

A Reappraisal of Indications for Abdominal Delivery at a Referral Health Institution in South East Nigeria.

Uzoam M Agwu¹, Odidika U J Umeora¹, Grace Umahi²

¹Department of Obstetrics and Gynaecology, Ebonyi State University Teaching Hospital. Abakaliki.

& ²Department of Physiology, Ebonyi State University, Abakaliki.

Abstract:

Background: There is a global worry about the increase in the rate of caesarean section despite attempts to reduce the rising trend especially in developing countries where the figures are competing seriously with those for developed counties.

Objective: The study assesses the current caesarean section rate in the hospital, compare it with past figures and appraise the indications for the Caesarean sections.

Materials and Method: Case records of all cases of caesarean section managed in the hospital over a three-year period (1st of January 2006 to 31st of December 2008) were analyzed.

Results: A total of 4005 deliveries were undertaken during the study period (1st of January 2006 to 31st of December 2008). Out of which 736 were caesarean section giving an incidence of Caesarean section to be 18.4%. The commonest indication is previous Caesarean section, accounting for 19.6%. This is followed by obstructed labour (11.7%) and presumed foetal distress (7.9%).

Conclusion: There is a rising trend in caesarean section rate. There is need for more comprehensive audit, taking into consideration the opinion of the consultants and patients if the rate should be curbed. There is also need to improve facilities to pick true foetal distress before embarking on Caesarean section.

Key words: Caesarean Section, Indications, Fetal Distress, Obstructed Labour, Nigeria,

Running Header: Indications for Abdominal Delivery

Introduction

Caesarean section, is the most common major obstetric operation performed worldwide^{1,2} for a variety of foetal and maternal indications, and recently for patient's wishes and preferences³. Consistently over 70% can be attributed to the following four indications; dystocia (failure to progress during labour), Fetal distress; breech; and repeat caesarean delivery, and these have been cited as the major determinants of overall Caesarean section rate (CSR)⁴. The recommendation to reduce the total CSR involves reduction of Caesarean sections (CS) performed for these indications, in particular reducing primary CS regardless of parity⁵. In the last 30 years the rate has risen from 4.5% to 24.7%⁶ and much higher in developed countries. A review of delivery records at the Ebonyi State University Teaching Hospital (EBSUTH), Abakaliki, over a three year period (2000-2002) recorded a caesarean section rate of 17.8%⁷. In a 2006 publication reviewing caesarean delivery rates in South America, the median rate was 33%

with rates fluctuating between 28% and 75% depending on public service versus a private provider⁸.

Although a global phenomenon, the timing and rate of increase has differed between countries and marked differences in rates persist. A World Health Organization (WHO) organized a consensus conference in 1985, concluded that there were no additional health benefits associated with a CSR above 1015%⁵. This was based on an examination of estimates of national CSR and maternal and perinatal mortality rates from various countries. Since then efforts are being made to reduce the incidence by advocating, for instance offering a woman with breech presentation, external cephalic version and only resort to caesarean section when it fails,

Correspondence: Dr. Uzoma M. Agwu, Department of Obstetrics and Gynaecology, Ebonyi State University Teaching Hospital. Abakaliki. E-mail: vehgorsafeway@yahoo.com

Table I. Socio-Demographic characteristics of the patients.

	2006	2007	2008
Age	n (%)	n (%)	n (%)
≤19	14(5.8)	12 (5.0)	4(1.6)
20-24	32(13.2)	44 (18.5)	36(14.1)
25-29	83(34.2)	87(36.6)	85(33.3)
30-34	73(30.0)	59(24.8)	87(34.1)
35-39	23(9.5)	30(12.6)	37(14.5)
≥40	2(0.8)	6(2.5)	5(2.0)
Not Stated	1(0.4)	0(0.0)	1(0.4)
Parity	n (%)	n(%)	n(%)
1	78 (32.1)	77(32.4)	78(30.6)
2-4	107(44.0)	115(48.3)	107(42.0)
≥5	44(18.1)	40(16.8)	55(21.6)
Not stated	14(5.8)	6(2.5)	15(5.6)
G.A	n (%)	n(%)	n(%)
<28	1(0.4)	0(0.0)	0(0.0)
28-32	6(2.5)	10(4.2)	4(1.6)
33-36	15(6.2)	24(10.1)	19(7.5)
≥37	186(76.5)	200(84.0)	219(85.9)
Not Stated	34(14.0)	4(1.7)	13(5.1)
Birth weight	n (%)	n(%)	n(%)
<1.500Kg	9(3.7)	6(2.5)	6(2.4)
1.500-2.499	34(14.0)	48(20.2)	41(16.1)
2.500-4.000	185(76.1)	173(72.7)	190(74.5)
>4.000	15(6.2)	11(4.6)	18(7.1)

the use of active management of labour and induction of labour for postdate pregnancies. But the rise in CSR continued.

