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EMOTIONAL RESPONSES OF PREGNANT WOMEN UNDERGOING CHORIONIC VILLUS SAMPLING OR AMNIOCENTESIS

by

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THESIS SUBMITTED IN PARTIAL FULFILLMENT OF

THE REQUIREMENTS FOR THE DEGREE OF

DOCTOR OF PHILOSOPHY

in the Department

of

Psychology

SIMON FRASER UNIVERSITY

April 8, 1986

ISBN 0-315-30753-6

APPROVAL

Name: John W. Spencer

Degree: Doctor of Philosophy

Title of thesis: EMOTIONAL RESPONSES OF PREGNANT WOMEN UNDERGOING CHORIONIC VILLUS SAMPLING OR AMNIOCENTESIS

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Emotional Responses of Pregnant Women Undergoing Chorionic Villus Sampling or Amniocentesis

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ABSTRACT

Emotional responses of pregnant women participating in a clinical trial comparing two prenatal diagnostic procedures were assessed over a period ranging from eight to twenty-two weeks post-menstrual gestational age (PMGA). Subjects were 74 pregnant women of 8-11 weeks PMGA designated as "high-risk" because of a family history of chromosomal abnormality, a previous abnormal child or late maternal age of 35 years or older. Immediately prior to an intake counselling session, all subjects were assessed on five background variables (age, parity, fetal loss, family income and living arrangement with the father) and six dependent measures (anxiety, depression, hostility, maternal attachment-self, maternal attachment-others and concern about abortion). The 61 women who agreed to participate further were randomized into either a chorionic villus sampling (CVS) or an amniocentesis (Amnio) group. Thirteen women who declined further involvement constituted the intake comparison group.

The CVS and Amnio groups were assessed three additional times between 9 and 22 weeks PMGA on five of the six dependent measures and one further time for concern about abortion. An additional measure, procedure discomfort, was assessed immediately following prenatal testing.

Analyses of variance revealed no significant differences on the background variables among the three groups. On the dependent measures, the CVS group underwent an earlier reduction

in anxiety and reported earlier development of maternal attachment. CVS women attributed no significant differences in maternal attachment between self and others, while the Amnio group attributed greater maternal attachment to others following intake until after prenatal testing. Scores for depression declined significantly for both groups from the outset to the conclusion of the study, while comparisons for hostility were interpreted as showing no effect. No significant differences were found in concern about abortion. Finally, women reported significantly less discomfort associated with CVS than with amniocentesis.

The present findings were discussed in the context of evidence linking prenatal maternal emotionality to increased risk of obstetric complications and to reduced maternal attachment. Should procedural risks prove to be equivalent, results regarding anxiety, maternal attachment and procedure discomfort favour CVS as the prenatal diagnostic procedure of choice.

ACKNOWLEDGEMENTS

I would like to thank the members of my thesis committee:
Dr. David Cox, Senior Supervisor, for his facilitation and support of this project;
Dr. Ray Koopman for his advice and for his review of the design and methodology;
Dr. Robert Ley for his enthusiastic support and constructive suggestions;
Dr. Barbara McGillivray for her advice and careful editing of the medical subject matter in the thesis.

I would also like to thank the medical genetics staff of Grace Hospital, especially Ms. Carolyn Ganshorn and Dr. Doug Wilson for their cooperation and assistance during the project.

I am also indebted to Ms. Barbara Chambers for her assistance in the extensive data collection process, to Ms. Sandra Murray for her expert assistance in programming the analyses, tables and figures, and to Ms. Brigitte Peter-Chernoff for her numerous computer searches of the relevant medical and psychological literature.

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PART A

INTRODUCTION

The present investigation is affiliated with the Canadian Multicentre Medical Research Project (CMRC, 1984) which is an ongoing evaluation comparing the safety and accuracy of two prenatal diagnostic procedures, chorionic villus sampling (CVS) and Amniocentesis (Amnio). CVS is a first-trimester procedure performed at 9-12 weeks post-menstrual gestational age (PMGA) that typically involves the insertion of a flexible cannula through the pregnant woman's cervix to a region surrounding the amniotic sac. A small amount of tissue is withdrawn for genetic analysis. Amnio is a second-trimester procedure performed at 16-18 weeks PMGA. The technique involves the insertion of a needle through the pregnant woman's abdominal wall and into the amniotic sac, from which a small amount of fluid is aspirated for genetic analysis. Because these two procedures differ both in the time and method of administration, it is likely that there are substantial differences in the emotional reactions to the procedures manifested by pregnant women. The present research investigates some of these potential differences.

Of the five major prenatal diagnostic procedures currently employed, ultrasonography, fetal echocardiography, fetoscopy, Amnio and CVS, the latter two have been shown to provide the greatest diagnostic utility. During the 1970s there was extensive growth in the use of Amnio for prenatal diagnosis. By the end of the decade major collaborative studies from three countries had reported on the safety and utility of Amnio. These were the American reports of the NICHD National Registry for

Amnio Study Group (NICHD, 1976, 1979), the Canadian collaborative study under the auspices of the Medical Research Council (CMRC, 1977), and the report of the British Working Party on Amnio to the Medical Research Council (BMRC, 1978). Chapter One reviews these studies as well as more recent research on the development, procedure, technical concerns and risks of Amnio.

CVS was first reported in 1968, but extensive international research on the safety and utility of the procedure commenced in the 1980s following significant technical advances in real-time ultrasonography as an accompaniment to the procedure. While CVS appears to be a very promising method of prenatal diagnosis, a number of questions presently remain unanswered. Chapter Two examines the development, procedures, technical concerns and risks of CVS.

Both Amnio and CVS are invasive procedures that have a physical and an emotional impact on pregnant women. There is an accumulating body of research to suggest that negative maternal emotionality, particularly maternal anxiety, is associated with pregnancy complications, fetal loss and abnormal infant development. It follows that the negative emotions generated by prenatal testing may well contribute to the overall level of maternal anxiety present, perhaps further increasing the risk of subsequent problems. Thus, should a choice exist between available prenatal diagnostic procedures (i.e. Amnio vs. CVS), the one that arouses the lower level of negative emotionality

over the shorter period may prove to be the more desirable, provided that there are no significant discrepancies in procedural risk, patient discomfort and service-delivery costs. Chapter Three reviews some of the emotional responses associated with pregnancy and prenatal testing and their relationship to reproductive outcome, providing the context for the present investigation.

CHAPTER I

AMNIOCENTESIS

Amniocentesis (Amnio) has been in use as a prenatal diagnostic technique for over fifty years (Nadler, 1968), but the technological advances that have permitted its common use are more recent and are still evolving. Until the late 1970s, the widest application of Amnio had been in the prenatal detection and management of Rh isoimmunization, a condition in which the mother and fetus have different Rh blood groups, placing the fetus at risk for the development of haemolytic disease in the newborn (Nitowsky, 1971). The use of Amnio in the management of this disorder reduced the infant mortality rate from Rh incompatability and demonstrated that the amniotic fluid could be safely sampled during the third trimester of pregnancy.

More recently, second trimester Amnio has been successfully employed in the detection of a number of genetic disorders. These include chromosomal disorders, neural tube defects and inborn errors of metabolism.

Chromosomal Disorders

This group of fetal disorders is the most common, occurring most frequently among women 35 years and older (Bloom, 1983). The most commonly-occurring chromosomal disorder is Down syndrome, a condition recognizable at birth by such features as

hypotonia, slanted palpebral fissures, flat facial profile, a single palmar crease and congenital heart defects. Children with Down syndrome manifest severe retardation and may have a reduced life expectancy. The condition is usually attributable to a trisomy of the 21st chromosome pair, although two to five percent of Down children have a "translocation" chromosomal karotype that includes a structurally abnormal chromosome that attaches to another chromosome (Omenn, 1976). One in every 660 births in British Columbia is a child with Down syndrome, with nearly half of these born to mothers over thirty-five. The risk factor rises from 1/1420 at age twenty to 1/100 at age forty (Allanson & Hall, 1983). Some estimates are even higher (Hook & Chambers, 1977).

A survey of six large-scale studies by Hook and Hamerton (1977) found that Down syndrome, sex chromosome anomolies and balanced chromosomal translocations were the most frequently-occurring chromosomal disorders. The risk rate for any significant chromosomal abnormality rises from 1/500 among mothers at age twenty to 1/70 among mothers at age forty. The overall rate of clinically significant chromosomal abnormalities is probably less than 3.0 per 1000 births. As with the rate of occurrence for Down syndrome, this figure rises sharply with advancing maternal age.

Neural Tube Defects

Open neural tube defects (spina bifida and anencephaly) are among a group of multifactorial disorders such as congenital heart disease, pyloric stenosis, cleft lip and cleft palate, club foot and congenital dislocation of the hip that do not manifest a clear pattern of hereditary transmission or a definable environmental cause (Brock, 1985). Though the etiology is unknown, empirically-derived estimates of the recurrence risk of neural tube defects are available. The risk increases with the number of previous children with the disorder, and certain cultural groups are known to have a high incidence, particularly the Irish and Egyptians. In the United States, open neural tube defects occur at the rate of 1.2 per 1,000 births (Milunsky & Alpert, 1984). The recurrence risk has been estimated at 1% to 2% (Janerich & Piper, 1978; McBride, 1979), but that rate is dependent on incidence figures.

Open neural tube defects include spina bifida, a malformation of the spine and spinal cord in which the posterior portion of the laminae of the vertebrae fails to close, allowing damage to neural elements, and anencephaly, a disorder characterized by the absence of the cerebrum and cerebellum and the flat bones of the skull. The prognosis for spina bifida can be extremely variable, while anencephaly is always fatal. The prenatal diagnoses of these conditions from amniotic fluid was first reported by Brock and Sutcliffe (1972), who found that

high levels of alpha-fetoprotein (a normally-occurring embryologic and fetal protein) were associated with open neural tube defects. A survey of British studies in this area reported a detection rate of 97.6% for open spina bifida and 98.2% for anencephaly, with a false positive rate of 0.79% (BMRC, 1978). Other studies have reported much lower detection rates from alpha-fetoprotein (AFP) concentrations alone, in the range of 80 to 85% (Milunsky & Alpert, 1984; Thom et al., 1985). Measurement of AFP levels is not a clinically specific form of diagnosis. There are a variety of conditions in which elevated AFP levels have been observed, most of them very rare, and few of which are invariably associated with increased AFP (Brock, 1982).

A more recent development in the prenatal detection of neural tube defects is the acetylcholinesterase (AChE) test (Chubb, Pilowsky, Springwell, & Pollard, 1979; Smith et al., 1979). The current technique for analysis of the enzyme AChE distinguishes the single slower-moving enzyme band associated with normal pregnancies from the presence of both a slow-moving and a faster-moving band common to neural tube defects. As an ancillary test, AChE analysis may improve upon the discriminative efficiency of amniotic AFP analysis alone in resolving false negative cases of neural tube defects and false positive cases among normal pregnancies (Aitken, Morrison, & Ferguson-Smith, 1984). However, abnormal AChe bands are also associated with other fetal abnormalities in which AFP is raised, underscoring the lack of clinical specificity in both

diagnostic approaches. Other substances in the amniotic fluid may also predict neural tube defects. High amniotic concentrations of glial fibrillary acidic protein have also been reported in 20 cases of fetal anencephaly (Albrechtsen, Bock & Norgaard-Petersen, 1984). Unlike the diagnosis of fetal chromosome abnormalities, the interpretation of a raised amniotic fluid AFP level can be a difficult clinical problem.

Inborn Errors of Metabolism

Inborn errors of metabolism (IEMs) comprise an array of infrequently-occurring disorders, many of which can be detected through Amnio. Examples include Tay-Sachs disease and Lesch-Nyhan syndrome.

Tay Sachs disease is an autosomal recessive disorder that involves an inborn error of ganglioside catabolism that affects infants in the first year of life. The neonate appears normal, but within six months psychomotor degeneration begins, resulting in blindness, convulsions, retardation, spasticity and finally, death between three and five years of age. The disease has a carrier frequency of 1/25 to 1/35 among Ashkenazi Jews, manifesting itself in 1/4000 births. The carrier frequency is 1/100 among the general population, with a correspondingly lower rate of occurrence. The presence of Tay-Sachs disease can be diagnosed prenatally by determining the percentage of the enzyme hexosaminidase A in the amniotic fluid cells (Schneiderman,

Lowden & Rae-Grant, 1978; Kaback, 1981).

Lesch-Nyhan syndrome is a rare, X-linked recessive disorder that results in elevated uric acid levels in the bloodstream, choreoathetoid involuntary movements, and a compulsive self-mutilating tendency. Boys afflicted with this disorder literally destroy their lips and fingers by involuntary biting. Extraction of the boys' teeth is only a partial solution, as restraint may also be required to prevent them from compulsively blinding themselves. Lesch-Nyhan syndrome can be diagnosed prenatally by testing amniotic fluid cells for hypoxanthine-guanine phosphoribosyl transferase enzyme activity (DeMars, Sarko, Felix & Benke, 1969).

Advances in recombinant DNA methods are having a major impact on the diagnosis of IEMs, permitting the detection of genetic disorders from tissues in which the genetic defect is not expressed, (i.e. from the DNA itself). Recent studies have reported on the prenatal diagnosis of sickle-cell anemia (Chang & Kan, 1981; Geever et al., 1981; Chang, Golbus & Kan, 1982; Wilson et al., 1982) and beta-thalassaemia (Scriver et al., 1984; Wong, 1984; Rosatelli et al., 1985) among others.

In addition to those already discussed there exist more than 1600 known genetically-based human disorders, accounting for more than 25% of the hospitalizations of children. Stephenson and Weaver (1981) initially reported on over 150 of these that could be detected prenatally, but their manuscript was outdated

by publication time and required an addendum of a dozen new diagnoses. The number of disorders that can be diagnosed prenatally is continually on the increase.

The Procedure for Amnio

Second-trimester Amnio is an outpatient procedure optimally performed during the 16th week PMGA. Under ultrasound guidance a needle is inserted through the abdominal wall into the amniotic sac and 15 to 25 ml. of amniotic fluid is aspirated. The amniotic fluid contains fetal cells sloughed from a number of sites. A cell culture is initiated from the obtained fluid sample, and within two weeks there is usually an actively growing cell colony that may be subjected to cytogenic (chromosomal) analysis, and later, when additional cells are available, to biochemical or DNA assay (Bloom, 1983). Alpha-fetoprotein measurements, enabling the identification of neural tube defect and other developmental abnormalities of the central nervous system, require less than one week (NICHD Antenatal Diagnosis Report, 1979). Results from Amnio are usually communicated to the patient within 3 1/2 weeks.

Amnio is generally accompanied by static or real-time ultrasound. Prior to Amnio, ultrasound may be used to establish the age of the fetus by measurement of the biparietal diameter, to detect multiple pregnancy, abnormal fetal growth, fetal death and uterine abnormalities that might complicate the procedure of

Amnio, and to localize the area of placental attachment. The localization of the placenta prior to Amnio reduces the frequency of multiple needle insertions, repeat procedures and complications during labour and delivery (CMRC, 1977). More recent studies suggest that real-time ultrasound is of particular value during transplacental Amnio. Crane and Kopta (1984) reported that among the 35 percent of their sample who required transplacental Amnio accompanied by real-time ultrasound, there were no differences in the incidence of spontaneous abortion, fetal loss, prematurity and low birth weight compared with the nontransplacental group. Henkel (1984) also concluded that real-time ultrasound reduces the risk of transplacental Amnio to a level equivalent to that of nontransplacental Amnio. Henkel suggested that the use of real-time ultrasound permits a more accurate mapping of the course of the puncture, a reduction in the depth of needle penetration into the amniotic sac, and the interruption of the procedure should the fetus come in proximity to the needle.

Much of the research on the procedure for Amnio has addressed such concerns as the optimal gestational age for the procedure, the effects of needle size, the amount of fluid removed, the relationship of blood-stained fluid and subsequent complications and the cumulative effect of multiple sampling of the amniotic fluid.

Gestational Age

The Canadian study (CMRC, 1977) reported that the detection of fetal defects was found to be most successful if Amnio was performed no earlier than 16 weeks PMGA. The overall accuracy of prenatal diagnosis by Amnio is high if performed between 16 and 18 weeks PMGA. American Data from the NICHD established an accuracy figure of 99.4 percent in 1976. A more recent study reported an accuracy rate of 99.5 percent (Benn, Hsu, Carlson & Tannenbaum, 1985), a marginal increase that is not significant.

Needle Size

The NICHD (1976) and CMRC (1977) reports also reported that when the maximum size of the needle used was limited (20 to 21 gauge in the CMRC report; 18 gauge in the NICHD report), there were fewer complications such as blood spotting and amniotic fluid leakage, fewer spontaneous abortions and fewer difficulties with labour and delivery, including a lower rate of Caesarian births. It was also found that the use of larger needles was associated with the need for multiple samples of the amniotic fluid (CMRC, 1977).

Amniotic Fluid

The amount of fluid volume withdrawn during Amnio has also come under scrutiny. In the Canadian study (CMRC, 1977), the likelihood of a successful diagnosis was greatest when at least 12 ml of fluid was taken. Neonatal complications increased when

fluid samples of 17 ml or more were withdrawn. To maximize successful diagnoses and minimize complications among the newborn, the study recommended the aspiration of 13 to 16 ml of fluid. However, Milunsky (1979) reported no significant relationship between higher volumes of fluid withdrawn and neonatal complications.

A second issue related to the amount of amniotic fluid withdrawn concerns the replacement of the fluid to original levels following the procedure. Generally, it is believed that the replacement time for the amniotic fluid is about three hours. This conclusion is based on early studies that examined the sites and rates of fluid exchange between fetal and maternal compartments (cf. Hutchinson, Hunter, Nelson & Plentl, 1955). However, the movement of amniotic fluid between these compartments appears to be unrelated to the actual volume of the fluid present in the amniotic sac. Early studies seem to have concluded that amniotic fluid is produced at the same rate that it ~~is~~ exchanged between the fetal and maternal compartments. Although this assumption has not been invalidated it cannot be supported experimentally at present (Seeds, 1980). If amniotic fluid is not replaced as readily as has been widely assumed, there exist serious implications for any procedure that reduces the volume of this fluid, especially when the procedure is repeated during the course of a single pregnancy.

Blood-Stained Fluid

The presence of blood in the amniotic fluid obtained is of serious concern for a number of reasons. With respect to the health of the fetus, blood in the amniotic fluid is associated with a higher risk of fetal loss and such life threatening events as fetal-maternal haemorrhage (Ron, Yaffe, & Beyth, 1982). Blood-stained samples also increase the risk of incorrect diagnoses. Fetal blood in the sample raises the alpha-fetoprotein level, increasing the risk of a false-positive diagnosis of neural tube defects (Cowchock & Jackson, 1976). Maternal cells in the sample may grow in the culture, resulting in genetic analysis of the mother rather than the fetus. This would obviously invalidate fetal sex determination, and could also result in more serious false-negative diagnoses, such as the failure to diagnose Down syndrome (NICHD, 1976).

Multiple Sampling of the Fluid

Repeated sampling of the amniotic fluid is associated with higher risks of complications during pregnancy, labour and delivery, and with fetal loss (CMRC, 1977). The causal chain here is not entirely clear, however. For example, consider a case in which an initial sample of amniotic fluid is blood-stained, requiring a second sample to be taken, followed by loss of the fetus. The cause of the loss is confounded: the loss cannot be attributed with any certainty to either the blood-staining, the repeat sampling, or both. The most plausible

assumption is that multiple taps are undesirable from the standpoint of statistical risk. Whatever the risk rate for a single tap, each additional sample would increase that risk accordingly.

