slightly higher ranging from 8.1% in Delhi to 21.1% in Trivandrum (Rao KB, 1994).

Why are the caesarean section rates on the increase?

1. Due to an increase in the number of repeat sections, as many obstetricians are reluctant to take risks in allowing subsequent trial of vaginal delivery.
2. Because with the use of continuous electronic fetal monitoring, more cases of fetal distress are 'detected'.
3. Because of increasing trends for caesarean section for uncomplicated breech presentations so as to reduce perinatal death.

4.Because of rising induction rates, with caesarean section for cases of failed induction.

5. Because obstetricians prefer caesarean section to difficult vaginal delivery for pelvic arrest.

6. There are better 'chances of survival' of LBW and VLBW babies delivered by cesarean than delivered vaginally.

7. Because of better maternal and fetal prognosis in cases of antepartum hemorrhages (placenta previa or abruptio) with caesarean than by conservative vaginal delivery.

8. Caesarean section for severe PIH including eclampsia in primigravidae when urgent pregnancy terminations are needed or when there is no response to conservative therapy.

9. Because of the rising incidence of IUGR as made out by clinical and ultrasonologic methods.

10. To avoid malpractice suits for alleged neglect in vaginal delivery when the child has convulsion or cerebral palsy later. A physician with a history of malpractice claim is more likely to opt for caesarean section due to defensive obstetrics.

11. Due to economic incentives because professional charges are higher for caesarean than for a successful vaginal delivery.

12. In some cases because of lack of patience on the part of the patient or her physician. The physician factor in caesarean section was obvious from the study involving 11 physicians from single institution where a cesarean rate varied from

19.1% to 42.3% depending on the physician's outlook and judgment (Goyert et al 1989).

It is of great importance to obstetrician to understand the evolution of caesarean section not only to appreciate the alarming rise in its incidence during the last three decades but also to take suitable measures to bring it down to reasonable levels. Professional bodies were concerned at this enormous rise in the caesarean section rates and appointed special committees to enquire into the cause of the sharply rising trends and suggest suitable measures to control these rates. Numerous factors have been shown to contribute to a women's risk of cesarean delivery, including maternal age, parity, socio-economic status and delivering physician (private vs. training program). Intra-partum factors include birth weight, fetal fat deposition, epidural analgesia, fetal malposition, and chorioamnionitis. Maternal obesity is also a factor associated with an increased risk of caesarean delivery.

BODY MASS INDEX

Obesity is one of the most common nutritional problems complicating pregnancy in developed countries. Maternal obesity has been defined in various ways, including a body weight above 80kg, a weight 50 to 300 percent more than ideal prepregnancy weight for height, and a maternal body-mass index of more than 29kg/m^2. Body mass index (BMI) is one of the most accurate ways to determine when extra pounds translate into health risks. BMI is a measure, which takes into account a person's weight and height to gauge total body fat in adults. This is calculated by:

Weight (kg) / height (m) x height (m).

Someone with a BMI of 26 to 29 is about 20 percent overweight, which is generally believed to carry moderate health risks. A BMI of more than 29 is considered obese. The higher the BMI, the greater the risk of developing additional health problems. A BMI lower than 19.8 are considered underweight and normal BMI is between 19.8 till 26.

TABLE 4.1: BODY MASS INDEX CHART

	BODY MASS INDEX											
	19	**20**	**21**	**22**	**23**	**24**	**25**	**26**	**27**	**28**	**29**	**30**
Height (Inch)	**body weight (lbs)**											
58	91	96	100	105	110	115	119	124	129	134	138	143
59	94	99	104	109	114	119	124	128	133	138	143	148
60	97	102	107	112	118	123	128	133	138	143	148	153
61	100	106	111	116	122	127	132	137	143	148	153	158
62	104	109	115	120	126	131	136	142	147	153	158	164
63	107	113	118	124	130	135	141	146	152	158	163	169
64	110	116	122	128	134	140	145	151	157	163	169	174
65	114	120	126	132	138	144	150	156	162	168	174	180
66	118	124	130	136	142	148	155	161	167	173	179	186
67	121	127	134	140	146	153	159	166	172	178	185	191
68	125	131	138	144	151	158	164	171	177	184	190	197
69	128	135	142	149	155	162	169	176	182	189	196	203
70	132	139	146	153	160	167	174	181	188	195	202	209
71	136	143	150	157	165	172	179	186	193	200	208	215
72	140	147	154	162	169	177	184	191	199	206	213	221
73	144	151	159	166	174	182	189	197	204	212	219	227

NEW RECOMMENDATIONS

The fact that obesity is now more frequent in the obstetric population coupled with the recent recommendations by the Institute of Medicine regarding recommended weight gain during pregnancy has resulted in a renewed interest in the effects of maternal weight on the risk of caesarean delivery.