Many studies have attempted to examine and evaluate the changes in population characteristics that may have contributed to the observed increases in CSR⁹. The fact that women are delaying childbirth and having fewer children has been cited as a change contributing to the rise⁹. CSR have been observed to increase with age⁹. However shifts in the age structure of any population have been shown to account for only a small part of the increase in CSR⁴. Martin noted that there is an increase in the percentage of birth to women aged 30-50 years despite a

decrease in the relative size with the population¹⁰. The risk of having a Caesarean delivery is higher in nulliparous patients and with increasing maternal age. The risk for caesarean delivery is also increased secondary to medical complications such as diabetes and preclampsia⁵. The rising number of indications for caesarean section, the use of foetal monitors, the current medico-legal climate, the importance of avoiding damage to the baby, and the increased safety of the caesarean section itself are also some of the reasons cited for the rise in caesarean section rate¹¹. This study sought to document the rate at EBSUTH and evaluate the indications for caesarean section in addition to the population characteristics and their

Table 2: The mean, range, and standard deviation of maternal age, and mean, range and standard deviation of Birth weight with sex and booking status of the study population.

	2006	2007	2008	
Maternal Age (yrs)				Average(yrs)
Mean	28.19	28.26	29.30	28.58
Range	17-45	15-44	16-45	
Std Dev	5.1190	5.3256	4.8387	5.0944
Birth Weight (Kg)				Average(Kg)
Mean	2.98	2.72	3.00	2.9
Range	1.0-5.45	1.25-4.80	0.7-4.7	
Std Dev	0.6756	0.6327	0.6830	0.6637
Sex	n(%)	n (%)	n(%)	Total
Male	132(52.3)	136(57.1)	143(56.1)	411(55.8)
Female	111(45.7)	102(42.9)	112(43.9)	325(44.2)
Total	243	238	255	736
Booking Status for caesarean section deliveries.				
Booked	178(73.2%)	166(69.7%)	166(65.1%)	510(69.3)
Unbooked	65(26.8%)	70(29.4%)	83(32.5%)	218(29.6)
Not stated	0(0.0%)	2(0.8%)	6(2.4%)	8(1.1)
Total	243(100%)	238(100%)	255(100%)	736

contribution to caesarean section rate.

Materials and Methods

Study Site and Population

The Ebonyi State University Teaching Hospital (EBSUTH) is located in Abakaliki, the capital city of Ebonyi state with an estimated population of over 2.1 million. The population is mainly agrarian with a high illiteracy and poverty levels. The hospital is one of the two tertiary health institutions in the state receiving referral from all over the state and her neighbours. The Department of Obstetrics and Gynaecology has 50 obstetric beds and undertakes about 1,300 deliveries annually. Labour is managed actively

and the partograph is used to monitor labour. There is an ongoing standardization of management protocols and regular in-service training for the staff in the department. The Obstetric unit takes care of booked and unbooked cases and operates 24-hour emergency services.

Study Design

This was a retrospective study of all Caesarean sections performed in the department over a three-year period (January 1st 2006 December 31st 2008). Information on socio demographic and delivery parameters of the parturients as well as neonatal records was gotten from the

TABLE 3. Trend of Primary Indications for Caesarean Section.