Risks Associated with Amnio

The assessment of risks associated with any prenatal diagnostic procedure, including Amnio, must take into account the baseline rate of occurrence of prenancy complications, fetal loss, and neonatal complications and loss that exists for pregnancies not subjected to prenatal diagnosis. The risk associated with the procedure is the elevation (if any) in the rate of occurrence of these problems above the existing baseline rate.

Two of the major collaborative studies comparing the pregnancies of women who undergo Amnio with women who do not, have generally reported no significant differences in the incidence of complications and fetal loss. The NICHD Report (1976) found no significant differences in fetal loss rate, perinatal complications, birth weights, neonatal complications, or birth defects between offspring of the 1040 women who underwent Amnio and offspring of the 992 controls. Nor were there statistically significant differences in growth and development by one year. The study found no evidence of increased risk to the fetus that could be directly attributed to

Amnio. The NICHD Report (1979) concluded that Amnio results in an increased risk rate of less than .5% for all serious complications arising from the procedure. Similar figures have also been reported by other authors (cf. Golbus et al., 1979; Simpson et al., 1979) The Canadian study (CMRC, 1977) compared the pregnancy complication and loss rates of 1020 women who underwent Amnio with existing vital statistics. No significant differences were found. However, the absence of more directly comparable control subjects underscores a methodological problem common to many of these studies. The use of vital statistics as a baseline measure may obscure potential differences between tested women and the statistical controls, since the majority of women undergoing Amnio in the 1970s was observed to be of higher than average socio-economic status (SES). Women high in SES tend to have healthier pregnancies with lower than average complication and loss rates. Thus, if the complication and loss rates for these high SES women increased marginally as a result of Amnio, the increases might not be detected if the rates are compared to population norms.

In contrast to the North American findings, the British collaborative study (BMRC, 1978) that compared 2428 Amnio subjects with an equal number of matched controls reported increased complication and loss rates associated with Amnio. This study found a higher incidence of newborn abnormalities, especially respiratory difficulties and orthopaedic postural deformities. The fetal loss rate was 2.6% compared with 1.1% for

controls, and the neonatal death rate was 1.1% to 0.5% respectively. Moreover, there was an excess of premature rupture of the membranes and threatened abortion among Amnio subjects. It was concluded that Amnio results in an increased risk rate of 1.5%. This figure compares with an average rate of 0.5% reported in the North American studies. The reason for this difference, while the subject of some conjecture, is not clear.

The risks associated with Amnio appear to be relatively low and increasing numbers of women have been willing to take those risks to obtain the diagnostic information the procedure provides. The emotional costs and benefits that accompany prenatal diagnosis are not as well established. These will be examined in Chapter Three.

Summary

In this chapter an historical background of the use of Amnio was presented. Early uses concentrated on the detection of Rh isoimmunization and fetal sex determination, while current diagnostic activity focuses primarily on chromosomal disorders, neural tube defects, and inborn errors of metabolism.

The procedure for Amnio was examined, and technical concerns such as optimal gestational age, needle size, amount of fluid aspirated and time required for fluid replacement, blood-stained fluid and multiple sampling of the fluid were discussed. The risks associated with Amnio were reviewed and the risk of

complications and fetal loss following the procedure appears to be around 0.5%.

CHAPTER II

CHORIONIC VILLUS SAMPLING

Chorionic villus sampling (CVS) is the most recently developed obstetric technique for prenatal diagnosis. The first description of the procedure was reported in 1968 by Hahnemann and Mohr. In their initial series of eight attempted first-trimester chorionic biopsies, only one tissue sample was of proven chorionic origin. Diagnostic attempts with CVS were discontinued in Scandinavia in the early 1970s because of a high rate of post-procedure complications (Kullander and Sandahl, 1973). Chinese researchers from Tietung Hospital reported on 100 first trimester biopsies for fetal sex determination in 1975. The procedures were done "blind," without ultrasound or endoscopic guidance, yet only 6% of mothers experienced spontaneous abortions, and there were no reported maternal complications. Fetal sex was correctly diagnosed among 93% of the sample. The first reported genetic application of CVS was in the USSR (Kazy, Rozofsky & Bakharev, 1982), screening for such disorders as haemophilia and X-linked hydrocephaly.

The World Health Organization (WHO, 1984) initiated an International Registry for CVS in 1983, and by the end of 1984, 43 centres had reported over 3000 diagnostic cases (Modell, 1985). The success rate for obtaining chorionic material had risen to 97%, a notable improvement over the first series reported by Hahnemann and Mohr in 1968.

The conventional techniques for detection of chromosomal and metabolic disorders may also be applied to chorionic tissue (Rodeck & Morsman, 1983; Ward, Modell, Petrou, Karagozlu & Douratsos, 1983). Because the long period (up to 4 weeks) necessary for growth of the amniotic cell culture (from Amnio) is not required with chorionic tissue, results are available much faster. Direct preparations requiring 2 to 48 hours or short-term cultures requiring one to 7 days may be employed for diagnosis (Lilford, Maxwell, Coleman, Czepullowsiki & Heaten, 1983; Pitman, Exterman, Graff & Engel, 1984; Perry, Vekemans, Lippman, Hamilton & Fournier, 1985). However, banding [1] quality is not as good following direct preparations as that achieved from amniotic fluid cell-cultures, and diagnosis of structural aberrations may be difficult with the direct technique (Perry et al., 1985). More recent developments have shown that a short culture time improves banding quality, at least to the level observed from preparations following Amnio (B. McGillivray, personal communication, August, 1985).

Further developments with other techniques such as restriction fragment length polymorphism will permit the first-trimester diagnosis of other disorders such as Duchenne muscular dystrophy (Murray et al., 1982), and factor IX deficiency (Choo, Gould, Rees & Brownlee, 1982). Chromosome-specific DNA probes used for fetal sex-typing are

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[1]Banding refers to any of several techniques of staining chromosomes so that a characteristic pattern of transverse dark and light bands becomes visible, permitting identification of individual chromosome pairs

proving useful in the first-trimester screening of X-linked conditions such as haemophilia that cannot be diagnosed and that only affect males (Gosden, Mitchell, Gosden, Rodeck & Morsman, 1982; Rodeck & Morsman, 1983). The risk rate for a male offspring of a carrier of such a disorder is 50%, while the risk rate for a female offspring is zero. If the fetus is female, parents may be reassured; if the fetus is male, the option of early termination (first-trimester as opposed to second trimester) is generally preferable. Moreover, the Y-specific DNA probe for early sex determination is more reliable and faster than sex chromatin determination (Gosden et al., 1984).

Chromosomal Disorders

Because the risk of chromosomal disorders increases with maternal age, fetal chromosome analysis is the major diagnostic application of CVS. Following the procedure, direct preparation or short-term culture of villus tissue permits a rapid diagnosis of Down syndrome (Brambabi & Simoni, 1983) and other chromosomal disorders. Rodeck and Morsman (1983) have noted that in addition to speed, direct preparations avoid the problems of culture-induced anomalies and the growth of maternal cells.

Neural Tube Defects

The first-trimester detection of neural tube defects cannot be achieved at the present time. A woman who undergoes CVS must typically return for a determination of the AFP level in her blood and an ultrasound scan, usually around 15 to 16 weeks PMGA (CMRC, 1984). This is a minor inconvenience, and both the drawing of a blood sample from the mother and the ultrasound scan of the fetus involve little or no risk. Of greater concern has been the finding by Perry, et al., (1985) that 33% of women who underwent CVS experienced a subsequent elevation in maternal serum AFP level. It is possible that the half-life of serum AFP may be long enough to interfere with the reliable detection of neural tube defects during the second trimester, some 7 to 8 weeks after CVS, but practically, this has not been found to be the case. While most neural tube defects are detectable by ultrasound scanning alone, a persistently high level of AFP could complicate the diagnosis of these disorders and lead to a false positive or false negative diagnosis.

The reason for the AFP elevation is not clear. There appears to be no relationship to be number of catheter insertions (multiple sampling) or to the amount of villus material biopsied. There is some speculation that a large AFP increase might be associated with subsequent miscarriage.

Inborn Errors of Metabolism

The first trimester diagnosis of inborn errors of metabolism (IEMs) is determined by the absence of normal enzymes or the presence of abnormal enzymes in the villus tissue of affected fetuses (Patrick, 1983; Vamos & Liebaers, 1984). Kazy et al. (1982) first reported on the diagnosis of IEMs from CVS, and a more recent report described the first-trimester diagnosis of three cases of Lesch-Nyhan syndrome (Gibbs et al., 1984). Another recent finding associated cystic fibrosis with low amniotic gamma-glutamyltransferase activity, and the possibility that this relationship may also exist in the chorionic villus tissue has led to some speculation that the first-trimester diagnosis of cystic fibrosis may also be possible (Modell, 1985). More recent work has established the location of the CF gene at chromosome seven, and DNA methods are being developed for prenatal diagnosis.

The prospect of the first-trimester detection of chromosomal disorders and IEMs is an appealing one, and the latter half of the 1980s should witness an dramatic increase both in the number of studies involving CVS and in the number of women requesting the procedure. Rodeck & Morsman (1983) point out that advances in recombinant DNA technology such as the development of gene-specific probes and the restriction of fragment linkage will enable the prenatal detection of increasing numbers of disorders.

The Procedure for CVS

CVS is an outpatient procedure that is performed during the first trimester, usually from the eighth to the twelfth week PMGA. A commonly-employed method utilizes a flexible cannula that is inserted through the woman's cervix under ultrasound guidance. Ten to twenty mg of chorionic tissue is aspirated, either from the chorion frondosum, the site of the most extensive villus development, or from the extra-placental chorion before the continuing growth of the gestational sac reduces circulation to this tissue and causes it to atrophy at 12 to 14 weeks PMGA. The tissue sample can be evaluated from a direct preparation of dividing villus cells in 4 to 48 hours, or from short-term cell-culturing in less than a week. AFP measurement for neural tube defects must be evaluated later, around 15 to 17 weeks PMGA.

As with Amnio, ultrasound also can be utilized prior to CVS to establish the age of the fetus by measurement of the bi-parietal diameter, to detect multiple pregnancy, abnormal fetal growth, fetal death and uterine abnormalities that might complicate CVS, and to localize the area of placental attachment.

Research on the technique of CVS has examined such issues as optimal gestional age, procedures for tissue sampling and the amount of tissue withdrawn.

Gestational Age

A number of researchers have reported on the optimum time for performing CVS (Ward et al., 1983; Anderson, Trent, Boogert, Smith & Sheannan, 1985; Perry, et al., 1985). Perry et al., (1985) reported that sampling is least likely to be successful early or late in the first trimester. Visualization of the chorion frondosum and the fetal heart were difficult prior to eight weeks, while reaching a placenta located high in the uterus became increasingly difficult after 12 weeks PMGA. The latter problem may be resolved by the introduction of longer catheters. Ward et al. (1983) suggested an optimal time for sampling of 10 weeks PMGA, noting that organogenesis is only just complete by eight weeks and that earlier attempts at CVS increase the risk of teratogenesis. Sampling later than 12 to 13 weeks PMGA raises the concern that the diagnostic report may not be available until 14 weeks, after which time an abortion, if desired, must be done according to a mid-trimester procedure, increasing the risk of maternal complications. Anderson et al. (1985) reported the highest success rate for tissue sampling at 8 to 9 weeks PMGA.

Tissue Sampling Procedures

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A number of methods for villus sampling have been tried. The three most common are trans-cervical procedures: catheter aspiration, endoscopy and biopsy forceps, all of which are undertaken under ultrasound guidance (Anderson, et al, 1985).

Transabdominal puncture has also been utilized, particularly in Europe (Smit-Jensen & Hahnemann, 1984), but this technique does not appear to be a preferred method in North America. However, trans-abdominal puncture may offer the advantage of a reduced risk of infection following CVS.

In a series of trials involving 48 patients, Rodeck, Morsman, Gosden and Gosden (1983) compared six different sampling methods. Direct-vision endoscopy, which employs a rigid tube instead of a flexible catheter, accompanied by ultrasound guidance yielded a 100% success rate in obtaining tissue suitable for analysis. These authors concluded that this technique provided maximal precision and reliability with minimal disturbance to the pregnancy.

Despite the high success rate with endoscopy achieved by Rodeck et al., the method employed for CVS appears does not appear to be a major factor in the success of the procedure. A factor of equal if not greater importance appears to be the experience of the individual obtaining the sample. Other studies have reported sampling success rates approaching 100% using biopsy forceps (cf. Kazy et al., 1982) and catheter aspiration (Old et al., 1982; Perry et al., 1985) after initially experiencing lower rates of success. Experienced investigators may successfully obtain chorionic villus tissue in 97% (WHO, 1984) to 99% (CMRC, 1984) of cases attempted.

Amount of Tissue Withdrawn

The minimum amount of tissue required for analysis appears to be 10 mg (Perry et al., 1985). Failure to obtain this amount may require additional sampling, with the inherent disadvantages and increased risk that multiple sampling carries.

Risks Associated with CVS

The most serious risk following CVS is fetal loss through spontaneous abortion. The extent to which the risk of fetal loss following CVS exceeds the background spontaneous abortion rate for women in their first-trimester should provide a measure of the short-term obstetric risk following CVS. While the spontaneous abortion rate during the first trimester is known to be relatively high, exact figures are not available. Gustavi (1984) has reported a figure of about 10% of confirmed pregnancies as generally accepted, but the figure rises with maternal age to exceed 30% in woman over forty. Still another estimate places the spontaneous abortion rate at 20.6% by the twentieth week of PMGA for pregnancies that are diagnosed by the sixth week (CMRC, 1984).

Even more confusing are the reported rates for spontaeous abortion following CVS. Early figures ranged from 3% to 25%, while more recent reports from centres worldwide varied from 0% to 50%, with an average loss rate of 4.8%. The lower rate of spontaneous abortion following CVS (4.8%) compared to the

background rate of loss (10 to 20%) may be accounted for by the exclusion from CVS of women found at ultrasound examination to have blighted ovaries or fetal deaths. In perhaps 80% of pregnancies destined to spontaneously abort, ultrasound at 8 to 10 weeks PMGA reveals one of these conditions. It appears that once ultrasound reveals that a viable pregnancy is underway with a fetus compatable for dates, the subsequent loss rate may be only 1% to 2%, with the figure again rising with maternal age (Wilson, Kendrick, Wittman & McGillivray, 1984; Gilmore and McNay, 1985). Hence an average loss rate following CVS of 4.8 % might reflect a 2% background loss rate plus an added procedure-induced loss rate of 2.8%. It should be emphasized that these figures are tentative estimates at best. At present, the risk of fetal loss following CVS is generally believed to be around 5%, a figure that is a composite of the background loss rate added to the procedure-induced loss rate. Information that would permit a reliable separation of the two sources of risk is as yet unavailable.

It is worth recalling that the risk rate for spontaneous abortion as a result of Amnio has been estimated to be no more that 0.5% (NICHD, 1979). This figure reflects the procedure-induced loss rate only. The overall risk of fetal loss following Amnio may be around 2.0%, which includes a background loss rate after 16 weeks PMGA of 1.5% for women who have previously undergone ultrasound examination. The comparison of procedure-induced loss rates between CVS and Amnio is further

complicated by the observation from clinical trials that some women who are randomized into the Amnio group experience spontaneous fetal losses before undergoing Amnio, but after the time at which they might have had CVS. Had these women been randomized into the CVS group, the fetal losses would have been attributed to the procedure, thereby inflating the risk rate for CVS (B. McGillivray, personal communication, August, 1985). This observation underscores the fact that risk rates for CVS and Amnio are simply not comparable.

Additional risks associated with CVS have not been well established. The failure to obtain tissue on the first attempt, necessitating repeated insertions, needs to be examined further. In addition, leakage of amniotic fluid and maternal bleeding are complications that involve potentially serious consequences, but the rates of incidence and obstetric outcomes for these problems have not been well documented (Hogge, Hogge & Golbus, 1986). Some concern has been expressed that CVS occurs at a time of rapid growth of the fetus and placenta and of differentiation of vital organs and tissues, which could interfere with final placental size and function and ultimately with fetal development (England, 1983, cited in CMRC, 1984). The observation has also been made that fetuses subjected to CVS are exposed to an unusually large amount of ultrasound during early development (Chalmers, 1984; Modell, 1985). While there do not appear to be any known risks to the fetus associated with ultrasound scanning, the possibility should not be overlooked.

A Comparison of Amnio and CVS

The following comparison is derived from the proposal to the Medical Research Council of Canada (CMRC, 1984).

Procedure

For Amnio, a 21-22 gauge needle is inserted through the mother's abdomen into the amniotic sac under ultrasound guidance and about 15 ml of fluid is aspirated. The experience is much like a blood test.

A typical method for CVS involves the insertion of a small plastic catheter through the mother's vagina and cervix under ultrasound guidance for the aspiration of 10 to 20 mg of chorionic villus tissue from either the chorion frondosum or from the extra-placental chorion. The amniotic sac is not punctured. The experience is much like having an intrauterine device implanted.

Gestational Age

Amnio is generally conducted at about 15 to 16 weeks PMGA, while chorionic villus sampling is usually performed at about 8 to 12 weeks PMGA.

Test Results

Results from Amnio, including a determination regarding the presence of neural tube defects, require a minimum of two weeks and as long as four weeks before they become available. In most instances CVS results are available within one week and in some centres within 48 hours. Testing for neural tube defects cannot be done during CVS and the mother must return at 15 to 16 weeks PMGA for an ultrasound examination and a blood test specifically for maternal serum AFP.

Risk of Fetal Loss Following the Procedure

The risk of fetal loss directly related to Amnio does not appear to exceed 0.5%. Exact figures for loss directly related to CVS are not known, although estimates place the combined risk from both the background rate of loss and from CVS-induced loss at about 5 %.

Termination of Pregnancy

Elective abortion following the results from Amnio is carried out at 19 to 20 weeks PMGA. The procedure involves the intra-amniotic injection of prostoglandin following the withdrawal of a small amount of amniotic fluid. Contractions usually begin about 12 hours later, with delivery occurring within another 8 hours. The woman remains awake throughout, and barring complications, she is in hospital for 2 days.

Following results from CVS, elective abortion by suction curettage (D & C) is carried out at 10 to 14 weeks PMGA. A suction tube is inserted through the vagina and cervix and the pregnancy is removed. This procedure is performed with the woman under a general anaesthetic, but takes only 10 minutes. Barring complications, she may return home the same day.

One study reported a maternal complication rate following mid-trimester elective abortion (following Amnio) of 34% (Grimes, Hulka & McCutchen, 1980), while first-trimester elective abortion (following CVS) carries a complication rate of less than 2% (Wulff & Frieman, 1977).

The comparison of Amnio and CVS should also consider the emotional effects associated with the two procedures. Maternal emotionality will be considered in Chapter Three.

Summary

This chapter reviewed the development of first-trimester CVS, from its early use for fetal sex-determination to its present use in the diagnosis of chromosomal disorders and inborn errors of metabolism. Unlike Amnio, CVS cannot be used to detect neural tube defects.

The procedure for CVS was examined, and technical concerns such as gestional age, tissue sampling methods and amount of tissue withdrawn were discussed. The risks associated with CVS

were reviewed and the risks of fetal loss following the procedure appear to be in the range of 3% to 5%, including the background rate for spontaneous abortion. The chapter concluded with a comparison between CVS and Amnio.