Weight gain during pregnancy is highly variable and gains at either extreme of the range have health implications for both mother and infant. Several studies, with large population groups, have found a strong linear association between the

amount of weight a woman gains during pregnancy and the birth weight of her infant (Gormican et al, 1980; Abrams & Laros, 1986; Mitchell & Lerner, 1987; Springer et al, 1992). It has been argued that the widespread aversion to fatness among the female population may prejudice young women against gaining weight during pregnancy (Palmer et al, 1985). To test this hypothesis Palmer et al developed a short questionnaire that they tested among a group of white middle class women in USA. A significant association was found between attitude scores from the questionnaire and actual weight gain during pregnancy. Negative attitudes to weight gain and attitudes favoring slimness were associated with smaller weight gain during pregnancy. When the same questionnaire was used with a group of pregnant adolescents, however this relationship was not observed (Stevens-Simons et al, 1993). However it appears that as pre-pregnancy weight increases the importance of weight gain during pregnancy diminishes (Abrams & Laros, 1986). Whilst inadequate weight gains therefore contribute to reduced birth weight, excessive weight gains increase the risk of complication during pregnancy Shepard et al, 1986). There is general agreement that maternal obesity is associated with an increased risk of medical and puerperal complications, including hypertension, preeclampsia, gestational diabetes mellitus, thrombophlebitis, labor abnormalities (including prolonged second stage labor and shoulder dystocia), delivery after 42 weeks of gestation, and caesarean delivery. There is also an increased risk of becoming obese in the future. Positive associations have been found between the amount of weight gained during pregnancy and the amount retained 9 months to a year post-partum (Ohlin &

Rossner, 1990; Parham et al, 1990). Despite the higher frequency of complications of pregnancy among obese women, the prenatal mortality rate among their offspring is low. Among obese pregnant women, weight before pregnancy is the most important factor influencing birth weight. This is the opposite of the case of no obese mothers, in whom weight gain during pregnancy has an overriding effect on birth weight. It has been hypothesized that obese women can mobilize larger nutritional reserved to supply fuel for fetal growth.

On the basis of such evidence the American Institute of Medicine (AIM) (Food and Nutrition Board, Institute of Medicine, 1990) recommended weight gain ranges for pregnancy based on woman's pre-pregnancy body mass index (BMI). The degree of effect gestational weight gain has on infant size is modified by prepregnancy weight status: a low prepregnancy weight increases the effect, and a high prepregnancy weight lessens it. Thus, women who enter pregnancy with a low BMI, particularly if weight gain is inadequate are at greater risk for adverse pregnancy outcome. Conversely, obese women tend to deliver infants of higher birth weight, despite lower gestational weight gain. Regardless of degree, however, gestational weight gain is linearly correlated with infant birth weight in women of all prepregnant weight categories, including the very obese. Moreover, weight gains below 16 lb in obese women have been associated with higher rates of small-for-gestational-age infants and higher rates of perinatal mortality. There is increasing evidence that gestational weight gain in younger adolescents has a greater effect on infant's birth weight than in older adolescents or adults. Young adolescents have been shown to require higher gestational have been shown to

The recommendations differ from previous ones in that they are ranges rather than single numbers and they are specific to a woman's body-size category. The recommended weight gain for a twin pregnancy is approximately additional ten pounds.

In addition to total weight gain, the rate and pattern of weight gain have been shown to influence fetal growth and length of gestation. In adults, Abrahms found weight gains <270 g/week to be associated with a nearly threefold increase in incidence of small-for-gestational-age infants, while a similar low rate of gain during the second half of pregnancy resulted in higher rates of preterm delivery. In adolescents, despite adequate total weight gain, early inadequate gains (< 4.3 kg by 24 weeks gestation) were associated with increased rates of small-for-gestational-age infants, while late inadequate weight gain (< 400g/week after 24 weeks) resulted in higher rates of preterm deliveries. Recommended rate of weight gain are listed in Table 3. Weight gain of less than 1 kg/month in women of normal prepregnancy BMI or less than 0.5 kg/month in women with high BMI, as well as gain in excess of 3 kg/month, warrant evaluation. Potential causes of inadequate weight gain include insufficient energy intake, high levels of physical activity or physically demanding employment, psychological stress, gastrointestinal or dental problems, chemical abuse, limited food access, carbohydrate intolerance, dieting, and eating disorder. Excessive weight may be related to high fat or energy intakes, infrequent large meals, or a low level of physical activity. High weight gains associated with fluid retention or following a

recent rapid weight loss or cessation of smoking or chemical use should be differentiated from other causes and the women should be reassured.