Primary Indication to perform Caesarean Section	2006 n(%)	2007 n(%)	2008 n(%)	Total n(%)	Average n(%)
Previous Caesarean section	39 (16.0)	53 (22.3)	48 (18.8)	140 (19.0)	46.7(19.0)
Obstructed labour/Contracted Pelvis	30 (12.3)	22 (9.2)	36 (13.7)	88 (12.0)	29.3(11.7)
Not document	38 (16.0)	28 (11.8)	17 (6.7)	84 (11.4)	28.0(11.5)
Poor progress/dystocia	20 (8.2)	16 (6.8)	33 (12.9)	69 (9.4)	23.0(9.3)
APH/IPH	18 (7.4)	25 (10.5)	25 (9.8)	68 (9.2)	22.7(9.2)
Presumed fetal distress	19 (7.8)	22 (9.2)	17 (6.7)	58 (7.9)	19.3(7.9)
Malpresentation/Unstable lie	19 (7.8)	11(4.8)	18 (7.1)	48 (6.5)	16.0(6.7)
Maternal Medical Conditions/Severe Preclampsia	15 (6.2)	8 (3.4)	18 (7.1)	41 (5.6)	13.7(5.6)
Breach Presentation	10 (4.1)	16 (6.7)	10 (3.9)	36 (4.9)	12.0(4.9)
Cephalopelvic Disproportion	14 (5.8)	7 (2.9)	7 (2.7)	28 (3.8)	9.3 (3.8)
Uterine/Previous Uterine Rupture/Scar	10 (4.2)	6 (2.5)	9 (3.5)	25 (3.4)	8.3 (3.4)
Multiple Pregnancy	2 (0.8)	8 (3.4)	3 (1.2)	13 (1.8)	4.3(1.8)
Cord prolapse	4 (1.6)	5 (2.1)	4 (1.6)	13 (1.8)	4.3(1.8)
Chorioamnionitis	1 (0.4)	2 (0.8)	2 (0.8)	5 (0.7)	1.7(0.7)
Macrosomia	1 (0.4)	2 (0.8)	2 (0.8)	5 (0.7)	1.7 (0.7)
Postdatism	0 (0.0)	2 (0.8)	1 (0.4)	3 (0.4)	1.0 (0.4)
Retained Second Twin	0 (0.0)	1 (0.4)	2 (0.8)	3 (0.4)	1.0 (0.4)
Bad Obstetrics History	2 (0.8)	0 (0.0)	0 (0.0)	2 (0.3)	0.7 (0.3)
Cervical Prolapse/Utero Vaginal prolapse	1 (0.4)	1 (0.4)	0 (0.0)	2 (0.3)	0.7 (0.3)
Cervical Tumour	0 (0.0)	0 (0.0)	2 (0.8)	2 (0.3)	0.7 (0.3)
Precious Baby	0 (0.0)	2 (0.8)	0 (0.0)	2 (0.3)	0.7 (0.3)
Vaginal Septum	0 (0.0)	1 (0.4)	0 (0.0)	1 (0.1)	0.3 (0.1)
Total	243	238	255	736	245.3

APH=Antepartum Haemorrhage,IPH=Intrapartum Haemorrhage,

delivery note book at the labour ward as well as patients case records retrieved from the central records department and the labour ward theatre, Approval was obtained for the study by the Research and Ethics committee of the hospital. Data was analyzed using Epi info 2005 soft ware Version 3.3.2 (CDC. Atlanta USA) and CHISQ.EXE. The data was coded in the make view component of the Epi info statistical package and data was entered into the Enter Data component. The results were produced using the Analysis data component. The results were presented using simple frequency tables. For normal distributions, student t-test was used. Statistical significance was assumed if $p < 0.05$. The associations between the Caesarean section as mode of delivery and various demographic and pregnancy characteristics were entered into CHISQ.EXE statistical package and evaluated. Probability of less than 0.05 was considered to be statistically significant.

Results

During the study period, a total of 4005 deliveries were undertaken. Of these, 736 were by Caesarean sections, giving a Caesarean section rate of 18.4%. There was however a rising

trend from 15.7% in 2006, 18.9% in 2007 to 21.3% in 2008. The mean maternal age was 28.6 years (+5.1). The mean birth weight of the study population was 2.9 kilogrammes (+0.7). There were 411 males (55.8%) and 325 (44.2) female babies. Sixty nine point three percent of the Caesarean sections were for booked parturients and 29.6% were unbooked. Table 1, shows maternal age, parity, gestational age, and birth weight distribution. Four point one percent were teenagers while 1.8% were aged 40 years and above. Majority were within the age group of 25-29 years (36.7%). Thirty one point seven percent were primigravidae, 74.7% were multiparae and 18.9% were grandmultiparae. 10.7% were preterm deliveries while 82.2% were term deliveries and gestational of 6.9% were not known.