CHAPTER III

MATERNAL EMOTIONALITY AND OBSTETRIC OUTCOME

It is widely believed that emotional factors have a bearing on the course and outcome of pregnancy and on subsequent infant and child development. The precise physiological mechanisms by which maternal emotionality adversely affects the intrauterine environment are not known, but there is mounting evidence that connects negative maternal emotionality during pregnancy to obstetric complications (McDonald, 1968; Carlsen & LaBarba, 1979; Norbeck & Tilden, 1983). The majority of studies that have examined "maternal emotionality" have been concerned with the anxiety experienced by pregnant women. The two terms are frequently used interchangeably, although a few researchers have been more precise in defining their variables (cf. Gorsuch & Key, 1974).

The relationship between maternal emotionality and obstetric complications has also been examined with regard to other contributory factors to emotionality during pregnancy, such as life stress (Nuckolls, Cassel, & Caplan, 1972; Gorsuch & Key, 1974; Chalmers, 1982; Norbeck & Tilden, 1983), psycho-social support (Nuckolls et al., 1972; Williams, Williams, Griswold, & Holmes, 1975; Chalmers, 1982), and socio-economic status (Obayuwana, Carter, & Barnett, 1984). This chapter reviews studies that have examined the link between sources of maternal emotionality and obstetric complications.

Maternal Anxiety and Obstetric Complications

Early attempts to establish a link between emotionality and obstetric complications were reviewed by McDonald (1968), who compared studies that examined either a single complication or studies that looked at a blend of complications with problem-free pregnancies. While he noted that many of the studies were methodologically flawed, McDonald did conclude from the better-designed research that consistent differences in levels of self-reported anxiety existed between women who experienced complications and women with problem-free pregnancies.

A later review by Carlsen and LaBarba (1979) also examined the relationship between maternal emotionality and obstetric complications, again comparing studies that examined a single complication and studies that looked at a blend of complications with problem-free pregnancies. Among the better-designed research, these authors also found differences in emotionality between mothers with obstetric complications and those with problem-free pregnancies. An association was reported between maternal anxiety and the occurrence of the single complications of habitual abortion, hyperemesis gravidarum (severe vomiting), toxemia and abnormal infant development following birth. Less clear was the relationship between maternal anxiety and the single complications of stillbirth, labour and delivery problems, mental and physical handicaps and maternal infertility. These findings are similar to those of McDonald

(1968), who implicated maternal anxiety with habitual abortion, hyperemesis gravidarum, toxemia and prematurity, but not with pseudocyesis (phantom pregnancy) and labour difficulties. Both reviews reported a strong link between maternal anxiety and multiple complications, leading Carlson and LaBarba to conclude that maternal anxiety may predispose the expectant mother to various pregnancy and birth complications.

Not all researchers would agree with these conclusions, however. Farber, Vaughn and England (1983) assessed pregnant women of low socio-economic status (SES) for anxiety during the third trimester. At birth and at three and six months postpartum, infants (and mothers) were again assessed on a variety of measures. Their results showed no relationship between third-trimester anxiety and the incidence of pregnancy and birth complications or developmental sequellae. Norbeck and Tilden (1983) examined the relationship between a number of variables, including emotional disequilibrium (a composite measure of anxiety, depression and self-esteem), and obstetric complications. Obstetric outcome was assessed in each of three categories: 1) gestation complications, 2) labour, delivery and postpartum complications, and 3) infant-condition complications. High scores for emotional disequilibrium were associated only with infant-condition complications, contrary to the general belief that emotionality during pregnancy is associated with a wide range of complications. However, the inclusion of a more enduring personality characteristic (self-esteem) with the more

transitory state variables (anxiety and depression) in the measure of emotional disequilibrium makes it difficult to determine the extent to which anxiety induced by the pregnancy alone might have been associated with obstetric complications.

These studies demonstrate that while the link between maternal emotionality and obstetric complications is generally acknowledged, it is not universally supported. Many of the studies in this area have been methodologically flawed in some respect, casting some doubt on the validity of their conclusions. McDonald (1968), Carlsen & LaBarba (1979) and Norbeck and Tilden (1984), and others have enumerated a number of such shortcomings:

1. studies were not controlled for medical history or medical risk factors. Nearly all studies surveyed by Mcdonald and Carlsen and Labarba did not distinguish risk of complications due to medical risk factors such as high blood pressure from the prediction of complications from maternal anxiety. An observed relationship between maternal anxiety and obstetric complications in such a study could be spurious;
2. control groups matched for such factors as age, parity, stage of pregnancy at which assessments are taken, marital status, SES, life stress and social support were seldom included. Many studies were conducted at clinics which served primarily low income mothers, many of whom were single parents. Such women might be likely to have very

different experiences during pregnancy than middle or high income women;

3. small sample sizes were often a problem. Because obstetric complications are statistically infrequent, large sample sizes are required to demonstrate a statistically significant link between maternal emotionality and obstetric complications. Inappropriate selection procedures were also a problem in these studies;
4. diagnostic criteria were inconsistent. Measures of emotionality varied in time of administration and type of assessment, relying on patient self-report, behavioural samples, or clinical judgment. Measures of obstetric complications were not matched for breadth or severity;
5. retrospective designs were frequently employed. In many studies, maternal emotionality was assessed <u>after</u> a complicated delivery had occurred. It is unlikely that a woman who has undergone labour and delivery problems can provide an objective account of her feelings during her pregnancy. Causal connections are difficult, if not impossible to establish with such a design.

Finally, it should be recalled that even when well-designed studies reveal a link between maternal emotionality and obstetric complications, it is difficult to determine whether the association between the two is causal, or instead due to an unseen moderator variable, such as a personality characteristic, that might be responsible for both (Chalmers, 1983).

Most of the later studies that investigated maternal emotionality utilized more reliable measures, assessing the presence of maternal anxiety with psychometrically sound self-report instruments. However, few of these reports attempted to distinguish among the contributing elements of maternal anxiety and the conditions under which these elements might predict obstetric complications. The sources of emotional distress related to anxiety were apparently regarded by many as being indistinguishable. Yet maternal "anxiety" arises from at least three major sources. The first of these is the pregnancy itself, including changes directly attributable to the pregnancy. These would include somatic changes such as nausea and vomiting, increased medical attention and psychological distress such as feelings of inadequacy regarding the birth or motherhood. Many women appear to find these changes associated with the pregnancy itself to be especially anxiety-arousing. One study reported that 50% of the normal obstetric population tested complained of insomnia, emotional lability, anxiety, increased worry and depression (Jarrah-Zeddah, Kane, Van-de Castel, Lachenbruch & Ewing, 1969).

The presence of anxiety as a more stable, enduring characteristic of the mother is a second potential source of anxiety during pregnancy. Pregnant women who were generally anxious individuals prior to becoming pregnant and who tended to react to life-changes in this characteristic fashion would of

course manifest this "trait" anxiety during pregnancy. It is possible that trait anxiety is more predictive of obstetric complications than other sources of anxiety.

The third source of maternal anxiety involves life stress, such as family problems, occupational and economic problems and major life changes other than the pregnancy. While these life-stressors may not be entirely independent of pregnancy, the potential for these problems to become manifest would have been present in the individual or the family prior to the pregnancy. Indeed, life stress during the year prior to pregnancy has been shown to be related to obstetric complications (Norbeck & Tilden, 1983). The pregnancy may then precipitate or exacerbate such difficulties. The presence of these life stresses may in and of themselves predict obstetric complications independent of other sources of maternal emotionality.

The independent contributions of these three sources of maternal emotionality were investigated by Gorsuch and Key (1972). Using the State-Trait Anxiety Inventory (Spielberger, Gorsuch & Leshene, 1970) and the Schedule of Recent Events (Holmes & Rahe, 1967), they assessed two types of anxiety, state and trait, and the stress of life change among 118 pregnant women during each lunar month of pregnancy. The results showed that state anxiety prior to the fifth lunar month predicted obstetric complications. Anxiety was also found to be higher among these women around the first and third trimesters of pregnancy, declining during a period corresponding to the second

trimester. Indirect support for this finding was later provided by Lips (1982), who factor-analysed responses by subjects in different categories to the Symptom Checklist. She extracted an independent factor for negative emotional state that contained high loadings for such feelings as anxiety, depression, irritability and upset. The majority of pregnant subjects (98%) were assessed during the third to fifth month of pregnancy, and these women did not differ in negative emotionality from a control group[1] of non-pregnant women. This period of low negative emotionality corresponds with the lower levels of anxiety around the second trimester reported by Gorsuch and Key.

Gorsuch and Key found no association between trait anxiety and obstetric complications, suggesting that a woman's early emotional reactions to her pregnancy are more important than more stable personality characteristics. Life change was predictive of complications only <u>after</u> the third month of pregnancy. Gorsuch and Key concluded that anxiety and life change are independent contributors to pregnancy complications, and that the stress of life change later in pregnancy can lead to complications regardless of whether or not the life event evokes measureable anxiety in the expectant mother.

The nature of the relationship between the stress of life change and obstetric complications was challenged by a later study by Jones (1978), who found an increase in the

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[1]It is not clear whether the control sample was matched on demographic, medical or psychological variables.

complications was associated with an decrease in life stress. Earlier, Nuckolls et al. (1972) had proposed that the relationship between life stress and obstetric complications may be mediated by a woman's ability to utilize appropriate defenses, by her adaptability, and by her level of psychosocial support. It appears that the association between life stress and obstetric outcome is more complex than had been earlier supposed. The level of psychosocial support appears to interact with the presence of life stress immediately prior to or during pregnancy. A number of subsequent studies (cf. Williams et al., 1975; Chalmers, 1982; Norbeck & Tilden, 1983) have shown that pregnancy complications may be associated with life stress only in the absence of tangible, established psychosocial support systems.

Gorsuch and Key's findings that anxiety is linked to obstetric complications only prior to the fifth lunar month of pregnancy underscores the importance of assessing maternal emotionality on more than one occasion during pregnancy, preferably on three or four occasions. Had these authors measured maternal anxiety only during the final four months of pregnancy, no relationship would have been evident. Other authors (cf. Lubin, Gardiner & Roth, 1975) have also found high levels of maternal anxiety at certain times during the pregnancy and not during others. Contrary to the findings of Gorsuch and Key, Crandon (1978a, 1978b) found high levels of maternal anxiety in the third trimester that were associated with

obstetric complications. However, Crandon assessed anxiety at only a single measurement point, and because no earlier assessments were made, it is not possible to determine the direction of causality. It may be that women in his study became more anxious during the third trimester as a result of a legitimate concern that something was amiss.

Maternal Depression and Obstetric Complications

While the link between maternal anxiety and obstetric complications seems well-established, only a few studies have looked for a connection between prenatal maternal depression and obstetric complications. Pilowsky and Sharp (1971) implicated maternal depression with toxemia, and Harper and Williams (1974) reported that infants who later develop childhood autism were more likely than non-autistic controls to have had mothers who were depressed during their pregnancies. Zajicek and Wolkind (1978) found that depressive symptoms (usually accompanied by anxiety) were associated with poor post-partum adjustment and emotional problems among women in her study, but infant status was not assessed. In contrast to these findings are studies by Dalton (1971) and Meares, Grimwade and Wood (1975) that found that while maternal anxiety was associated with post-partum depression, depression during pregnancy was not predictive of post-partum depression. Finally, Lips (1982) reported no difference in scores on the Beck Depression Inventory between pregnant women assessed during the second trimester and

non-pregnant controls. As with many studies of maternal emotionality, most of these studies are methodologically flawed in some respect, and on the basis of the limited evidence available, no conclusions regarding a connection between maternal depression and obstetric complications may be drawn.

Emotional Distress Associated with Prenatal Diagnosis

Maternal anxiety has been implicated in a number of obstetric complications, while the effects of depression and life change during pregnancy are uncertain. It was suggested earlier that maternal anxiety may be a composite of a number of factors affecting the expectant mother. It appears likely that prenatal diagnosis may be one of these factors, contributing to the background level of anxiety experienced during pregnancy. There have been many anecdotal reports that women find Amnio to be an anxiety-arousing procedure, and the limited number of studies that have looked at the emotional aspects of Amnio have confirmed these reports (cf. Fava et al., 1983; Black & Furlong, 1984; Brewster, 1984; DiGusto et al., 1984). It appears that anxiety is greatest during a period of as yet unspecified length just prior to Amnio. Fava et al. (1983) reported that levels of anxiety, depression and hostility among 44 pregnant women measured during the 8th to 12th week of pregnancy dropped significantly when subjects were assessed during the 16th to 17th week of pregnancy, immediately after Amnio. There was another significant drop in anxiety and depression during the

19th to 20th weeks, when the results were known. If the original anxiety, depression and hostility are accepted as anticipatory to prenatal diagnosis when measured at 8 to 12 weeks, and if it is further assumed that there was no gradual decline in these emotions during the period between this first measurement and the second measurement at 16 to 17 weeks and again during the period leading up to the third measurement at 22 weeks (i. e., that the drop in these emotions was abrupt following Amnio and again following the results), this means that high levels of anxiety, depression and hostility persisted for up to 9 weeks, and that anxiety and depression continued at a lower level for 3 additional weeks. In view of the research on anxiety and its effect on obstetric outcome, this is a potentially disturbing conclusion. These women remained anxious through approximately half the second trimester, in contrast to the pregnant women not subjected to prenatal testing assessed by Lubin et al. (1975), whose anxiety declined to relatively low levels during the second trimester, followed by an increase during the third trimester, presumably in anticipation of the delivery. If the women in the study by Fava et al. also experienced a return to higher levels of anxiety during the third trimester, their pregnancies were indeed a very emotional time.

It remains a question whether the anxiety aroused by Amnio is predictive of obstetric complications, as the rate of loss following the procedure (0.5%) remains quite low. Because the women who have undergone Amnio to date have been of

higher-than-average SES, they may have had initially lower levels of anxiety, been in better health overall, and may also have possessed more adequate coping styles than women of lower SES (Grossman, Eichler, & Winickoff, 1980). As more women of lower SES begin seeking prenatal diagnoses, the anxiety associated with the procedure could become a matter of greater concern. Women of low SES may have an initially higher background anxiety level, and they may be more likely to have coping abilities that are inadequate.

With respect to the emotionality associated with the prenatal procedure and with the waiting period before the results, it appears that CVS, conducted between 8 and 12 weeks PMGA, with results available within a week, would be preferable to Amnio. The reduction in emotionality following the procedure and the results should occur up to 8 weeks and 10 weeks earlier, respectively.

A few studies have attempted to reduce the anxiety associated with prenatal testing either through therapy and counselling (cf. Norton, 1980) or through education (cf. DiGusto et al., 1984), with little reported success. The principal element in the reduction of emotionality associated with prenatal testing appears to be the reassurance derived from a successful procedure and normal results (Fearn, Hibbard, & Robinson, 1982), although Di Gusto et al. found that knowledge of the procedure was associated with lower levels of anxiety concerning fetal loss during the procedure itself.

It was mentioned earlier that women scheduled to undergo Amnio experience anxiety, depression and hostility that is reduced following the procedure and again after receiving the results. A study involving women undergoing fetoscopy found similar results, although the levels of pre-procedure anxiety, depression, hostility and somatic symptomatology were even more pronounced than among women waiting for Amnio (Fava, Michelacci, Trombini, Bovicelli & Orlandi, 1984). There is no comparable information available on the emotional reactions of women scheduled for CVS, but there is speculation in both directions. Emotionality may be less, because there is no needle puncture involved (in most North American centres), but because CVS is trans-cervical, requiring women to be in the lithotomy position, and because the risk rate is higher than for Amnio, emotionality may be greater among women scheduled for CVS.

Prenatal Diagnosis and Attachment to the Fetus

Prenatal maternal attachment[2] is a complex phenomenon involving the interplay of biological predispositions and situational factors (Klaus & Kennel, 1976). A comprehensive research base attesting to the importance of these feelings, which seem to facilitate involvement with and commitment to the

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[2]The term, "prenatal attachment" is used in this section to describe feelings of awareness and closeness to the fetus by the mother. It is acknowledged that this usage may describe a qualitatively different phenomenon than the more commonly-observed postnatal attachment response, which can be directly observed and which appears to be more reciprocal in nature (Ainsworth, 1969).

pregnancy, and which may be associated with later postnatal attachment, does not exist.

Bibring (1959) has described the stages of prenatal attachment through which the pregnant woman passes. The first trimester is marked by the growing awareness and acceptance by the mother of her fetus as a viable entity. During this period, the mother's attention is focused on the somatic and physiological changes she is experiencing. These experiences tend to be unpleasant and the mother often views herself as having a medical condition. The convergence of these unpleasant feelings with the awareness of being pregnant often results in a first trimester of considerable emotional lability, during which the mother tries to reconcile the discomfort she is experiencing with her attempts to accept the pregnancy as a real and meaningful development in her life. It has been suggested that the emotional upheaval early in pregnancy may play an important energizing role in the reorganization of the woman's behaviour patterns and in the martialling of her resources to cope with the major change in her lifestyle that lies ahead (Brazelton, 1973). This adjustment process may well facilitate acceptance of the pregnancy, and once this is complete, the woman is emotionally prepared for the next phase in the attachment process.

Quickening is the process that heralds the second trimester, when the mother comes to perceive the fetus as apart from herself. The somatic symptoms of the first trimester have either

subsided or become manageable, and the sensory cues provided by the increasingly active fetus signal the growth of another human being and bring home the emotional reality of a separate life. This process continues with fetal development during the second trimester and the mother becomes increasingly attached to her child. By the end of the second trimester, even unplanned pregnancies become more acceptable. The mother may begin to fantasize about the baby, and begin outwardly preparing for the birth.

Because women experience an increasing fetal presence and a growing attachment to the fetus during the second trimester, elective abortion midway through this period has more profound psychological ramifications than abortion during the first trimester, when a physical sense of fetal awareness may not yet be present. Since results from Amnio are generally not available until midway through the second trimester, some women awaiting the outcome of this procedure have reported trying to suppress feelings of attachment to their fetuses, fearing the emotional distress of abortion should prenatal test results prove to be positive (cf. Silvestre & Fresco, 1980; Brewster, 1984). Still others may do this unconsciously. The effect of attachment suppression on the pregnancy or its outcome has not been established, but at the very least it appears to rob some mothers of the joy of the growing attachment to their fetuses early in the second-trimester, and it may have negative implications for the woman's social support system, to the

extent that inviduals who comprise this system may be denied involvement with the pregnancy. At worst there may be a detrimental effect on later adaptation and attachment. There is some evidence to suggest that the development of prenatal attachment may be related to the quality of postnatal attachment between mother and infant. Shereshefsky, Liebenberg and Lockman (1974) investigated the experiences of pregnant women and found that early adaptation to pregnancy was predictive of early maternal adaptation. In particular, the ability of these women to visualize themselves as nurturing mothers was a key determinant. The suppression of attachment during pregnancy would seem likely to interfere with the ability to visualize oneself as a nurturing mother, and thus result in poorer postnatal adaptation. Cohen (1966) reported that stress during pregnancy which, among other things, potentially threatens the health and safety of either the mother or fetus may delay preparation for motherhood, including the development of maternal attachment. If it can be assumed that women awaiting Amnio regard that procedure as potentially threatening, the implication for maternal attachment among these women is evident.

Unlike Amnio, CVS is a first-trimester procedure, the outcome of which is generally known between 9-13 weeks PMGA. This earlier outcome in turn permits an earlier decision regarding elective abortion, if necessary, or earlier reassurance to the mother (and father) that no abnormalities

were found. Because the outcome of CVS usually precedes the quickening process of maternal attachment that occurs around the beginning of the second trimester, CVS may not interfere with the development of maternal attachment. If CVS does adversely affect attachment, its earlier occurrence would likely render it less disruptive to attachment than would Amnio.