TABLE 4.3: Recommended weight gain rate during pregnancy.

Prepregnancy BMI (kg/m^2)	Trimester 1 (total lb.)	Trimester 2,3 (lb/week)
Low	5	1 or more
Normal	3	1
High	2	0.66
Very High	1.5	0.5

The IOM acknowledged that the guidelines were based in part on the committee's judgment, because the observed range of weight gain for women with healthy outcomes was too broad to be useful clinically and also because few published studies described the distribution of pattern of gain during pregnancy. The committee said that when abnormal gain was detected, it was important that health care providers "try to determine the cause and then develop and implement corrective actions jointly with the woman (Carmichael S, 1997).

Purposed of my study is to evaluate whether maternal weight gain and body mass index measured either before or during pregnancy are associated with an increased risk of cesarean delivery.

OBJECTIVES

OF

DISSERTATION

OBJECTIVES OF THE DISSERTATION

1) To evaluate whether maternal weight and body mass index measured either before or during pregnancy are associated with increased risk of caesarean section.

2) To determined whether greater weight gain during pregnancy is associated with an increased risk of caesarean delivery.

3) To determined if there is a threshold of BMI or weight gain above which the risk of caesarean delivery is increased differentially.

METHODOLOGY

METHODOLOGY

This is a cross-sectional study conducted in the Obstetrics and Gynecology Department, Hospital Universiti Sains Malaysia, Kubang Kerian, Kelantan from August 1999 till 31 July 2000. Candidates for this study are antenatal patients who came for booking at our antenatal clinic and planned to deliver at HUSM with singleton pregnancy at period of amenorrhoea of 32 weeks or less and their estimated date of delivery must be before 31st July 2000. Women were not enrolled if they planned to be delivered at another hospital or had known major congenital anomalies, placenta previa, multifetal gestation, cervical cerclage or two previous caesarean section.

To obtain the data, patients will be interviewed using a questionnaire during the antenatal booking after they give an informed consent. Questionnaire includes demographic data (race, age, educational level, monthly income), obstetrics history or complications, outcome of pregnancy and maternal anthropometrics. Gestational age was calculated from the first day of the last menstrual period or by ultrasonic examination in the weeks 16 to 20 of pregnancy in those who were unsure of their dates. Heights were measured to nearest 0.5cm with a Detecto scale. Maternal prepregnancy weight was based on self-reporting. Both current and prior obstetrics and medical information was documented through review of the women's medical records.

anomalies and 1 patient underwent cervical cerclage. From 644 patients that fulfilled the criteria, only 631 complete data were obtained. The results of this study is based on this 631 complete data. The primary outcome is defined as caesarean delivery. Caesarean delivery rate is calculated by dividing the number of caesarean deliveries by the number of newborn infant. The data were analysed using the Statistical Package for Social Science (SPSS Inc, Illinois, USA). The Chi-Square test was used for the analysis of categorical variables. A p value of less than 0.05 was considered statistically significant. To eliminate the confounding effect, multivariate study was done using stepwise logistic regression analysis. Odds ratio were estimated for the statistically significant variables using the results from logistic regression.

RESULTS

MODE OF DELIVERIES

There were 8422 deliveries that occur during this study period. Out of this number, 950 cases underwent caesarean section. These account for 11.29% of all deliveries. However only 631 cases were included in this study. From these 631 cases, 86 cases (13.62%) ended with caesarean section

TABLE 7.1: Mode of deliveries between study group with total patient.