Table 3 assesses the indications of Caesarean sections and trend from 2006 to 2008. Previous Caesarean section accounted for average of 19.2%, Obstructed labour - 11.7%, and presumed foetal distress 7.9%. Others include Poor progress/dystocia (6.7%), malpresentation/abnormal lie (6.5%), Medical disorders in pregnancy/severe preeclampsia

(5.6%), breech presentation (4.9%), cephalopelvic disproportion (3.8%).

Discussion

The incidence of Caesarean section in the literature varies from region to region and from one country to another. On the whole there appears to be a rising trend of Caesarean section rates in our practice similar to the trend in developed countries³. Caesarean section rates have varied from 15.7% in 2006, to 21.3% in 2008. The current overall Caesarean section rate of 18.4% is lower than the previously 19.3% documented between 2000 to 2002. At that time there was a downward trend from 27.9% in 2000, to 14.5% in 2002. The Caesarean section rate of 18.4% is also lower than 25% in Enugu also in southeast Nigeria¹² and 28.5% in Port Harcourt, South south Nigeria¹³. It is however higher than 15.8% reported/ in Jos in North central Nigeria¹⁴. The varying rates between centres may reflect differences in socio demographic characteristics of the parturients in the different facilities as well as the various units' protocol of labour management and their threshold for Caesarean delivery. The rising trend in our rates through the triennia under review might have been due to increasing contributions from previous Caesarean sections, poor progress in labour/dystocia, obstructed labour and hypertensive disorders of pregnancy as shown on Table 3. The results of the analysis of the indications in this study show a complete deviation from similar appraisal done about five years ago for the triennia 2000 to 2002.

The commonest indication in this study is previous Caesarean section (19.2%). This would be much higher if all cases were taken into consideration irrespective of whether it is primary indication or secondary indication. The figure is much higher than the result in the same institution few years ago where it contributed just 7.7% of the Caesarean section. Cephalopelvic disproportion (CPD) was the commonest indication then (25.8%). The firm establishment of residency training in the department, the introduction and utilization of the partograph, coupled with daily review of labour management under close supervision by Consultant staff in the department, might have

driven the threshold for Caesarean section lower to ensure optimum foetal and maternal outcomes. Reducing CSR in the department must therefore start with re evaluation of the indications for primary Caesarean section in the unit. Rather than being employed defensively, Caesarean section must be validly indicated before being embarked upon. The senior obstetric staff must sanction decisions of junior residents in the department to operate.

The need to reduce the Caesarean section rate, especially of primary section is emphasized, as primary section eventually may come back as previous Caesarean sections or ruptured uterus. In our environment women still attempt vaginal delivery after Caesarean section outside modern medical facilities. This has been attributed to socio economic factors, dependence on family decisions and belief in supernatural powers¹⁵. Traditionally vaginal birth after more than one Caesarean section is not allowed due to the fear of uterine scar dehiscence or rupture and its attendant maternal and foetal risks. Against the background of high Caesarean section rates, increasing population of women with previous Caesarean sections, and the fact that vaginal delivery is safer, there is now a growing body of literature highlighting successful vaginal births in women with more than one previous Caesarean section with good foeto maternal outcome in carefully selected patients. Presently more than 5000 cases of vaginal birth after more than one Caesarean section have been reported in obstetric literature in last fifty years^{16,17}. It is therefore highly recommended that the feasibility of allowing attempts at vaginal delivery after two Caesarean sections in well selected parturients be critically evaluated to reduce the overall rate of Caesarean section.

Obstructed labour remains one of the leading causes of maternal and fetal death in poorly resourced areas of the world and contribute significantly to Caesarean section rate. It came second in ranking in this study (11.68%) Studies have shown that symphysiotomy can still be a manoeuvre that will help reduce the Caesarean delivery rate in the centre. A study by Ersdal HI (2008) showed that there is no significant difference in long term outcome complications

after symphysiotomy and do not differ notably from those after Caesarean delivery for similar indications and have the advantage of not having a scarred uterus and its sequelae¹⁸. Foetal distress is referred to as presumed foetal distress in this study as only clinical sign of foetal distress are used alone to make diagnosis in our centre. This has been criticized^{19,20}. It accounted for 7.9% of all indications in this study. Studies have shown that there is poor correlation between the clinical signs and real foetal hypoxia. Adding monitoring with fetal blood sampling to confirm hypoxia before taking a decision to give a woman a scar may reduce significantly the Caesarean section rate due to foetal distress^{20,21}.