The possibility also exists that CVS may facilitate prenatal attachment. Because a woman scheduled for this procedure must first undergo ultrasound, during which she is able to view the ultrasonic image of the fetus, she may experience enhanced awareness and acceptance of her pregnancy which could expedite the attachment process (Reading, Cox, Sledmere & Campbell, 1983). This early acceleration of attachment might be temporarily curtailed by the mother's perception of CVS or its outcome as potentially threatening to the fetus, but CVS and its results are usually complete within two weeks following the ultrasound, thereafter permitting the woman to experience the pleasure of her enhanced attachment to an apparently healthy fetus.

By contrast, a woman who is scheduled for Amnio may not undergo ultrasound until the second trimester of pregnancy. Even if she does have ultrasound during the first trimester, she must still wait until midway through the second trimester before learning the outcome of her Amnio. Her attachment to the fetus is likely to be suppressed during the waiting period by her perception of Amnio as potentially threatening to the fetus. It

is ironic that the same technological advances that have produced ultrasound and Amnio may in the first instance accelerate maternal attachment while evoking a temporary suppression of attachment in the second.

Prenatal Diagnosis and Elective Abortion

An additional source of maternal emotionality arising from prenatal diagnosis is the possibility of abnormal results followed by a decision regarding elective abortion. Callahan (1970) and Kessler (1979) have observed that while the decision to abort a pregnancy is usually made for sound medical and personal reasons, it is often accompanied by an awareness that abortion is in violation of personal moral and ethical standards. Given a choice between bearing a seriously disordered child or aborting the fetus, most women will choose to terminate, but the decision may have both immediate and lasting consequences. Senay (1974) has suggested that women often view abortion as a type of murder, and that memories of the procedure linger for years afterwards. Experiences of shame, guilt and grief are common, as is a tendency toward self-denigration. These feelings can persist even in the face of an intellectual awareness that, under the circumstances, termination was the most logical and sensible decision. Kuman and Robson (1978) found that feelings of anxiety and depression early in a subsequent pregnancy were common among women who had aborted their previous pregnancies, and were more pronounced than

similar feelings among pregnant women who had not undergone an abortion.

Other studies have questioned the intensity and duration of negative post-abortion symptoms. Shusterman (1976) argued that the consequences of abortion may in fact be relatively minor. Bradley (1984) found no differences in anxiety and maternal functioning between pregnant women who aborted their previous pregnancies and pregnant women who had never undergone an abortion, and Greenglass (1976) had earlier reported that abortion can improve the mental health of women carrying unwanted pregnancies.

Post-abortion responses following termination of a pregnancy involving a genetically-disordered fetus appear to be generally negative and enduring. A study of couples who elected to terminate following second trimester prenatal detection of a genetically-disordered or potentially-affected male fetus found that the majority experienced serious psychological disturbances afterward (Blumberg, Golbus & Hanson, 1976). Ninety-two percent of the women and 82% of the men showed depressive symptoms of greater severity than those usually associated with stillbirth. Lowered self-esteem and guilt were common for both men and women, and many couples experienced marital difficulties. Women also experienced intrusive thoughts and feelings about the abortion, childbirth and childrearing. These feelings persisted at a six-month followup.

A similar study by Bonnai, Charles and Harris (1981) found that a high proportion of women undergoing elective termination of a wanted pregnancy following Amnio experienced intense emotional difficulties. In their study, abortions were carried out as late as 27 weeks gestation. Not surprisingly, they found that women expressed a strong desire to have their pregnancies aborted as soon as possible after hearing the (positive) results.

The studies by Blumberg et al. and by Bonnai et al. involved elective abortions following second-trimester prenatal diagnosis. It is likely that second-trimester abortion is more psychologically disturbing than first trimester abortion for two reasons. The first of these has to do with the medical procedures for abortion. These were described earlier, and first-trimester abortion is by far the simpler, safer and less painful of the two. The second reason involves the mother's growing attachment to her fetus, which was described in the previous section.

Conclusion

There is considerable evidence to suggest that maternal anxiety is associated with obstetric complications. There is also growing evidence to suggest that prenatal diagnosis is a potential source of negative emotionality which may interfere with the normal process of maternal attachment among pregnant

women. In view of the connection between emotionality and problem pregnancies, the prenatal diagnostic procedure that evokes the lowest level of negative emotionality over the shortest period would be the preferred technique, given roughly equivalent procedural risks. Amnio is performed during the second trimester, and results are often not available until the 19-20 weeks PMGA, while CVS is performed during the first trimester and results can be available as early as the 9 weeks PMGA. Because it occurs earlier in pregnancy, CVS appears to have the greater potential for reducing emotionality associated with prenatal diagnosis. The present research compares the emotional impact of these two procedures on pregnant women.

PART B

THE PRESENT STUDY

The present study compared the emotional responses, maternal attachment, concerns about abortion and procedure-related discomfort of pregnant women undergoing one of two types of prenatal diagnosis: chorionic villus sampling or amniocentesis. These two procedures differ in significant ways and the emotional responses of women undergoing these procedures should differ as well.

It was hypothesized that at the time of entry into the study, women randomized into the CVS and Amnio groups would manifest no significant differences on measures of anxiety, depression, hostility, maternal attachment-self, maternal attachment-others and concern about abortion. Differences in these measures were expected to emerge as women in the CVS group underwent that procedure and received their results during the first trimester while women in the Amnio group were still a few weeks away from undergoing that procedure. Convergence between the two groups on these measures was anticipated at 22 weeks PMGA, when all testing would be complete and the results known.

Women from both groups were also compared for discomfort experienced while undergoing their respective prenatal diagnostic procedures. It was not at all clear at the outset of the study which procedure might arouse the most discomfort. Finally, background information was collected on age, number of children, fetal loss, annual family income and living arrangement of the mother and father, but for the present thesis research, subject numbers were not expected to be sufficient to

utilize this data other than to determine whether significant differences existed for any of these variables among the CVS, Amnio and Non-Participation groups.

CHAPTER IV

METHOD

Overview

The present study was affiliated with a Canadian multicentre medical research trial that is a clinical and economic evaluation of prenatal diagnosis comparing CVS and Amnio (CMRC, 1984). The setting was the Grace Hospital, a large urban hospital in Vancouver, British Columbia, Canada, that specializes in prenatal and perinatal care. The subjects were pregnant women who were referred by their family doctors or obstetricians for prenatal diagnosis, and who expressed an interest in participating in the medical trial. Residents of British Columbia participate in a prepaid health-care plan, and women in the study were covered for their medical and hospital expenses related to pregnancy and birth. Demographic information revealed that nearly all of these women lived within 60 miles of Vancouver. As a group, they were in their mid- to late thirties, and were from high-income families; only one woman was not living with the father of her fetus at the time of the study. On the whole, these were involved and enlightened women, concerned about the risks of prenatal diagnosis but committed to maximizing the likehood of a normal pregnancy outcome. Because of their ages, high SES and supportive living arrangements, these women differed from women surveyed in many previous studies of pregnancy which were often conducted at clinics that

served low income mothers, many of whom were, or were destined to become, single parents. However, the present sample of women is not inconsistent with those who participated in earlier studies of the safety and accuracy of Amnio, most of whom were older, high SES women similar to those in the present study.

Women who agreed to take part in the study after an intake counselling and information session were randomized into either the CVS or Amnio group for subsequent prenatal diagnosis. Those who elected not to take part were initially assessed on a variety of measures so that a baseline comparison of emotionality could be made between those who did not participate and those who did. Inclusion and exclusion criteria for subjects were dictated by both the requirements for the medical research and those of the present study, and were as follows:

Inclusion Criteria

1. Pregnant and referred in time to undergo CVS prior to 12 weeks gestation;
2. Appropriate for prenatal diagnosis according to the Canadian Recommendations for Prenatal Diagnosis of Genetic Disorders where the diagnosis can be obtained by both CVS and Amnio;
3. Ability to attend 3 appointments at hospital, for an information and screening session, for ultrasound scanning, and for the prenatal test itself;
4. Williness to complete questionnaires on four separate occasions, two of which coincide with hospital appointments;
5. Sufficient fluency in verbal and written English to provide

informed consent and to complete the questionnaires.

Exclusion Criteria

1. Fetus at risk for neural tube defects;
2. Dead or disorganized fetus, blighted ovum or multiple pregnancy.

Subjects

Seventy-four pregnant women for whom prenatal diagnosis was appropriate were enrolled between 8 and 11 3/7 weeks PMGA. Each subject participated in an intake counselling session describing the procedures and risks of CVS and Amnio. Following the intake sessions, 61 women agreed to participate in the clinical trial, 29 of whom were randomized into the CVS group and 32 of whom were randomized into the Amnio group. Dates for their prenatal tests were set at this time. Thirteen women declined further participation following intake.

Description of Measures

The selection of instruments was dictated in part by the limited time available to respondents while at hospital. By necessity a set of questionnaires was chosen that would require no more than fifteen minutes to complete on any single occasion. A specimen set is included in Appendix A.

1. Background Information Form. This form asks for general

background data, including information regarding age, parity, fetal loss (a composite measure of miscarriages, stillbirths and abortions), annual family income and living arrangement of the mother and father. These factors have all been proposed as potential mediating factors in maternal anxiety and obstetric outcome.

2. Multiple Affect Adjective Checklist (MAACL). The MAACL-General is a 132-adjective checklist that measures anxiety, hostility and depression, and has been validated using a variety of settings and subjects (Zuckerman & Lubin, 1965). The MAACL is psychometrically sound and correlates well with other measures of these variables, yet can be completed by most subjects in only five minutes. The MAACL is commonly used and widely available, and is not included in Appendix A.

3. Maternal Attachment to Fetus Form (MAFF). The MAFF was devised for the present investigation following a brief pilot study during which several possible measures of prenatal maternal attachment were tested. It is a Likert-type scale that asks each subject to report how close she feels to her baby (fetus) and how close she thinks other women in her situation feel to their babies at that moment. This scale is intended to assess 1) the developing attachment between mother and fetus (maternal attachment-self), and 2) the attribution by subject women of maternal attachment among women in a similar situation (maternal attachment-others).

4. Concern about Abortion Questionnaire (CAQ). The CAQ is another form devised for the present investigation based on similar instruments that have been employed at the Grace Hospital to assess the psychological effects of prenatal ultrasound scanning. The CAQ asks the subject to imagine a situation in which she has learned that her fetus has a genetic disorder that requires her to consider elective abortion. The scale consists of nine positive and nine negative adjectives, and the respondent is asked to rate her reponse to each item in reference to the imaginal situation described (1 = not at all, to 4 = very much). At least one related scale has revealed alpha coefficients of internal consistency of .80 or higher. The CAQ is designed to compare the emotional reactions to abortion of women undergoing CVS versus those of women undergoing Amnio.

5. Procedure Discomfort Scale (PDS). The PDS was devised for the present investigation following a brief pilot study. It is a Likert-type scale that asks the respondent to rate the discomfort she experienced during prenatal diagnosis. This scale is intended simply to compare the relative discomfort experienced by women undergoing each of the two procedures.

6. Followup Questionnaire. This is an open-ended questionnaire that is designed to elicit feedback after each subject concludes her part in the study. These results are intended to provide information for further study, and will not enter into the current analysis.

Procedure

Subjects were asked to complete four sets of questionnaires, each requiring from 10 to 15 minutes. Three of the sets were administered at equivalent measurement points for both groups based on the subjects' PMGAs. The administration procedure is shown in Table 1. The first set was administered at hospital immediately prior to the intake counselling session, which occurred at 8 to 11 weeks PMGA. After signing a written consent that informed them of their rights and of the need to gather information regarding patient response to prenatal diagnosis, subjects completed the Background Information Form, the MAACL, which provided measures of anxiety, depression and hostility, the MAFF, which assessed how close the mother felt to her fetus and how close the mother thought other expectant mothers felt in a similar situation, and the CAQ, which measured feelings about a possible elective abortion. Subjects who declined participation in the clinical trial completed no further questionnaires.

All women randomized into the CVS and Amnio groups completed a subsequent set of questionnaires that was administered at different times for each group. CVS women completed these forms immediately following their procedures, at 9-12 weeks PMGA, and Amnio women completed these forms immediately following their procedures, at 16-17 weeks PMGA. This administration, which was referred to as "time of procedure" (Time pr.), was the second

Table 1

Administration of Measures

	8-11 weeks	9-12 weeks	13-14 weeks	16-17 weeks	20-22 weeks
	Time 1	Time pr.	Time 2		Time 3
CVS	SET 1: Back. info MAACL MAFF CAQ	SET PD: MAACL MAFF CAQ PDS	SET 2: MAACL MAFF	No Measures	SET 3: MAACL MAFF Followup

	Time 1		Time 2	Time pr.	Time 3
AMNIO	SET 1: Back. info. MAACL MAFF CAQ	No Measures	SET 2: MAACL MAFF	SET PD: MAACL MAFF CAQ PDS	SET 3: MAACL MAFF Followup

	Time 1
NON-PARTICIPATION	SET 1: Back. info MAACL MAFF CAQ

administration for CVS women and the third administration for Amnio women (see Table 1). This set of questionnaires contained the MAACL, the MAFF, the CAQ and the PDS.

Another set was administered by mail (outside hospital), at Time 2, approximately 13-14 weeks gestation for women in both groups. CVS women had received their results,[1] while Amnio women were still awaiting their procedures. This set of questionnaires contained the MAACL and the MAFF only.

The final set of questionnaires was also administered by mail (outside hospital), at Time 3, approximately 22 weeks gestation for women in both groups. CVS women had received the results of their tests for neural tube defects and Amnio women had received their results. This set contained the MAACL, the MAFF and the Followup Questionnaire.

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[1]The one woman in the study who received abnormal results elected not to complete the remaining questionnaires.

CHAPTER V

RESULTS

The data were submitted to analyses of variance, and pairwise comparisons were conducted where appropriate. This section will first examine the background variables on which data were collected, following which findings for each of the seven dependent measures will be reported sequentially. For five of these seven variables, the following analyses were conducted:

1. separate analyses of variance for the CVS and Amnio groups examined the dependent measure across four measurement points (Time 1, Time 2, Time 3, Time pr.);
2. within each group three pairwise comparisons evaluated changes from one measurement point to the next. For two of the measures, depression and hostility, a posteriori pairwise comparisons also evaluated changes from the first to the fourth (final) measurement point;
3. at Time 1, the point of subject intake, a one-way analysis of variance comparing the CVS, Amnio and Non-Participation groups was conducted. Time 1 was the only measurement point at which data was collected for the Non-Participation group;
4. a group x time analysis of variance compared the CVS and Amnio groups across the three comparable measurement points. Measurements from Time pr. occurred at different PMGA's for each group and were therefore excluded from this particular analysis;
5. pairwise comparisons at Time 1, Time 2 and Time 3 evaluated

differences between the two groups;

All the above analyses were conducted on all the data available at each measurement point. Additional analyses of variance within the CVS and Amnio groups examined the problem of subject attrition, and the extent to which conclusions might differ had data analysis been restricted to those subjects who were assessed at all four measurement points.

For the remaining two measures, concern about abortion and procedure discomfort, a reduced number of measurements were taken and pairwise comparisons were conducted as appropriate.

In all the analyses conducted, the relatively large number of pairwise comparisons were corrected for multiplicity. A given pairwise comparison was judged significant only if it could be declared significant according to either the Bonferroni or the Studentized Range (HSD) test (Kesselman, 1974). Summaries for all analyses are provided in Appendix B.

Background Variables

Three of the background variables on which information was collected are presented in Table 2. An inspection of means and standard deviations for age, number of children, number of fetal losses (including abortions, miscarriages and stillbirths) reveals that the three groups were comparable for these variables. For another background variable, annual family income, the scale employed was inadequate to assess the

Table 2

Means ($\bar{x}$) and Standard Deviations (s) for Background Variables

Group		Age	Children	Fetal Loss
CVS	($\bar{x}$)	35.21	1.31	.93
(n=29)	(s)	4.09	1.61	1.16
Amnio	($\bar{x}$)	36.84	1.29	1.35
(n=31)	(s)	2.78	1.16	1.21
Non-Participation	($\bar{x}$)	35.77	1.00	1.23
(n=13)	(s)	4.23	.99	1.30

relatively high incomes of the subjects in the study. Sixty-eight of the seventy-four subjects checked the highest category, reporting an annual income of "over $40,000."

The remaining background variable, living arrangement, was not included in the analysis because 73 of 74 respondents indicated they were living with the father of the child.

Analyses of variance confirmed there were no significant differences for the background variables among the three groups.

Anxiety

Means, standard deviations and the number of subjects providing data at each measurement point for the CVS, Amnio and Non-Participation groups are provided in Table 3. Inspection of this table reveals that for the CVS group, a reduction in the mean score for anxiety occurs at Time 2, with a further small reduction occurring at Time 3. For the Amnio group, a reduction in the mean score for anxiety occurs at Time 3. The significance of these changes was evaluated by analyses of variance and by pairwise comparisons.

An analysis of variance for anxiety across the four measurement points for the CVS group was significant, $F(3,60) = 10.52$, $\epsilon = .78$,[1] $p = .0001$, as was the companion analysis of

[1]Where appropriate, Huynh-Feldt corrections for heteroscedasticity of differences were applied to the degrees of freedom

Table 3

Means ($\bar{x}$), Standard Deviations (s) and Number of Measurements (n) for Anxiety

Group		Time 1 8-11 weeks	Time pr.[1] 9-12 weeks	Time 2 13-14 weeks	Time pr. 16-17 weeks	Time 3 20-22 weeks
CVS	($\bar{x}$)	9.17	9.36	5.87		4.67
	(s)	4.39	4.68	3.37		2.29
	(n)	29	28	23		21
Amnio	($\bar{x}$)	9.19		9.14	9.48	5.32
	(s)	3.27		3.80	3.49	2.32
	(n)	32		29	25	22
Non-Participation	($\bar{x}$)	9.08				
	(s)	3.40				
	(n)	13				

[1]Time pr., the time at which prenatal testing occurred, differed for the CVS and Amnio groups.

variance for the Amnio group, $F(3,63) = 18.68$, $\epsilon = 1.0$, $p < .0001$. For the purpose of these comparisons, means and standard deviations were computed from only those subjects for whom anxiety measurements were taken at all four points in the study. These adjusted means and standard deviations are provided in Table 4.

Three subsequent a priori pairwise comparisons were conducted within each group. For the CVS group, anxiety scores at Time 1 were compared to anxiety scores at Time pr., scores at Time pr. were compared to scores at Time 2, and scores at Time 2 were compared to scores at Time 3. For the Amnio group, anxiety scores at Time 1 were compared to anxiety scores at Time 2, scores at Time 2 were compared to scores at Time pr., and scores at Time pr. were compared to scores at Time 3 (for both the CVS and Amnio groups, the pairwise comparisons reflect the order of administration of the four sets of measures). The error terms utilized were specific to each comparison to overcome heteroscedastic difference problems.