PATIENT	VAGINAL DELIVERIES	CAESAREAN SECTION
STUDY GROUP	86.38 %	13.62%
TOTAL DELIVERIES	88.71%	11.29%

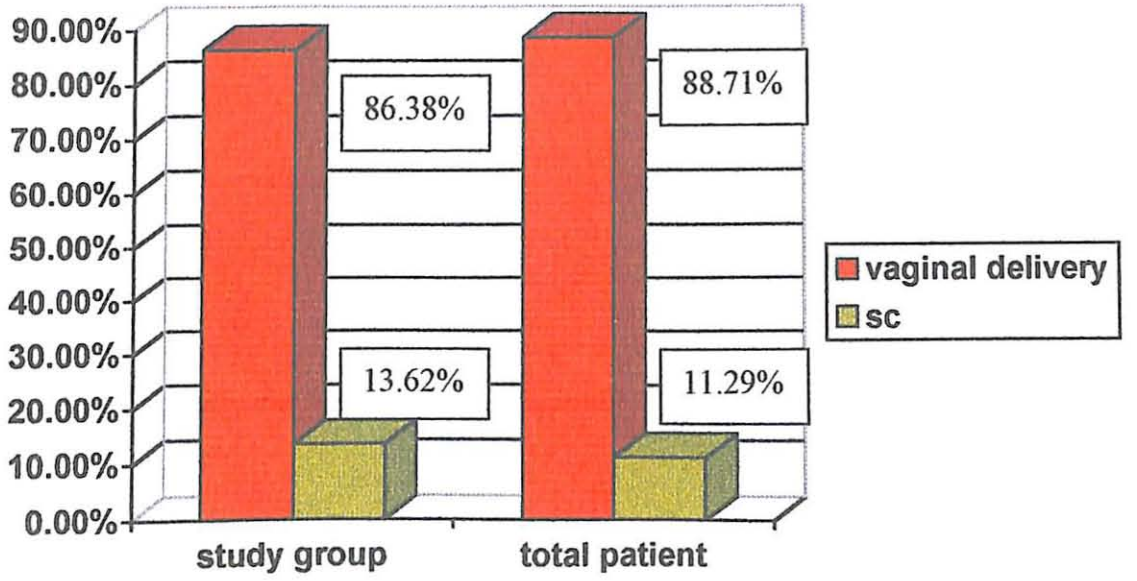

CHART 7.1: Mode of deliveries between study group with total patient.

This study shows that the study group have slightly higher CS rate.

TABLE 7.2: Characteristics of 631 women studied and their pregnancy outcome.

FACTORS	MEAN ± SD		
	TOTAL	VAGINAL DELIVERY	CAESAREAN DELIVERY
AGE (YEAR)	30.84±5.84	30.70±5.65	31.77±6.87
GRAVIDITY	3.73 ± 2.50	3.77± 2.45	3.48±2.83
POA	38.75 ± 1.62	38.80±1.53	38.43±2.09
WEIGHT(KG) PREPREGNANCY 3rd TRIMESTER	 54.43±10.3 62.96± 11.10	 50.07± 9.77 62.43± 10.30	 56.72±13.00 66.32±14.85
BMI (KG/M²) PREPREGNANCY 3rd TRIMESTER	 23.30 ± 4.17 26.38 ± 4.41	 22.97± 3.94 26.25 ±4.07	 24.66±5.18 28.82±5.79
WEIGHT GAIN (KG)	11.01 ± 3.49	10.81± 3.36	12.25±4.02
BIRTH WEIGHT (KG)	3.08± 0.95	3.09 ±0.42	3.03±0.70
SEX MALE FEMALE	 54.8% 45.2%	 46.1% 53.9%	 60.5% 39.5%
MEDICAL COMPLICATIONS(%) PIH GDM PIH & GDM	 7.0 4.8 1.6		
INDUCTION OF LABOUR	12.2%	12.5%	10.5%

TABLE 7.3: Indications for caesarean section.

INDICATION	FREQUENCY	PERCENTAGE
POOR PROGRESS	24	27.90
FETAL DISTRESS	21	24.43
BREECH	20	23.25
ABNORMAL LIE	9	10.46
OTHERS	12	13.96
TOTAL	86	100.00

In this study the most frequent cause of caeserean deliveries is poor progress(24). Followed by fetal distress(21), breech presentation(20) and abnormal lie(8). Others include 4 cases done for big baby; 2 cases each for failed induction, abruptio placenta and precious pregnancy. In 2 other cases caeserean section is indicated for cord prolapse and impending rupture.

DEMOGRAPHIC DATA

TABLE 7.4 : Ethnic group distribution.