Cephalopelvic disproportion can be suspected based on possible macrosomia or an arrest of labour despite augmentation. Many cases diagnosed as cephalopelvic disproportion are the result of a primary or secondary arrest of dilatation or arrest of descent. Predicting true primary or secondary arrest of descent due to cephalopelvic disproportion is best assessed by sagittal suture overlap, but not lambdoid suture overlap, particularly where progress is poor in a trial of labour²². The over diagnosis of the condition was a reason for its being the commonest indication between 2000 and 2002²² but ranked ninth in this study as residents were more instructed on its management. It however remain a contributor to CSR in our centre. The diagnosis of cephalopelvic disproportion must be accurately done and if possible by a Senior Registrar or Consultant. It is pertinent to note that some of these sections were done for dead foetus simply because of lack of knowledge/skill in destructive operations. Giving a woman a scar for inadequate pelvic in the presence of a dead foetus should be justified. The need to adopt the "no indicated risk" practice in which a woman with presumed inadequate pelvis should be given a chance to try labour^{23,24,25} is advocated. This may reduce the number of Caesarean Sections due to assumed pelvic disproportion and this will subsequently reduce the number of previous caesarean section contribution to Caesarean section rate.

For breech presentation, offering external cephalic version may reduce its contribution to

CSR as against the previous beliefs²⁶. One should also be careful giving a woman a scar for maternal distress, utero-vaginal prolapse, precious baby, previous infertility, and previous myomectomy (without the knowledge of extent of surgery) as more often the implication of a scar is missed. This accounted for about 1.8% in this study. Women who have a uterine scar prior to transmural myomectomy are required to have elective caesarean section to prevent rupture, which occurs in 4-10% of cases²⁷. While acknowledging the general concern about the upward trend in rates of caesarean delivery worldwide, caesarean delivery still remains the most appropriate option for many obstetric situations. There is need for continuous training of residents in proper application and use of the obstetric instruments.

Conclusion

The implication of the rising trend is the need for better and improved patient selection, better counseling about what the procedure entails such as morbidity and mortality for both the mother and the foetus. The ever-expanding list of indications calls for restraints. Supervision of patients in labour by qualified Obstetrician may help reduce the incidence of "un-necessary Caesarean sections". There is also a need for continuous audit of the Caesarean section in the centre. Increase in the skill for forcep and better and good functioning vacuum extractors. Symphysiotomy can still be used to reduce the need for Caesarean section. An auditable standard is the use of oxytocin in the management of primigravida with suspected failure to progress in labour prior to Caesarean section. Where CS is contemplated because of an abnormal foetal heart rate pattern, in cases of suspected foetal acidosis, foetal blood sampling (FBS) should be undertaken when it is technically possible to do so and there are no contraindications. It is recommended that umbilical artery acid base status should be performed as a minimum if emergency Caesarean section is performed for foetal distress.