Subject attrition resulted in varying numbers of measurements for each of these comparisons. Table 5 provides means, standard deviations, number of measurements, F values and probabilities for the three comparisons within the CVS and Amnio groups. Inspection of this table reveals that for the CVS group, the reduction in anxiety that occurred from Time pr. to Time 2 was significant, $F(1,22) = 9.45$, $p = .006$. For the Amnio group, the comparison of anxiety scores at Time pr. versus those at

Table 4

Means ($\bar{x}$) and Standard Deviations (s) for Anxiety for Only Those Subjects Providing Data at All Four Measurement Points

Group	Time 1	Time pr.	Time 2	Time pr.	Time 3
CVS ($\bar{x}$)	8.95	8.52	5.52		4.67
(n=21)(s)	4.03	4.42	2.89		2.29
Amnio ($\bar{x}$)	9.00		8.95	9.91	5.32
(n=22)(s)	2.96		3.87	3.22	2.32

Table 5

Means ($\bar{x}$), Standard Deviations (s), Number of Measurements (n), F Values and Probabilities (p) for Three Pairwise Comparisons for Anxiety

Group		Time 1	vs Time pr	Time pr	vs Time 2	Time 2	vs Time 3
CVS	($\bar{x}$)	9.43	9.36	9.30	5.87	5.52	4.67
	(s)	4.25	4.68	4.97	3.57	2.89	2.29
	(n)	28		23		21	
	(F)	.01		9.45		2.13	
	(p)	.91		.006[1]		.16	
		Time 1	vs Time 2	Time 2	vs Time pr	Time pr	vs Time 3
Amnio	($\bar{x}$)	9.31	9.14	8.84	9.48	9.91	5.32
	(s)	3.42	3.76	3.94	3.49	3.22	2.31
	(n)	29		25		22	
	(F)	.01		1.06		39.37	
	(p)	.74		.31		.000[1]	

[1]Results are significant

Time 3 was significant, $F(1,21) = 39.37$, $p < .0001$. These comparisons reveal that subjects in the CVS group underwent a significant decline in anxiety at some point following the CVS procedure (at 9-12 weeks gestational age), while subjects in the Amnio group remained at a relatively high anxiety level until some point following the Amnio procedure (at 16-17 weeks gestional age), after which these subjects reported a significant decline in anxiety.

Additional comparisons for anxiety were conducted at comparable measurement points between the CVS, Amnio and Non-Participation groups, where appropriate. A one-way analysis of variance for anxiety compared these three groups at Time 1. Means, standard deviations and number of measurements for each group are provided in Table 3. The analysis revealed no significant differences between these groups at Time 1, the intake measurement point, $F(2,71) = 0.0$, $p = .996$. No further measurements for anxiety were taken for the Non-Participation group.

A group x time analysis of variance compared the CVS and Amnio groups at the three comparable measurement points (Time 1, Time 2 and Time 3; Time pr. was not comparable for the two groups). The main effects for group and for time were of no particular interest in this analysis. The existence of a main effect for group is potentially of some interest, but the pattern of change is of greater consequence. Given the a priori assumption that anxiety levels for the CVS and Amnio groups will

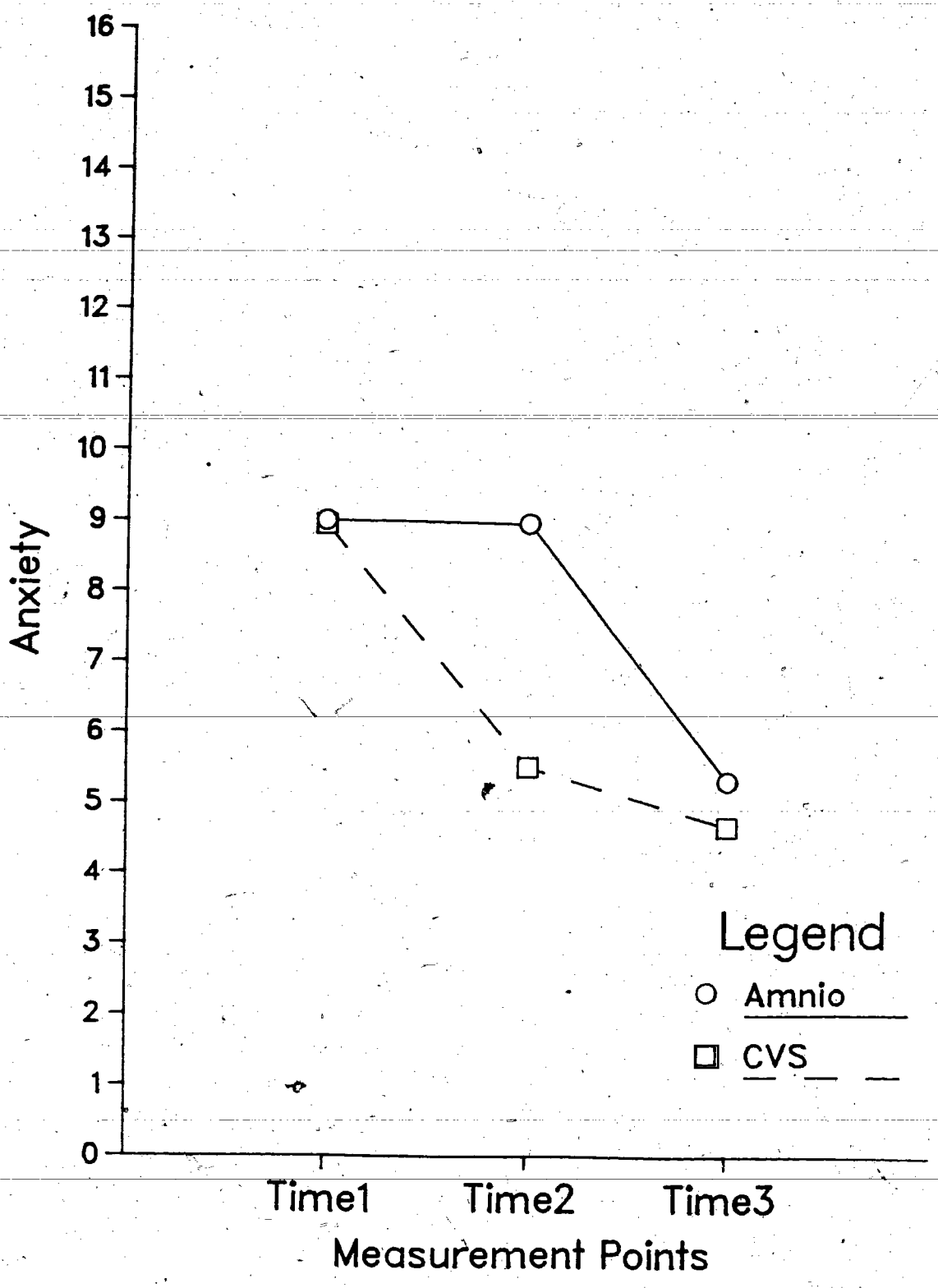
be equivalent at the outset and conclusion of the study, the only difference is expected to occur at the middle point in the study, at Time 2. This difference is difficult to detect with an analysis of variance main effect, and the overall pattern of change for the two groups provides a more sensitive comparison. The existence of a main effect for time is not of interest because of the expectation of different patterns of change over time for the CVS and Amnio groups. What is of interest is the effect of time within each group separately, rather than the effect of time averaged over the two groups.

The group x time interaction revealed that anxiety reported by the CVS group differed significantly over time from that reported by the Amnio group, $F(2,82) = 5.55$, $\epsilon = 1.0$, $p = .006$. This change in anxiety over time for both groups is shown in Figure 1.

Subsequent *a priori* pairwise comparisons for anxiety between the CVS and Amnio groups at Time 1, Time 2 and Time 3 were conducted. The means, standard deviations, and number of measurements for each of the three comparisons are shown in Table 3. The outcome of the comparison at Time 1 was not significant, $F(1,59) = 0.0$, $p = .998$, nor was the comparison at Time 3, $F(1,41) = 0.86$, $p = .36$. The comparison at Time 2 confirmed the lower anxiety scores reported by the CVS group, $F(1,50) = 10.02$, $p = .002$. These comparisons reveal that while the CVS and Amnio groups were at similar levels for anxiety at the outset (Time 1) and conclusion (Time 3) of the study, at a

Figure 1

Group x Time Interaction for Anxiety



point midway through the trial (Time 2) the CVS group reported significantly less anxiety.

A final set of comparisons addressed the problem of subject attrition. Subjects in each group who completed the entire series of four measurements were compared at each of the first three measurement points to subjects in that group who completed only three, two or one of the series of four measurements for anxiety. Means and standard deviations for these comparisons are shown in Table 6. For the CVS group, inspection of Table 6 reveals that at any particular measurement point, there is some variation among mean scores for anxiety according to the number of measurements completed. Indeed, at Time pr. an analysis of variance for anxiety according to the number of measurements taken was significant, $F(2,25) = 4.14$, $p = .03$. In general, however, visual examination of Table 6 reveals that while differences between means exist for the four groups at the first three measurement points, the pattern of change from measurement point to measurement point within each group is essentially similar. It is apparent that no gross bias exists, and there is little to militate against the *a priori* policy of using all available data at each measurement point.

For the Amnio group, inspection reveals somewhat less variation among the mean scores for anxiety according to the number of measurements completed, although the four subjects who completed only two measurements reported higher mean scores at Time 1 and Time 2. However, none of the analyses at any of the

Table 6

Means ($\bar{x}$) and Standard Deviations (s) for Anxiety According to Number of Measurements Completed per Subject

CVS							Amnio						
Number of Measurements Completed	Number of Subjects		Measurement Points Time1	Time pr	Time2	Time3	Number of Measurements Completed	Number of Subjects		Measurement Points Time1	Time2	Time pr	Time3
4	21	($\bar{x}$)	8.95	8.52	5.52	4.67	4	22	($\bar{x}$)	9.0	8.96	9.91	5.32
		(s)	4.03	4.42	2.89	2.29			(s)	2.96	3.87	3.22	2.32
3	2	($\bar{x}$)	15.50	17.50	9.50		3	3	($\bar{x}$)	7.33	8.00	6.33	
		(s)	.71	2.12	3.19				(s)	5.86	5.29	4.51	
2	5	($\bar{x}$)	9.00	9.60			2	4	($\bar{x}$)	12.50	11.00		
		(s)	4.53	3.51					(s)	2.65	2.16		
1	1	($\bar{x}$)	2.00				1	3	($\bar{x}$)	8.00			
		(s)	0						(s)	0			

three measurement points was significant, indicating that the inclusion of all available data is unlikely to alter the conclusions that might otherwise be drawn were incomplete sets of measurements to be excluded.

Depression

Means, standard deviations and the number of subjects providing data at each measurement point for the CVS, Amnio and Non-Participation groups are provided in Table 7. Inspection of this table reveals that for the CVS group, a reduction in the mean score for depression occurs at Time 2, with a further reduction occurring at Time 3. For the Amnio group, mean scores for depression rise from Time 1 through Time pr., followed by a reduction at Time 3. The significance of these changes was evaluated by analyses of variance and by pairwise comparisons.

An analysis of variance for depression across the four measurement points for the CVS group was significant, $F(3,60) = 3.39$, $\epsilon = .82$, $p = .03$, as was the companion analysis of variance for the Amnio group, $F(3,63) = 11.70$, $\epsilon = .89$, $p < .0001$. For the purpose of these comparisons, means and standard deviations were computed from only those subjects for whom anxiety measurements were taken at all four points in the study. These adjusted means and standard deviations are provided in Table 8.

Table 7

Means ($\bar{x}$), Standard Deviations (s) and Number of Measurements (n) for Depression

Group		Time 1	Time pr	Time 2	Time pr	Time 3
CVS	($\bar{x}$)	13.39	13.82	12.35		11.14
	(s)	4.38	4.59	4.38		3.84
	(n)	29	28	23		21
Amnio	($\bar{x}$)	13.81		14.35	14.72	11.14
	(s)	4.53		4.10	5.20	3.66
	(n)	32		29	25	22
Non-Partic.	($\bar{x}$)	15.31				
	(s)	5.75				
	(n)	13				

Table 8

Means ($\bar{x}$) and Standard Deviations (s) for Depression for Only Those Subjects Providing Data at All Four Measurement Points

Group	Time 1	Time pr.	Time 2	Time pr.	Time 3
CVS ($\bar{x}$)	14.23	13.52	12.43		11.14
(n=21)(s)	4.24	4.96	4.58		3.84
Amnio ($\bar{x}$)	14.17		14.95	15.50	11.17
(n=22)(s)	4.31		3.71	4.45	3.66

Three subsequent a priori pairwise comparisons were conducted within each group. For the CVS group, depression scores at Time 1 were compared to depression scores at Time pr., scores at Time pr. were compared to scores at Time 2, and scores at Time 2 were compared to scores at Time 3. For the Amnio group, depression scores at Time 1 were compared to depression scores at Time 2, scores at Time 2 were compared to scores at Time pr., and scores at Time pr. were compared to scores at Time 3 (for both the CVS and Amnio groups, the pairwise comparisons reflect the order of administration of the four sets of measures). The error terms utilized were specific to each comparison to overcome heteroscedastic difference problems.

Subject attrition resulted in varying numbers of measurements for each of these comparisons. Table 9 provides means, standard deviations, number of measurements, F values and probabilities for the three comparisons within the CVS and Amnio groups. Inspection of this table reveals that for the CVS group, none of these pairwise comparisons were significant. For the Amnio group, the rise in means for depression From Time 1 to Time 2 and from Time 2 to Time pr. is still evident, but neither of these two comparisons was significant. However, the reduction in the mean for depression from Time pr. to Time 3 resulted in significance for that comparison, $F(1,21) = 23.45$, $p < .0001$. These comparisons reveal that the CVS group experienced little change in depression from one measurement point to the next, while the Amnio group experienced little change from Time 1

Table 9

Means ($\bar{x}$), Standard Deviations (s), Number of Measurements (n), F Values and Probabilities (p) for Three Pairwise Comparisons for Depression

Group		Time 1 vs Time pr		Time pr vs Time 2		Time 2 vs Time 3	
CVS	($\bar{x}$)	14.25	13.82	13.91	12.34	12.43	11.14
	(s)	4.11	4.59	4.91	4.38	4.58	3.84
	(n)	28		23		21	
	(F)	.21		1.69		3.94	
	(p)	.65		.21		.06	
		Time 1 vs Time 2		Time 2 vs Time pr		Time pr vs Time 3	
Amnio	($\bar{x}$)	13.65	14.34	14.28	14.72	15.50	11.14
	(s)	4.68	4.10	4.38	5.20	4.45	3.66
	(n)	29		25		22	
	(F)	1.74		.56		23.45	
	(p)	.20		.46		.0001*	

*Results are significant

through Time pr., followed by a statistically significant drop at Time 3. However, a visual comparison at Time 3 shows that both the CVS and Amnio groups have identical means at this measurement point.

Subsequent to these analyses, a posteriori pairwise comparisons of Time 1 versus Time 3 for depression were conducted for both groups. The CVS group showed a significant decline in depression from the outset to the conclusion of the study, $F(1,20) = 8.53$, $p = .009$, as did the Amnio group, $F(1,21) = 13.68$, $p = .001$.

Additional comparisons for depression were conducted at comparable measurement points between the CVS, Amnio and Non-Participation groups, where appropriate. A one-way analysis of variance for depression compared these three groups at Time 1. Means, standard deviations and number of measurements for each group are provided in Table 7. The analysis revealed no significant differences between these groups at Time 1, the intake measurement point, $F(2,71) = .51$, $p = .61$. No further measurements for depression were taken for the Non-Participation group.

A group x time analysis of variance compared the CVS and Amnio groups at the three comparable measurement points (Time 1, Time 2 and Time 3; Time pr. was not comparable for the two groups). As was the case with the comparable analysis for anxiety, the main effects for group and for time were of no

particular interest in this analysis. The group x time interaction revealed that depression reported by the CVS group differed significantly over time from that reported by the Amnio group, $F(2,82) = 3.45$, $\epsilon = .93$, $p = .04$. This change in depression over time for both groups is shown in Figure 2.

Subsequent *a priori* pairwise comparisons for depression between the CVS and Amnio groups at Time 1, Time 2 and Time 3 were conducted. The means, standard deviations, and number of measurements for each of the three comparisons are shown in Table 7. The outcome of the comparisons revealed no significant differences between the means for the two groups at either Time 1, $F(1,59) = .01$, $p = .92$, or Time 2, $F(1,50) = 2,87$, $p = .10$, or Time 3, $F(1,41) = 0.0$, $p = 1.0$. These comparisons reveal that the CVS and Amnio groups were at similar levels for depression at the outset (Time 1), the midway point (Time 2), and conclusion (Time 3) of the study.

A final set of comparisons addressed the problem of subject attrition. Subjects in each group who completed the entire series of four measurements were compared at each of the first three measurement points to subjects in that group who completed only three, two or one of the series of four measurements for depression. Means and standard deviations for these comparisons are shown in Table 10. For the CVS group, inspection of Table 10 reveals that at any particular measurement point, there is some variation among mean scores for depression according to the number of measurements completed. However, none of the analyses

Figure 2

Group x Time Interaction for Depression

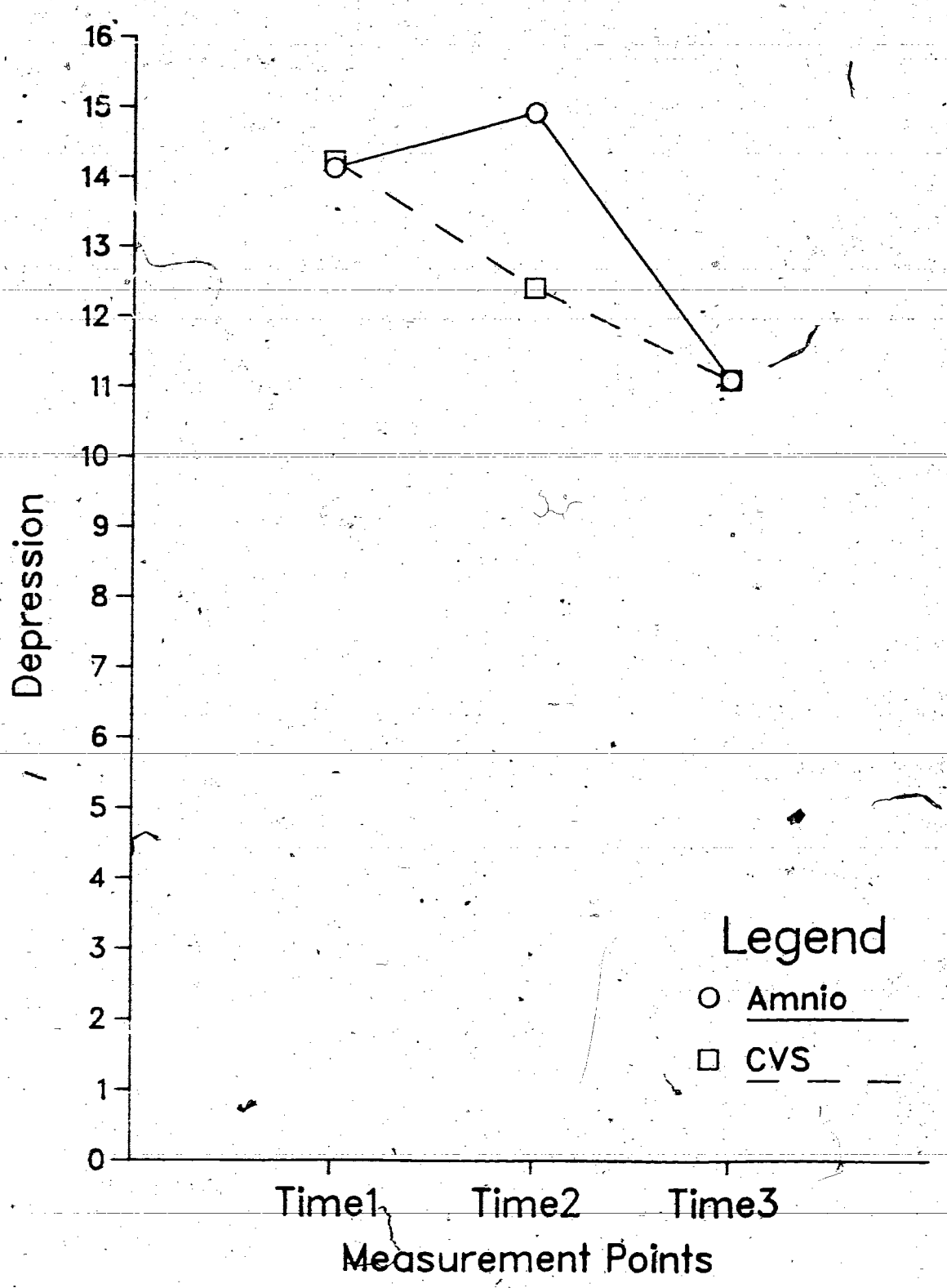


Table 10

Means ($\bar{x}$) and Standard Deviations (s) for Depression According to Number of Measurements Completed per Subject

CVS						Amnio					
Number of Measurements Completed	Number of Subjects		Measurement Points Time1	Time pr	Time2 Time3	Number of Measurements Completed	Number of Subjects		Measurement Points Time1	Time2 Time pr	Time3
4	21	($\bar{x}$)	14.24	13.52	12.43 11.14	4	22	($\bar{x}$)	14.14	14.96 15.50	11.17
		(s)	4.24	4.96	4.58 3.84			(s)	4.31	3.71 4.45	3.66
3	2	($\bar{x}$)	18.50	18.00	11.50	3	3	($\bar{x}$)	10.00	9.33 9.00	
		(s)	.71	1.41	.71			(s)	8.72	6.66 7.81	
2	5	($\bar{x}$)	12.60	13.40		2	4	($\bar{x}$)	13.75	14.75	
		(s)	3.36	3.05				(s)	2.87	1.71	
1	1	($\bar{x}$)	5.00			1	3	($\bar{x}$)	15.33		
		(s)	0					(s)	2.89		

at the first three measurement points was significant.