ETHNIC GROUP	NUMBER	PERCENTAGE	POPULATION OF KELANTAN (%)
MALAY	606	96.0	93.0
CHINESE	22	3.5	5.4
OTHERS	3	0.5	1.6
TOTAL	**6 31**	**100.0**	**100.0**

The majority of the study patients is Malay, which constitutes 96.0%. While the Chinese only contributes 3.5% and Indians only 0.3% of the study population. This distribution is not much different from Kelantan population.

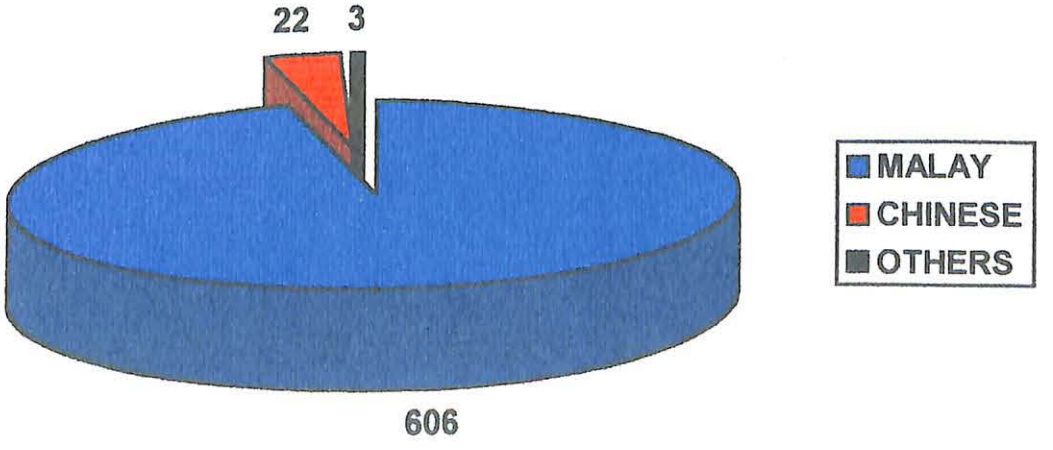

CHART 7.2: Ethnic group distribution.

TABLE 7.5: Distribution of age

AGE IN GROUP	FREQUENCY	PERCENTAGE
<20	11	1.7
20 TO 29	304	48.2
30 TO 39	278	44.2
>39	38	6.0
TOTAL	**631**	**100.0**

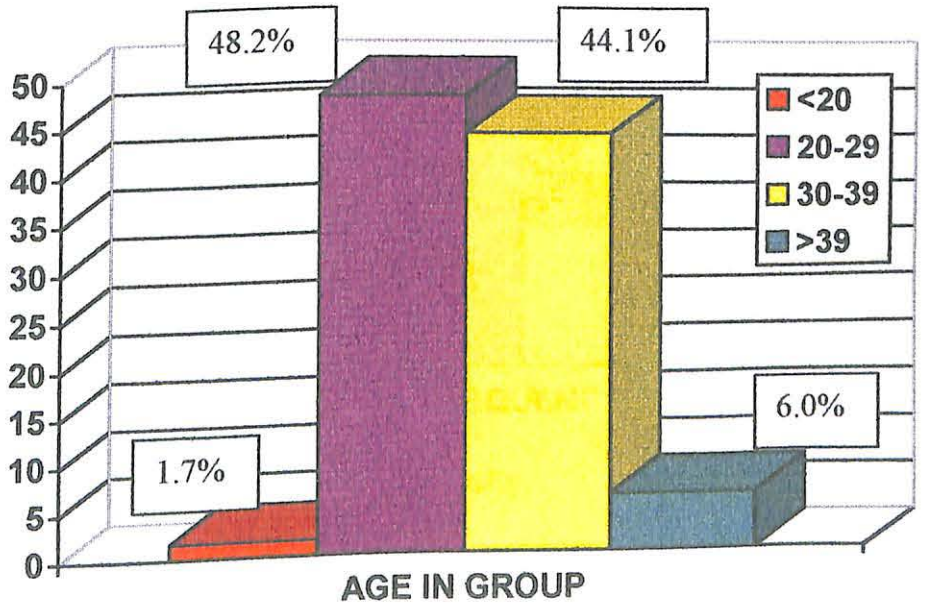

CHART 7.3: Distribution of age.

In this study, 92.3% patients aged between 20 t0 39 years. 6% aged more than 39 years and only 1.7% aged less than 20 years.