References

1. Ogah KO, Aboyeji PA, Abiodun MO. Unplanned Vaginal after Repeated Caesarean Birth in Nigerian Women. *Trop J Obstet Gynaecol*, 2007; 24(1): 64-66.
2. Cunningham FG, MacDonald PC, Gant NF, Leveno KJ, Gilstrap LC, Hankins GDV et al. Caesarean delivery and caesarean hysterectomy. In: *Cunningham, et al, editors. Williams Obstetrics, 20th Edition. Stamford, CT :Appleton & Lange; 1997; 507-531*
3. Saju Joy. Caesarean Delivery. Emedicine [on line] Apr 2009. Available from: <http://emedicine.medscape.com/article/263424-Overview>. Accessed 3rd of April 2009.
4. Anderson GM, Lomas J. Determinants of the increasing birth rate. Ontario data 1979 to 1982. *N. Engl J Med* 1984; 311:887-72.
5. Thomas J, Paranjothy S. Royal College of Obstetricians and Gynaecologists' Clinical effectiveness support Unit National Sentinel Caesarean Section Audit Report. *RCOG Press; 2001*.
6. Taffel SM, Placek PJ, Liss T. Trends in the United States Caesarean section for the 1980-1985 rise. *Am J Public Health*, 1987; 77:955.
7. Ibeke PC, Dimejesi IB. Obstetric Indices at the Ebonyi State University Teaching Hospital, Abakaliki, South East Nigeria. *Niger J Med*. 2008 ; 17(4): 399-402.
8. Villar J, Valladares E, Song TB. Predictive Factors for Vaginal Birth after Caesarean delivery. *Int J Gynaecol Obstet*. 2004; 86(3):392-393.
9. National institutes of Health Consensus Development Conference. Caesarean Childbirth. *NIH Consensus Statement Online*. 1980.
10. Martin JA, Hamilton BE, Sutton PD, et al. Final data for 2005. National Vital Statistics reports. In: Births. 56. (6). Hyattsville, MD : *National Centre for Health Statistics*; 2007.
11. Elhag BI, Milaat WA, Taylouni ER. An Audit of Caesarean Section Among Saudi Females in Jeddah, Saudi Arabia. *Journal of The Egyptian Public Health Association*. 1994; 69(1-2):1-17.
12. Ibeke PC. Rising Trends in Caesarean Section Rates: An Issue of Major Concern in Nigeria . *Niger J Med*, 2004; 13: 180-181.
13. Anya SE, Ikimalo JI, John CT. Rising Caesarean Section Rate in University of Port Harcourt Teaching Hospital. Abstracts of papers: 35th AGM and Scientific Conference of Society of Gynaecologist and Obstetricians (SOGON). *Trop J Obstet Gynaecol*, 2001; 18 (suppl. 1):27.
14. Mutahir JT, Daru PH, Ujah IAO. Elective Caesarean Sections at the Jos University Teaching Hospital. *Trop J Obstet Gynaecol*, 2005; 22(1): 39-41.
15. Udoma EJ, Ekanem AD, Abasiattai AM, Basse EA. Factors Contributing to Uterine Rupture in Women Having Vaginal Births After Caesarean Section. *Trop J Obstet Gynaecol* 2005; 22(2): 177-179.
16. Meehan FP, Rafia NM, Bolaji II. Delivery Following Caesarean Section In Studd J (ed) *Progress in Obstetrics and Gynaecology*, Vol 10, New York, Edinburgh, London; Churchill Livingstone, 1993: 213-228.
17. Okpere EE, Oronsaye AU. Pregnancy and Delivery after Caesarean Section. *Trop J Obstet Gynaecol* 1982; 1:45-48.
18. Ersdal HL, Verkuyl DA, Bjorklund KT, Bergstroms. Symphysiotomy in Zimbabwe; Postoperative outcome, width of the symphysis Joint, and knowledge, attitudes and practice among doctors and midwives *PLOS One* 2008; 3 (10):e53178.
19. Clayton SG, Lewis TLT, Pinker GD (eds): *Obstetrics by Ten Teachers* (14th ed), Edward Arnold publishers, London 1985; 308-317.
20. Somerset DA, Murrills AJ, Wheeler T. Screening for foetal distress in labour using the umbilical artery blood velocity waveform. *Br.J. Obstet Gynaecol*, 1993; 100: 55-88.
21. Ayromlooi J, Garfinkel R. Impact of foetal blood pH on the incidence of caesarean section performed for foetal distress. *Int. J. Gynaecol*, 1980; 17:139.
22. Ibeke PC, Obuna JA. Appraisal of Indications for Caesarean Sections in Abakaliki, Nigeria. *Trop J Obstet Gynaecol*, 2006; 23(2):149-151.
23. Philpott RH. The recognition of Cephalopelvic disproportion. *Clin Obstet Gynaecol* 1982, 3:609-624.
24. Armon P. Cephalopelvic disproportion. *Trop Doct* 1998; 28:54
25. Pattinson Rc. Pelvimetry for foetal cephalic presentations at term. *Cochrane. Database Syst Rev*, 2000.
26. Hannah ME, Hannah WJ, Hewson SA, Hodnett ED, Saigal S, Willian AR. Planned Caesarean Section versus planned vaginal birth for breech presentation at term. Randomized multicentre trial. *Lancet* 2000; 356:1375-1383.
27. Gomen R, Tamir A, Deganis. Obstetrics Opinion regarding patient choice in caesarean delivery. *Obstet Gynecol*. 2002; 99(4):577-580.