For the Amnio group, variation also exists among the mean scores for depression according to the number of measurements completed. Indeed, the comparison at Time pr was significant, $F(1,23) = 4.77$, $p = .04$. However, the pattern of change for depression is essentially similar regardless of the number of measurements completed, and again there is nothing of sufficient concern to indicate that the *a priori* policy of using all available data is not appropriate.

Hostility

Means, standard deviations and the number of subjects providing data at each measurement point for the CVS, Amnio and Non-Participation groups are provided in Table 11. Inspection of this table reveals that for the CVS group, a small reduction in the mean score for hostility occurs at Time 3. For the Amnio group, means scores for hostility rise at Time 2, declining slightly at Time pr., and again at Time 3. The significance of these changes was evaluated by analyses of variance and by pairwise comparisons.

An analysis of variance for hostility across the four measurement points for the CVS group was not significant, $F(3,60) = 1.30$, $\epsilon = .82$, $p = .28$, while the companion analysis of variance for the Amnio group was significant, $F(3,63) = 4.11$ $\epsilon = .82$, $p = .02$. For the purpose of these comparisons, means

Table 11

Means ($\bar{x}$), Standard Deviations (s) and Number of Measurements (n) for Hostility

Group		Time 1	Time pr	Time 2	Time pr	Time 3
CVS	($\bar{x}$)	8.66	8.75	8.78		7.76
	(s)	2.64	2.98	3.67		2.45
	(n)	29	28	23		21
Amnio	($\bar{x}$)	8.88		9.83	9.52	8.14
	(s)	2.52		3.95	3.62	2.83
	(n)	32		29	25	22
Non-Participation	($\bar{x}$)	9.85				
	(s)	3.24				
	(n)	13				

and standard deviations were computed from only those subjects for whom hostility measurements were taken at all four points in the study. These adjusted means and standard deviations are provided in Table 12.

Three subsequent a priori pairwise comparisons were conducted within each group. For the CVS group, hostility scores at Time 1 were compared to hostility scores at Time pr., scores at Time pr. were compared to scores at Time 2, and scores at Time 2 were compared to scores at Time 3. For the Amnio group, hostility scores at Time 1 were compared to hostility scores at Time 2, scores at Time 2 were compared to scores at Time pr., and scores at Time pr. were compared to scores at Time 3 (for both the CVS and Amnio groups, the pairwise comparisons reflect the order of administration of the four sets of measures). The error terms utilized were specific to each comparison to overcome heteroscedastic difference problems.

Subject attrition resulted in varying numbers of measurements for each of these comparisons. Table 13 provides means, standard deviations, number of measurements, F values and probabilities for the three comparisons within the CVS and Amnio groups. Inspection of this table reveals only slight changes in mean scores across measurement points for the CVS group. None of the comparisons were significant. For the Amnio group, there is a gradual increase in the means for hostility across the first three measurement points, followed by a slight decline at the fourth measurement point (Time 3), but none of these comparisons

Table 12

Means ($\bar{x}$) and Standard Deviations (s) for Hostility for Only Those Subjects Providing Data at All Four Measurement Points

Group	Time 1	Time pr.	Time 2	Time pr.	Time 3
CVS ($\bar{x}$)	8.95	8.95	8.61		7.76
(n=21)(s)	2.31	2.81	3.63		2.45
Amnio ($\bar{x}$)	9.09		10.36	9.86	8.14
(n=22)(s)	2.71		4.19	3.56	2.83

Table 13

Means ($\bar{x}$), Standard Deviations (s), Number of Measurements (n), F Values and Probabilities (p) for Three Pairwise Comparisons for Hostility

Group		Time 1 vs Time pr		Time pr vs Time 2		Time 2 vs Time 3	
CVS	($\bar{x}$)	8.82	8.75	9.09	8.78	8.61	7.76
	(s)	2.52	2.98	2.83	3.67	3.64	2.45
	(n)	28		23		21	
	(F)	.02		.15		2.69	
	(p)	.89		.70		.12	
		Time 1 vs Time 2		Time 2 vs Time pr		Time pr vs Time 3	
Amnio	($\bar{x}$)	8.93	9.52	9.92	9.52	9.86	8.14
	(s)	2.64	3.95	4.19	3.62	3.56	2.83
	(n)	29		25		22	
	(F)	2.50		.77		6.43	
	(p)	.12		.39		.02	

*Results are significant

were significant. These comparisons reveal that both the CVS and Amnio groups underwent little change in hostility over the course of the study.

Subsequent to these analyses, a posteriori pairwise comparisons of Time 1 versus Time 3 were conducted for both groups. Neither comparison was significant, again suggesting that both groups underwent little change in hostility over the course of the study.

Additional comparisons for hostility were conducted at comparable measurement points between the CVS, Amnio and Non-Participation groups, where appropriate. A one-way analysis of variance for hostilitity compared these three groups at Time 1. Means, standard deviations and number of measurements for each group are provided in Table 11. The analysis revealed no significant differences between these groups at Time 1, the intake measurement point, $F(2,71) = .90$, $p = .41$. No further measurements for hostility were taken for the Non-Participation group.

A group x time analysis of variance compared the CVS and Amnio groups at the three comparable measurement points (Time 1, Time 2 and Time 3; Time pr. was not comparable for the two groups). Again, the main effects for group and for time were of no particular interest in this analysis. The group x time interaction revealed that hostilty reported by the CVS group did not differ significantly over time from that reported by the

Amnio group, $F(2,82) = 1.52$, $\epsilon = .96$, $p = .23$.

Subsequent a priori pairwise comparisons for hostility between the CVS and Amnio groups at Time 1, Time 2 and Time 3 were conducted. The means, standard deviations, and number of measurements for each of the three comparisons are shown in Table 11. None of the comparisons at these three measurement points were significant. These comparisons reveal that the CVS and Amnio groups were at similar levels for hostility at the outset (Time 1), midway point (Time 2) and conclusion (Time 3) of the study.

A final set of comparisons addressed the problem of subject attrition. Subjects in each group who completed the entire series of four measurements were compared at each of the first three measurement points to subjects in that group who completed only three, two or one of the series of four measurements for hostility. Means and standard deviations for these comparisons are shown in Table 14. For both the CVS and Amnio groups, inspection of Table 14 reveals that at any particular measurement point, there is some variation among mean scores for hostility according to the number of measurements completed. However, none of the analyses at any of the three measurement points for either group was significant, indicating that the inclusion of all available data is unlikely to alter the conclusions that might otherwise be drawn were incomplete sets of measurements to be excluded.

Table 14

Means ($\bar{x}$) and Standard Deviations (s) for Hostility According to Number of Measurements Completed per Subject

CVS							Amnio						
Number of Measurements Completed	Number of Subjects		Measurement Points Time1	Time pr	Time2	Time3	Number of Measurements Completed	Number of Subjects		Measurement Points Time1	Time2	Time pr	Time3
4	21	($\bar{x}$)	8.95	8.95	8.91	7.76	4	22	($\bar{x}$)	9.09	10.36	9.86	8.14
		(s)	2.31	2.82	2.68	2.45			(s)	2.71	4.19	3.56	2.83
3	2	($\bar{x}$)	9.00	10.50	8.00		3	3	($\bar{x}$)	8.00	6.67	7.00	
		(s)	2.83	3.54	9.90				(s)	3.46	2.89	3.61	
2	5	($\bar{x}$)	8.20	7.20			2	4	($\bar{x}$)	8.75	9.25		
		(s)	3.70	3.50					(s)	2.22	2.06		
1	1	($\bar{x}$)	4.00				1	3	($\bar{x}$)	8.33			
		(s)	0						(s)	.58			

Maternal Attachment-Self

Means, standard deviations and the number of subjects providing data at each measurement point for the CVS, Amnio and Non-Participation groups are provided in Table 15. Inspection of this table reveals that for both the CVS and Amnio groups, increments in the mean scores for maternal attachment-self occur at each measurement point from Time 1 to Time 3.

An analysis of variance for maternal attachment-self across the four measurement points for the CVS group was significant, $F(3,60) = 31.65$, $\epsilon = .92$, $p < .0001$, as was the companion analysis of variance for the Amnio group, $F(3,63) = 36.45$, $\epsilon = .71$, $p < .0001$. For the purpose of these comparisons, means and standard deviations were computed from only those subjects for whom measurements for maternal attachment-self were taken at all four points in the study. These adjusted means and standard deviations are provided in Table 16.

Three subsequent *a priori* pairwise comparisons were conducted within each group. For the CVS group, scores for maternal attachment-self at Time 1 were compared to scores for maternal attachment-self at Time pr., scores at Time pr. were compared to scores at Time 2, and scores at Time 2 were compared to scores at Time 3. For the Amnio group, scores for maternal attachment-self at Time 1 were compared to scores for maternal attachment-self at Time 2, scores at Time 2 were compared to scores at Time pr., and scores at Time pr. were compared to

Table 15

Means ($\bar{x}$), Standard Deviations (s) and Number of Measurements (n) for Maternal Attachment-Self

Group		Time 1	Time pr	Time 2	Time pr	Time 3
CVS	($\bar{x}$)	5.83	7.82	8.82		11.14
	(s)	3.48	3.62	3.33		2.92
	(n)	29	28	23		21
Amnio	($\bar{x}$)	5.63		6.14	8.44	11.50
	(s)	3.98		3.31	3.71	2.46
	(n)	32		29	25	22
Non-Partic.	($\bar{x}$)	5.53				
	(s)	4.72				
	(n)	13				

Table 16

Means ($\bar{x}$) and Standard Deviations (s) for Maternal Attachment-Self for Only Those Subjects Providing Data at All Four Measurement Points

Group	Time 1	Time pr.	Time 2	Time pr.	Time 3
CVS ($\bar{x}$)	5.67	7.90	8.90		11.14
(n=21)(s)	3.10	2.68	3.00		2.92
Amnio ($\bar{x}$)	4.90		6.00	8.27	11.50
(n=22)(s)	4.22		3.82	3.86	2.46

scores at Time 3 (for both the CVS and Amnio groups, the pairwise comparisons reflect the order of administration of the four sets of measures). The error terms utilized were specific to each comparison to overcome heteroscedastic difference problems.

Subject attrition resulted in varying numbers of measurements for each of these comparisons. Table 17 provides means, standard deviations, number of measurements, F values and probabilities for the three comparisons within the CVS and Amnio groups. Inspection of this table reveals that for the CVS group, the increase in maternal attachment from Time 1 to Time pr. was significant, $F(1,27) = 20.49$, $p = .0001$, as was the comparison of Time 2 versus Time 3, $F(1,20) = 22.91$, $p = .0001$. The comparison of Time pr. versus Time 2 failed to reach significance according to either the Bonferroni or HSD correction for multiplicity, $F(1,22) = 5.25$, $p = .03$. For the Amnio group, the comparison of scores for maternal attachment-self at Time 2 versus Time pr. was significant, $F(1,24) = 19.48$, $p = .0002$, as was the comparison of Time pr. versus Time 3, $F(1,21) = 32.11$, $p < .0001$. The comparison of Time 1 versus Time 2 failed to reach significance according to either the Bonferroni or HSD correction for multiplicity, $F(1,28) = 5.50$, $p = .03$. These results indicate that the CVS group experienced a significant increase in maternal attachment from the outset of the study to the time of their prenatal testing, and again from the midpoint of the study to the

Table 17

Means ($\bar{x}$), Standard Deviations (s), Number of Measurements (n), F Values and Probabilities (p) for Three Pairwise Comparisons for Maternal Attachment-Self

Group		Time 1 vs Time pr		Time pr vs Time 2		Time 2 vs Time 3	
CVS	($\bar{x}$)	5.68	7.82	7.78	8.82	8.90	11.14
	(s)	3.44	3.62	3.33	3.32	2.68	2.92
	(n)	28		23		21	
	(F)	20.49		5.25		22.91	
	(p)	.0001'		.03		.0001'	
		Time 1 vs Time 2		Time 2 vs Time pr		Time pr vs Time 3	
Amnio	($\bar{x}$)	5.24	6.14	6.20	8.44	8.27	11.50
	(s)	3.99	3.71	3.81	3.71	3.86	2.46
	(n)	29		25		22	
	(F)	5.50		19.48		32.11	
	(p)	.03		.0002'		.0000'	

'Results are significant

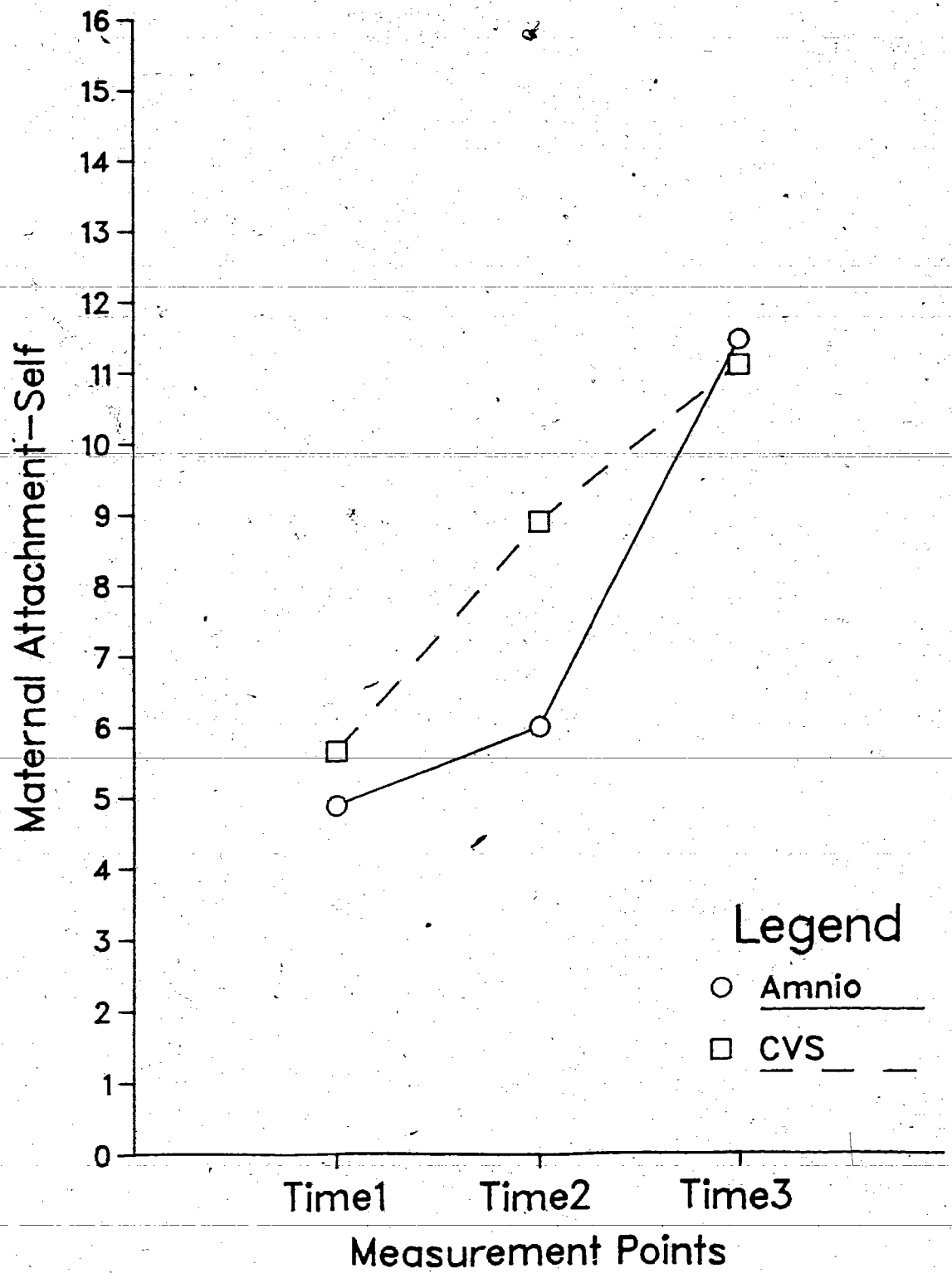
conclusion. By comparison, the Amnio group showed no significant increase in maternal attachment until the time of their prenatal testing, which occurred after the midpoint of the study. Consistent with the CVS group, the Amnio group then showed another significant increase in maternal attachment from Time pr. to Time 3, the final measurement point in the study.

Additional comparisons for maternal attachment-self were conducted at comparable measurement points between the CVS, Amnio and Non-Participation groups, where appropriate. A one-way analysis of variance for maternal attachment-self compared these three groups at Time 1. Means, standard deviations and number of measurements for each group are provided in Table 15. The analysis revealed no significant differences between these groups at Time 1, the intake measurement point, $F(2,71) = .03$, $p = .97$. No further measurements for maternal attachment-self were taken for the Non-Participation group.

A group x time analysis of variance compared the CVS and Amnio groups at the three comparable measurement points (Time 1, Time 2 and Time 3; Time pr. was not comparable for the two groups). Again, the main effects for group and for time were of no particular interest in this analysis. The group x time interaction revealed that maternal attachment-self reported by the CVS group differed significantly over time from that reported by the Amnio group, $F(2,82) = 7.00$, $\epsilon = .82$, $p = .003$. This change over time for both groups is shown in Figure 3.

Figure 3

Group x Time Interaction for Maternal Attachment-Self



Subsequent a priori pairwise comparisons for maternal attachment-self between the CVS and Amnio groups at Time 1, Time 2 and Time 3 were conducted. The means, standard deviations, and number of measurements for each of the three comparisons are shown in Table 15. The outcome of the comparison at Time 1 was not significant, $F(1,59) = .04$, $p = .83$, nor was the comparison at Time 3, $F(1,41) = .19$, $p = .67$. The comparison at Time 2 confirmed the higher scores for maternal attachment reported by the CVS group, $F(1,50) = 7.37$, $p = .009$. These comparisons reveal that while the CVS and Amnio groups were at similar levels for maternal attachment at the outset (Time 1) and conclusion (Time 3) of the study, at a point midway through the trial (Time 2) the CVS group reported significantly greater maternal attachment.

A final set of comparisons addressed the problem of subject attrition. Subjects in each group who completed the entire series of four measurements were compared at each of the first three measurement points to subjects in that group who completed only three, two or one of the series of four measurements for maternal attachment-self. Means and standard deviations for these comparisons are shown in Table 18. For both the CVS and Amnio groups, inspection of Table 18 reveals that at any particular measurement point, there is some variation among mean scores for maternal attachment-self according to the number of measurements completed. However, none of the analyses at any of the three measurement points for either group was significant,

Table 18

Means ($\bar{x}$) and Standard Deviations (s) for Maternal Attachment-Self According to Number of Measurements Completed per Subject

CVS						Amnio					
Number of Measurements Completed	Number of Subjects		Measurement Points Time1	Time pr	Time2 Time3	Number of Measurements Completed	Number of Subjects		Measurement Points Time1	Time2	Time pr Time3
4	21	($\bar{x}$)	5.67	7.91	8.91 11.14	4	22	($\bar{x}$)	4.91	6.00	8.27 11.50
		(s)	3.10	3.00	2.68 2.92			(s)	4.22	3.82	3.86 2.46
3	2	($\bar{x}$)	6.00	6.50	8.00	3	3	($\bar{x}$)	7.67	7.67	9.67
		(s)	7.07	7.78	9.90			(s)	3.22	4.16	2.52
2	5	($\bar{x}$)	5.60	8.00		2	4	($\bar{x}$)	5.25	5.70	
		(s)	4.39	5.74				(s)	3.20	3.50	
1	1	($\bar{x}$)	10.00			1	3	($\bar{x}$)	9.33		
		(s)	0					(s)	.58		

indicating that the inclusion of all available data is again unlikely to alter the conclusions that might otherwise be drawn were incomplete sets of measurements to be excluded.

Maternal Attachment-Others

Means, standard deviations and the number of subjects providing data at each measurement point for the CVS, Amnio and Non-Participation groups are provided in Table 19. Inspection of this table reveals that for both the CVS and Amnio groups, increases in mean scores for maternal attachment attributed to other pregnant women of equivalent gestation occur across all four measurement points. The significance of these changes was evaluated by analyses of variance and by pairwise comparisons.

An analysis of variance for other maternal attachment-others across the four measurement points for the CVS group was significant, $F(3,51) = 15.65$, $\epsilon = .95$, $p < .0001$, as was the companion analysis of variance for the Amnio group, $F(3,60) = 28.43$, $\epsilon = .90$, $p < .0001$. For the purpose of these comparisons, means and standard deviations were computed from only those subjects for whom measurements for maternal attachment-others were taken at all four points in the study. These adjusted means and standard deviations are provided in Table 20.

Three subsequent a priori pairwise comparisons were conducted within each group. For the CVS group, scores for maternal attachment-others at Time 1 were compared to scores for

Table 19

Means ($\bar{x}$), Standard Deviations (s) and Number of Measurements (n) for Maternal Attachment-Others

Group		Time 1	Time pr	Time 2	Time pr	Time 3
CVS	($\bar{x}$)	6.56	8.15	10.05		11.50
	(s)	3.88	3.41	2.76		2.75
	(n)	27	26	19		18
Amnio	($\bar{x}$)	6.10		7.96	9.79	11.05
	(s)	3.74		3.71	3.53	2.75
	(n)	31		28	24	21
Non-Partic.	($\bar{x}$)	6.08				
	(s)	4.79				
	(n)	13				

Table 20

Means ($\bar{x}$) and Standard Deviations (s) for Maternal Attachment-Others for Only Those Subjects Providing Data at All Four Measurement Points

Group	Time 1	Time pr.	Time 2	Time pr.	Time 3
CVS ($\bar{x}$)	7.28	9.00	9.83		11.50
(n=18)(s)	3.71	3.18	2.66		2.75
Amnio ($\bar{x}$)	5.33		6.95	9.33	11.05
(n=21)(s)	4.16		3.58	3.53	2.75

maternal attachment-others at Time pr., scores at Time pr. were compared to scores at Time 2, and scores at Time 2 were compared to scores at Time 3. For the Amnio group, scores for maternal attachment-others at Time 1 were compared to scores for maternal attachment-others at Time 2, scores at Time 2 were compared to scores at Time pr., and scores at Time pr. were compared to scores at Time 3 (for both the CVS and Amnio groups, the pairwise comparisons reflect the order of administration of the four sets of measures). The error terms utilized were specific to each comparison to overcome heteroscedastic difference problems.

Subject attrition resulted in varying numbers of measurements for each of these comparisons. Table 21 provides means, standard deviations, number of measurements, F values and probabilities for the three comparisons within the CVS and Amnio groups. Inspection of this table reveals that for the CVS group, the comparison of Time 1 versus Time pr. was significant, $\underline{F}(1,25) = 10.14$, $\underline{p} = .004$, as was the comparison of Time 2 versus Time 3, $\underline{F}(1,17) = 15.74$, $\underline{p} = .001$. For the Amnio group, the comparison of Time 1 versus Time 2 was significant, $\underline{F}(1,27) = 21.09$, $\underline{p} = .0001$, as was the comparison of Time 2 versus Time pr., $\underline{F}(1,23) = 25.60$, $\underline{p} < .0001$. These comparisons reveal that subjects in the CVS group attributed significant increases in maternal attachment to other pregnant women of equivalent gestation from the outset of the study to the time of their own prenatal testing, and again from the midpoint to the conclusion

Table 21

Means ($\bar{x}$), Standard Deviations (s), Number of Measurements (n), F Values and Probabilities (p) for Three Pairwise Comparisons for Maternal Attachment-Others

Group		Time 1 vs Time pr		Time pr vs Time 2		Time 2 vs Time 3	
CVS	($\bar{x}$)	6.38	8.15	9.15	10.05	9.83	11.50
	(s)	3.85	3.41	3.17	2.75	2.67	2.75
	(n)	26		19		18	
	(F)	10.14		2.69		15.74	
	(p)	.004'		.12		.001'	
		Time 1 vs Time 2		Time 2 vs Time pr		Time pr vs Time 3	
Amnio	($\bar{x}$)	5.79	7.96	7.41	9.79	9.33	11.05
	(s)	3.77	3.71	3.59	3.53	3.53	2.75
	(n)	28		24		21	
	(F)	21.09		25.60		5.93	
	(p)	.0001'		.0000'		.02	

'Results are significant

of the study. These changes follow the pattern of change in their own maternal attachment reported by subjects in the CVS group. Subjects in the Amnio group attributed significant changes in the maternal attachment of other pregnant women from the outset of the study to the midpoint, and again from the midpoint to the time of their own prenatal testing, yet these same subjects did not report a significant increase in their own maternal attachment until after the midpoint in the study.

Pairwise comparisons of maternal attachment between self and others were conducted at the four measurement points for each group. Means, standard deviations, number of measurements, F values, and probabilities for these comparisons are shown in Table 22. Inspection of this table reveals relatively small differences between the means at each of the four measurement points for the CVS group. Indeed, none of the comparisons were significant. For the Amnio group, small differences between the means are also present at three of the four measurement points, the exception being Time 2, when Amnio subjects attributed significantly greater maternal attachment to other women than to themselves. $\underline{F}(1,27) = 7.94$, $\underline{p} = .009$. These results show that the CVS group did not attribute greater attachment to other women of equivalent gestation than to themselves at any of the four measurement points. By comparison, the Amnio group attributed significantly greater maternal attachment to others at the midpoint of the study. This difference narrowed at Time pr., the measurement point immediately following Amnio, when no

Table 22

Means ($\bar{x}$), Standard Deviations (s), Number of Measurements (n), F Values and Probabilities (p) for Three Pairwise Comparisons between Maternal Attachment-Self and Maternal Attachment-Others

Group		Time 1		Time pr		Time 2		Time pr		Time 3	
CVS	($\bar{x}$)	5.93	6.56	7.96	8.15	9.63	10.05			11.33	11.50
	(s)	3.52	3.88	3.71	3.41	2.79	2.76			2.87	2.75
	(n)	27		26		19				18	
	(F)	.73		.13		.94				.22	
	(p)	.40		.72		.35				.65	
Amnio	($\bar{x}$)	5.71	6.10			6.25	7.96	8.58	9.79	11.62	11.05
	(s)	4.02	3.74			3.73	3.71	3.72	3.53	2.46	2.75
	(n)	31				28		24		21	
	(F)	.61				7.84		5.30		1.0	
	(p)	.44				.009[1]		.03		.33	

[1]Results are Significant

significant difference in attachment between self and others was reported, $F(1,23) = 5.30$. $p = .03$.

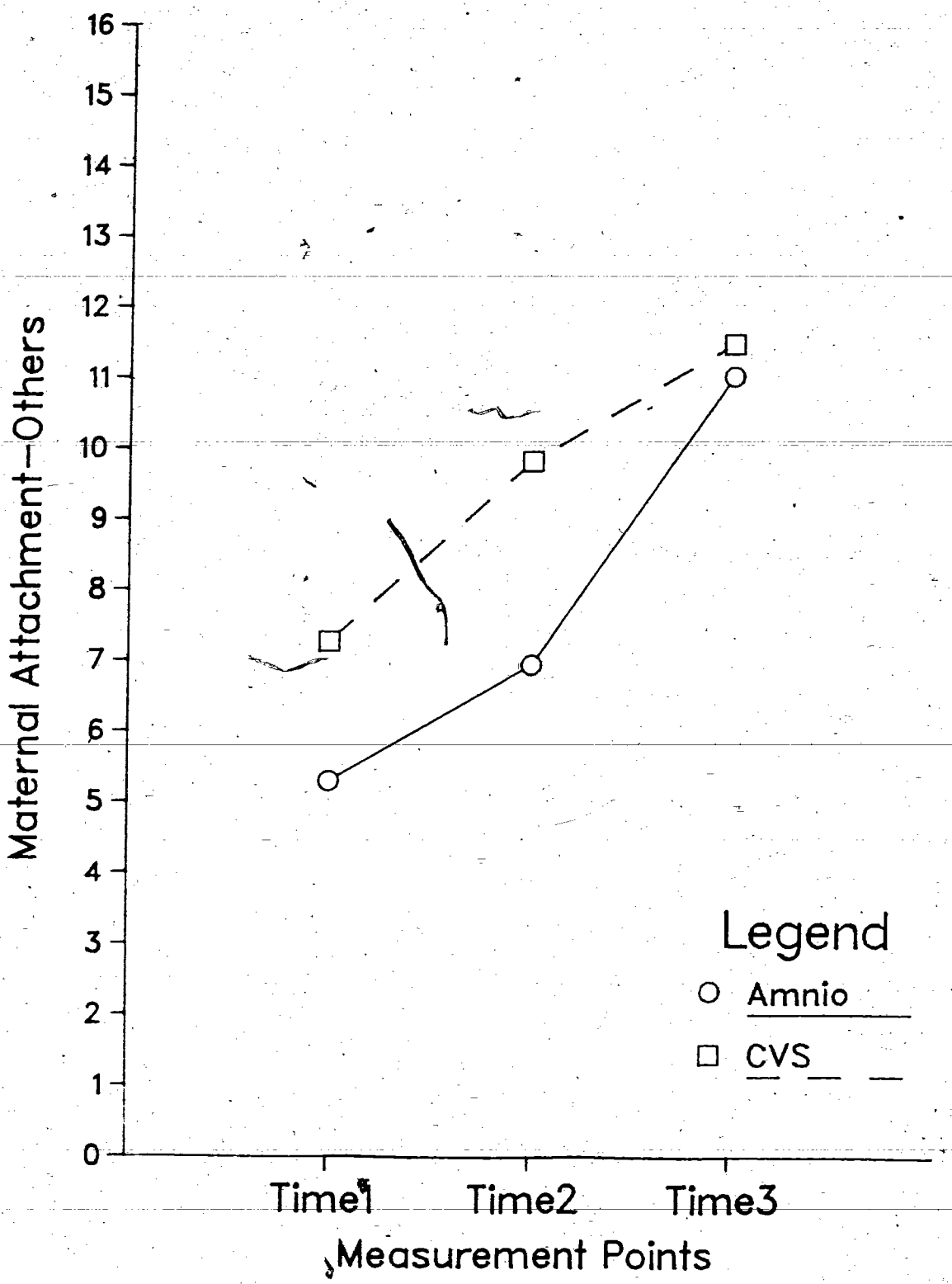
Additional comparisons for maternal attachment-others were conducted at comparable measurement points between the CVS, Amnio and Non-Participation groups, where appropriate. A one-way analysis of variance for maternal attachment-others compared these three groups at Time 1. Means, standard deviations and number of measurements for each group are provided in Table 19. The analysis revealed no significant differences between these groups at Time 1, the intake measurement point, $F(2,68) = .11$, $p = .89$. No further measurements for maternal attachment-others were taken for the Non-Participation group.

A group x time analysis of variance compared the CVS and Amnio groups at the three comparable measurement points (Time 1, Time 2 and Time 3; Time pr. was not comparable for the two groups). Again, the main effects for group and for time were of no particular interest in this analysis. The group x time interaction revealed that maternal attachment attributed to other pregnant women by the CVS group differed significantly over time from that reported by the Amnio group, $F(2,74) = 3.91$, $\epsilon = .89$, $p = .03$. Figure 4 shows this change in maternal attachment-others for both groups.

Subsequent *a priori* pairwise comparisons for maternal attachment-others between the CVS and Amnio groups at Time 1, Time 2 and Time 3 were conducted. The means, standard

Figure 4

Group x Time Interaction for Maternal Attachment-Others



deviations, and number of measurements for each of the three comparisons are shown in Table 19. None of the comparisons were significant. While the group x time interaction revealed that the CVS and Amnio groups differed significantly over time in their attributions of maternal attachment among other pregnant women, the pairwise comparisons revealed no significant differences in maternal attachment-others at any of the three measurement points the two groups have in common.

A final set of comparisons addressed the problem of subject attrition. Subjects in each group who completed the entire series of four measurements were compared at each of the first three measurement points to subjects in that group who completed only three, two or one of the series of four measurements for maternal attachment-others. Means and standard deviations for these comparisons are shown in Table 23. For the CVS group, inspection of Table 23 reveals that at any particular measurement point, there is some variation among mean scores for maternal attachment-others according to the number of measurements completed, but the general pattern of increasing attachment over time is similar for all groups, and none of the analyses at the first three measurement points was significant.

For the Amnio group, the variation among mean scores at any particular measurement point is more pronounced, and the analysis at Time 2 was significant, $F(2,25) = 3.81$, $p = .04$. However, the pattern of increasing attachment over time is similar for for all groups and there is little indication in

Table 23

Means ($\bar{x}$) and Standard Deviations (s) for Maternal Attachment-Others According to Number of Measurements Completed per Subject

CVS							Amnio						
Number of Measurements Completed	Number of Subjects		Measurement Points Time1	Time pr	Time2	Time3	Number of Measurements Completed	Number of Subjects		Measurement Points Time1	Time2	Time pr	Time3
4	18	($\bar{x}$)	6.95	8.74	9.83	11.50	4	21	($\bar{x}$)	5.33	6.95	9.33	11.05
		(s)	3.88	3.30	2.66	2.75			(s)	4.16	3.58	3.53	2.75
3	2	($\bar{x}$)	6.00	6.50	14.00		3	3	($\bar{x}$)	7.33	10.67	13.00	
		(s)	7.07	7.79	0				(s)	.58	1.16	1.00	
2	5	($\bar{x}$)	4.40	6.60			2	4	($\bar{x}$)	7.00	11.25		
		(s)	2.41	1.67					(s)	2.58	2.87		
1	1	($\bar{x}$)	11.00				1	3	($\bar{x}$)	9.00			
		(s)	0						(s)	1.73			

this analysis that the inclusion of all available data for other maternal attachment was not appropriate.

Concern about Abortion

Means, standard deviations and the number of subjects providing data for each measurement point for the CVS, Amnio and Non-Participation groups are provided in Table 24. Inspection of this table reveals that for the CVS group, a reduction in the mean scores for concern about abortion occurs from Time 1 to Time pr., while the Amnio group shows an increase in the mean scores from Time 1 to Time pr. The significance of these changes was evaluated by pairwise comparisons, and the adjusted means for each group based only on subjects who provided data at both measurement points are shown in Table 25. The changes over time within both the CVS and Amnio groups were not significant. From the data in Table 24, a comparison for concern about abortion was conducted at Time 1 between the CVS, Amnio and Non-participation groups. A one-way analysis of variance revealed no significant differences between these groups, $F(2,70) = .41$, $p = .67$.

Pairwise comparisons between the CVS and Amnio groups were conducted at Time 1 and at Time pr. The comparison at Time pr. was undertaken to determine whether subjects in the two groups felt differently about abortion following prenatal testing. The lack of gestational equivalence between the two groups at their

Table 24

Means ($\bar{x}$) and Standard Deviations (s), and Number of Measurements (n) for Concern about Abortion

Group		Time 1	Time pr.(9-12 weeks)	Time pr.(16-17 weeks)
CVS	($\bar{x}$)	53.31	51.96	
	(s)	7.10	7.41	
	(n)	29	28	
Amnio	($\bar{x}$)	52.97		55.08
	(s)	8.10		6.38
	(n)	31		24
Non-Participation	($\bar{x}$)	55.23		
	(s)	8.31		
	(n)	13		

Table 25

Means ($\bar{x}$) and Standard Deviations (s) for Concern about Abortion for Only Those Subjects Providing Data at Both Measurement Points

Group	Time 1	Time pr.(9-12 weeks)	Time pr.(16-17 weeks)
CVS ($\bar{x}$)	53.29	51.96	
(n=28)(s)	7.23	7.41	
Amnio ($\bar{x}$)	53.62		55.08
(n=24)(s)	7.39		6.38

respective Time pr. measurement points was recognized as potential confound; however, neither of the two comparisons was significant.

These results suggest that there was little difference between the three groups at the intake point, and that subjects in both the CVS and Amnio groups underwent little change in their concern about abortion during the period prior to hearing the results of their prenatal testing.

Procedure Discomfort

Means, standard deviations and the number of subjects for the CVS and Amnio groups for procedure discomfort are provided in Table 26. A pairwise comparison of the means revealed a significant difference between the two groups, $F(1,51) = 10.58$, $p = .002$. This outcome shows that immediately following prenatal testing, women reported significantly less discomfort from CVS than from Amnio.

Table 26

Means ($\bar{x}$), Standard Deviations (s) and Number of Measurements (n) for Procedure Discomfort

Group		Time pr. (9-12 weeks)	Time pr. (16-17 weeks)
CVS	($\bar{x}$)	4.14	
	(s)	3.29	
	(n)	28	
Amnio	($\bar{x}$)		7.28
	(s)		3.74
	(n)		25

CHAPTER VI

DISCUSSION

The present study shows that emotional responses of pregnant women undergoing prenatal testing can vary according to the type of procedure undergone. Findings will be discussed in the order of presentation adopted in the previous section to facilitate the interpretation.

Anxiety

Results for anxiety showed significant changes in the report of anxiety across the four measurement points for both the CVS and Amnio groups. Of particular interest was the finding that the CVS group experienced a significant decline from Time pr. to Time 2 (Table 1 shows the measurement points for each group), while the anxiety reported by the Amnio group did not show a similar decline until the measurement at Time 3. The significant difference in anxiety at Time 2 between the two groups confirms the earlier reduction in anxiety experienced by the CVS women.

This observed difference in reported anxiety means that the CVS women underwent a significant reduction in anxiety at a point following prenatal testing at 9-12 weeks PMGA, probably following notification of negative test results at 10-13 weeks PMGA. By comparison, the anxiety level among women in the Amnio group remained relatively high throughout the study until some

point following Amnio at 16-17 weeks, probably following notification of normal test results at 19-20 weeks. Previous research into prenatal diagnosis has shown that anxiety does not abate until after the test results have been received and women are reassured that no abnormalities have been detected. (cf. Fava et al., 1983; Fava et al., 1984). This finding is also consistent with the report by Norton (1980) that therapeutic intervention was not effective in reducing anxiety among women awaiting Amnio. Anxiety among these women declined only after the results were received.

If the key to anxiety reduction is notification of normal results, CVS women, who receive their results near the end of the first trimester, experience a decline in anxiety a full eight weeks earlier, on average, than Amnio women, who receive their results near the middle of the second trimester. The potential importance of this difference derives support from work by Bibring (1959) and Klaus and Kennel (1976), who have described the first trimester of pregnancy as one of physical upset, emotional upheaval and pronounced mood swings, as the pregnant woman makes the initial adjustment to the change in her life. These authors described the second trimester as one of relative quiescence and stability, as physical symptoms subside, anxiety declines and the intial adustment process concludes. For the CVS women, prenatal testing would likely add to the emotional tumult during the first trimester, but the extent to which the increase in anxiety associated with the procedure

would be detrimental is difficult to determine. It could be that the increased stress of CVS might be offset by the early attention to the pregnancy, such as the viewing of the fetus through ultrasound. The fact that the entire process of first contact, prenatal testing and notification of results can be completed within a two-week span, before the pregnant woman experiences any physical sensations from the fetus, suggests that any CVS-induced increment in anxiety over the background level common during the first trimester may be minimal.

The women scheduled for Amnio typically find themselves anticipating the procedure with some apprehensiveness. The present results that show the long waiting period before Amnio to be one of sustained anxiety are supported by anecdotal reports that this period, which can span from as early as 8 weeks PMGA to 20 weeks PMGA, is one of concern and agitation. This period of sustained agitation is even more disturbing in view of Gorsuch and Key's (1972) finding that it is the anxiety experienced before the first five months of pregnancy that is predictive of obstetric complications. Anxiety among CVS women would have abated by the third month, while anxiety among Amnio women would persist until the fifth month, precisely the period of the highest risk.

In view of the conclusions of McDonald (1968) and Carlson and LaBarba (1979) that significant differences in anxiety exist between problem-free and complicated pregnancies and that anxiety may predispose expectant mothers to obstetric

complications, the present findings showing CVS to be the less-anxiety arousing procedure over the long term are of considerable interest. The substance of these findings must of course await validation from pregnancy-outcome and followup comparisons of the two procedures.

The physical risks to pregnancy that the respective procedures involve must also be considered. The importance of maternal anxiety must be weighed against the potential risks of the intervention itself. Should subsequent research confirm that CVS poses a greater physical risk to the pregnancy than Amnio, the importance of the earlier reduction in anxiety associated with CVS would be correspondingly reduced. However, should the physical risks prove to be equivalent for the two procedures, the potential for earlier anxiety reduction would be a substantive consideration in the choice of a prenatal diagnostic technique.

An additional consideration involves the SES of the women undergoing prenatal testing in the present study. It was noted in the previous section that 68 of the 74 women in the study reported annual family incomes in excess of $40,000. This points to a select group of women in this study who may be less likely than women of low SES to experience stressful life events during pregnancy and who are more likely to possess adaptive coping styles (Carlson & Labarba, 1979; Grossman et al., 1980). Higher SES women should report correspondingly less anxiety associated with the prenatal testing, hence the difference in anxiety

observed between CVS and Amnio women may be less in the present study than would be the case among a more representative group of women. If this assumption is accurate, the earlier reduction in anxiety provided by first-trimester diagnosis from CVS assumes even greater significance. The additional strain of waiting for Amnio may impose a serious emotional burden on an already over-taxed pregnant woman of low SES, increasing further the risk of obstetric complications.

It is not only the risk rate that rises among lower SES women. As Carlsen and LaBarba point out, the potential consequences of moderate obstetric complications are magnified among the socially-disadvantaged, to the extent that such complications have been shown to be predictive of later disturbances only among children raised in socially and economically deprived environments. No differences in later childhood have been reported between children from problem-free pregnancies and children who experienced mild to moderate prenatal and perinatal complications who were raised in socially and economically advantaged environments (Sameroff & Chandler, 1975). This is not to imply that obstetric complications resulting from maternal emotionality are of no significance among high SES women. Rather, it is to suggest that the development of children who are "at risk" from pregnancy complications is strongly-influenced by economic and social factors, and as more women of lower SES begin seeking prenatal diagnosis, maternal emotionality during pregnancy may become an

issue of increasing concern.

Depression

Results for depression revealed significant changes over time for both groups, and the group x time interaction was significant, showing that patterns of change over time for depression were different within each group. However, pairwise comparisons revealed that only the Amnio group showed a significant change in depression between adjacent measurement points, recording a decrease between Time pr. and Time 3. It is tempting to suggest that the Amnio group experienced more feelings of depression during the study, culminating in a sharp decline to a level equivalent to that of the CVS group at the final measurement point (Time 3). However, the failure to find significant differences in depression between the two groups at any of the comparable measurement points effectively negates this argument.

Pairwise comparisons showed that both the CVS and Amnio groups underwent a significant decline in depression from the intake measurement point (Time 1) to the conclusion (Time 3) of the study, but the absence of any consistent pattern of decrease for both groups or of any sharp decline in depression following prenatal testing suggests that the feelings of depression experienced by women in both groups were to a large extent governed by events external to the study itself. The present

findings are contrary to the results of Fava et al. (1983), who reported significant decreases in depression among women undergoing Amnio across three consecutive measurement points.

Hostility

The present findings for hostility show relatively little effect. Only the Amnio group reported significant changes in hostility over time, yet the group x time interaction between the two groups was not significant, showing that patterns of change over time for hostility did not differ between the two groups. Pairwise comparisons at adjacent measurement points revealed only one significant change, from Time pr. to Time 3 for the Amnio group. Again it is tempting to suggest that the Amnio group experienced greater feelings of hostility during the study, culminating in a significant decline to a level equivalent to that of the CVS group at Time 3. Once again, the failure to find significant differences in hostility between the two groups at any of the comparable measurement points negates this interpretation.

Pairwise comparisons from Time 1 to Time 3 for both groups also failed to obtain significance, providing further evidence that women in both groups underwent little change in hostility during the study. These results are in contrast to those of Fava et al. (1983), who reported significant reductions in hostility among women undergoing Amnio across the first two of three

measurement points, and from the first to the third measurement points. The present results are also inconsistent with those of Fava et al. (1984), who found even more pronounced reductions in hostility among women undergoing fetoscopy. Overall, the present results for hostility may be most parsimoniously interpreted as showing no effect.

Maternal Attachment

This section will integrate findings from both maternal attachment-self and maternal attachment-others. Results from the maternal attachment-self scale showed growing attachment to the fetus over time for both groups. Of particular interest was the significant increase in reported attachment by the CVS group from Time 1 to Time pr., while the Amnio group showed no significant change in attachment until later in the study, from Time 2 to Time pr. The times of the largest increases in maternal attachment-self favour the interpretation that women in the study experienced a significant boost in attachment either during or immediately after the successful conclusion of the prenatal testing, a change that was picked up by the assessment immediately following the procedure. This means that women in the CVS group experienced a significant increase in maternal attachment at the time of their prenatal testing, from 9-12 weeks PMGA, while women in the Amnio group did not reach a comparable level until the time of their procedure, at 16-17 weeks, a difference of six weeks on average. The difference in

attachment between the two groups is supported by the comparison at Time 2, which reveals the Amnio group to be significantly less attached than the CVS group at this measurement point.

This finding is consistent with a number of anecdotal reports from women undergoing Amnio (cf. Brewster, 1984) that maternal attachment is suppressed during the period prior to the procedure. To allow attachment to progress normally during this period would be to compound the sense of guilt and loss experienced should an abnormality be detected that required a decision regarding termination of the pregnancy.

Results for maternal attachment-others also bear upon this interpretation. The CVS group attributed no significant differences in maternal attachment to other women of equivalent PMGA at any of the four measurement points. The increasing pattern of other maternal attachment was congruent with their own developing attachment. The Amnio women however, attributed significant increments in the maternal attachment of other pregnant women of equivalent PMGAs from Time 1 to Time 2 and from Time 2 to Time pr. These women view others as becoming increasingly attached during a period when they themselves report no growth in attachment. By attributing greater attachment to others during the waiting peroid, women undergoing Amnio are acknowledging the suppression of their own maternal attachment.

The emotional reactions of Amnio women during the waiting period may all contribute to a feeling of "outcome apprehension." The sustained anxiety manifested by the Amnio women during this period appears to be a major feature of this apprehensiveness, as is the suppression of maternal attachment. Both these responses are likely to be aggravated by the detection of maternal movements by the mother. Fetal movements are particularly important in the development of attachment during the second trimester (quickening), and play an eliciting role in the attachment process that some Amnio women try to suppress.

The findings regarding reduced maternal attachment among the Amnio group are of concern for at least three reasons. First, attachment suppression may deprive women of the joy of pregnancy (assuming the pregnancy is wanted) during the second trimester, a time when the pleasurable aspects of pregnancy may be at their highest. For many pregnant women, this is a period of declining anxiety (Lubin et al., 1975) and increasing closeness to the fetus (Klaus & Kennel, 1976). Second, women who suppress their attachment appear to be less inclined to reveal or discuss their pregnancies with those individuals who form their social support systems (Cox, 1986). This would suggest that during a period of elevated anxiety and concern, these women would not be able to rely on friends and family for emotional and tangible support. Third, there is the potential for suppressed prenatal attachment to adversely affect the development of postnatal attachment.

Shereshefsky et al. (1974) found that adaptation to pregnancy is a strong indicator of postnatal maternal adaptation. They reported that among other factors, the ability to visualize one's self as a mother and to find satisfaction in the nurturing role were predictive of good maternal adaptation. The suppression of prenatal maternal attachment does not directly preclude the occurrence of these predictor responses, but it may interfere with the ability of some women to see themselves as nurturing mothers.

In a similar vein, Cohen (1966) argued that any stress during pregnancy that leaves the mother feeling unloved, unsupported, or which is potentially threatening to the health and safety of either the fetus or the mother may delay preparation for motherhood and retard attachment. The outcome apprehension experienced by women awaiting Amnio must certainly involve health and safety concerns for themselves, their fetuses, or both. Because Amnio women share these concerns with the women in Cohen's study, they may be at similar risk for delayed preparation for motherhood or slowed attachment. Cohen cited several events during the second trimester, such as increased emotionality or failure to develop feelings of closeness to the fetus that suggest rejection of the pregnancy and hence poor maternal adaptation. While there is nothing to suggest that women awaiting Amnio actually "reject" their pregnancies,[1] the presence of increased emotionality and

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[1]indeed, the seeking of prenatal diagnosis may be viewed by some as strong evidence of involvement and protectiveness

suppressed maternal attachment provoke some concern for the later adaptation. This may not be a pronounced concern with the present sample of high SES women, but again, as more women of lower SES begin seeking prenatal diagnoses, the greater economic and social pressures faced by many of these women will contribute to concerns about retardation or failure of the attachment process.

Additional support comes from a study by Kezur (1978), who reported that among his small sample of pregnant women (none of whom underwent prenatal diagnoses), those who experienced feelings of maternal attachment prenatally also reported a smooth and pleasureable progression of attachment during the birth and postnatal periods. None of the women who experienced problematic postnatal attachments had reported feelings of prenatal attachment. Because the emergence of maternal attachment during the prenatal period, especially during the second trimester, may presage the development of sound postnatal attachment, the potential of Amnio to retard or interfere with the development of prenatal maternal attachment must be weighed carefully in any decision between the two diagnostic procedures.

Concern about Abortion

The Concern about Abortion Questionnaire asked the respondent to imagine a situation in which her prenatal diagnosis was positive, forcing her to confront the prospect of

abortion. It was not known whether differences would occur in the comparisons from Time 1 to Time pr., but it was expected that at Time pr., the Amnio group would report greater concern about abortion than the CVS group. None of the comparisons attained significance. This appears at first to be a surprising finding, since the abortion procedure following CVS is simpler, safer and less-painful than the procedure following Amnio. For this reason alone it might be expected that CVS women would report less concern about abortion at Time pr. When the early administration of this measure (corresponding to the earlier prenatal test) for the CVS group versus the later administration for the Amnio group is also considered, less concern about abortion by CVS women seems even more likely. Because women undergoing Amnio must endure a longer waiting period, during which outcome apprehension may promote negative feelings about the procedure and exacerbate fears for an abnormal fetus, it was expected that the later occurrence of the Amnio procedure and hence administration of the questionnaire would further heighten concerns about abortion among the Amnio women.

There are at least two plausible explanations for the failure to find differences in concern about abortion between the two groups. The first of these has to do with the questionnaire itself. The imaginal situation presented did not distinguish between first and second trimester abortion, but simply focused women's attention on the possibility of abnormal test results, followed by the need to consider abortion. This

probably accentuated the aspect of "loss" associated with abortion while failing to bring to awareness the differences both in the procedures themselves and in the disparate rates of maternal risk associated with first versus second trimester abortion.

Overall, the questionnaire may well have had the effect of potentiating the respondent's existing concerns about the possibility of abortion, resulting in elevated reports from all respondents on this measure. The mean scores observed at all measurement points for this measure were in fact very high. Further support for this account was provided anecdotally by a small number of women in the study who expressed a strong negative reaction to the Concern about Abortion Questionnaire. Indeed, one subject pushed the form aside and refused to complete it.

Additional support for this explanation comes indirectly from a study by Norton (1980), who reported that attempts to therapeutically reduce anxiety among women awaiting Amnio had the paradoxical effect of increasing their anxiety. Norton suggested that the therapy had disrupted a "minimizing" coping style that these women employed to reduce their assessments of the risks involved. The therapy disrupted this coping strategy by making the risks more salient. In the present study, women may also have minimized the possibility of having an affected child and the need for termination, a strategy that was momentarily disrupted by the Concern about Abortion

Questionnaire.

The other possible explanation for the failure to find differences between the two groups has to do with the time of administration. No differences would be expected at Time 1, just prior to randomization into the study. The second measurement for both groups at Time pr. followed closely the diagnostic procedure, which itself would focus the women's awareness of the risks involved in prenatal testing and the possibility of subsequent termination of the pregnancy. The administration of the questionnaire would further intensify their concerns, hence the elevated scores at this measurement point. In short, this is not a time when these women are likely to make an objective appraisal of the advantages of one type of abortion procedure over another.

That women would find the possibility of termination following Amnio more emotionally disturbing than termination following CVS still seems a plausible hypothesis. It is suggested that either a different format for the questionnaire, different assessment times, or both, may be required to effectively assess this difference.

Procedure Discomfort

It was not known at the outset of the study which diagnostic procedure women would find more uncomfortable. The image of a relatively large Amnio needle being inserted through the abdomen

is an evocative one among both patients and non-patients alike, and some women awaiting Amnio are quite fearful of this feature of the procedure, judging from their inquiries to the nursing staff. However, CVS women have reported that the experience of trans-cervical catheter-insertion while in the lithotomy position is both uncomfortable and embarrassing (C. Ganshorn, personal communication, September, 1985).

Results for procedure discomfort quite clearly showed that women found the discomfort associated with CVS to be much less than that associated with Amnio. However, the outcome apprehension experienced by Amnio women during their longer waiting periods may well have compounded the feelings of discomfort they ultimately experienced. The lack of equivalence in PMGA between women undergoing Amnio and those undergoing CVS precludes an unbiased comparison of procedure discomfort, but the magnitude of the difference ($p = .002$) appears to be great enough to outweigh concerns about the confounding influence of the non-comparable intervention times.

Summary and Conclusion

In summary, pregnant women who underwent CVS reported an earlier reduction in anxiety, earlier development of maternal attachment, and less discomfort from their procedures than women who underwent Amnio. Findings for anxiety are of interest because of evidence linking prenatal maternal anxiety to a

number of obstetric complications and abnormal developmental sequelae. Findings for prenatal maternal attachment that point to a suppression in the development of attachment to the developing fetus during the second trimester by women awaiting Amnio are of interest for at least three reasons. Attachment suppression may 1) deprive these women of the joy of a wanted pregnancy during a period when pleasurable feelings may be most likely to occur, 2) cause the woman to suppress information about her pregnancy, limiting the involvement of individuals who comprise her social support system, and 3) lead to problems with later, postnatal attachment between mother and infant. On the basis of reported procedure discomfort, pregnant women prefer CVS to Amnio, although further investigation of patient satisfaction with these two procedures will be required to fully evaluate this comparison.

Followup and longitudinal research with a large sample of children is needed to determine whether the varying levels of anxiety between the CVS and Amnio groups actually result in differences in obstetric outcome, infant and child development and postnatal maternal attachment. In addition, the inclusion of a non-test control group matched for age, SES and obstetric risk would provide needed information about the course of anxiety and maternal attachment among women who do not undergo prenatal testing.

The present findings regarding anxiety, prenatal maternal attachment and procedure discomfort provide a preliminary

indication that given equivalent procedural risks for both CVS and Amnio, CVS appears to be the prenatal diagnostic procedure of choice.

APPENDIX A

Specimen Set of Questionnaires

(Excluding the Mood-Affect Adjective Checklist)

Group Code_____

Patient Code_____

BACKGROUND INFORMATION

Name_____

Address_____

_____

Telephone_____

Date_____

Your age at the time of amniocentesis or chorion villi sampling (CVS)?_____

Reproductive history:

How many children do you have?_____

How many previous pregnancies have you had?_____

How many previous miscarriages, abortions and stillbirths have you had in total?_____

Occupation:

Mother_____ Father_____

Annual Family Income (circle one):

under $10,000	10,000 to 20,000	20,000 to 30,000	30,000 to 40,000	over 40,000

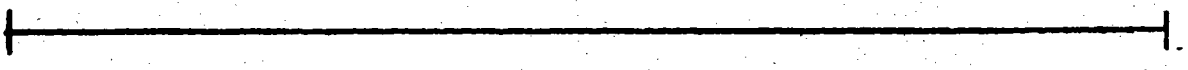
Living Arrangement:

Are the mother and father living together?_____

Maternal Attachment to Fetus Form (MAFF)

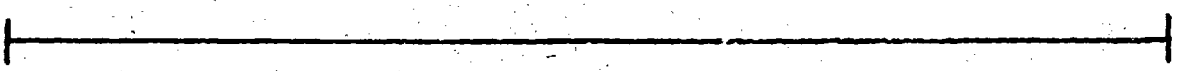
On each of the two lines below, please mark an "X" at a point that best describes your feelings.

1. How close do you feel to your baby now - today?



not at all close — extremely close

2. How close do you think other women in a similar situation would feel to their babies now - today?



not at all close — extremely close

Concern about Abortion Questionnaire (CAQ)

As you are aware, there is a small chance that the results of your prenatal test will reveal that your baby has a genetic disorder. Although it is unlikely to happen, we would like you to try to imagine that this has occurred in your case. You might find that closing your eyes briefly will help you make the scene more vivid. Try to be aware of how you think you would react to this situation and then complete the following scales based on your feelings concerning the event.

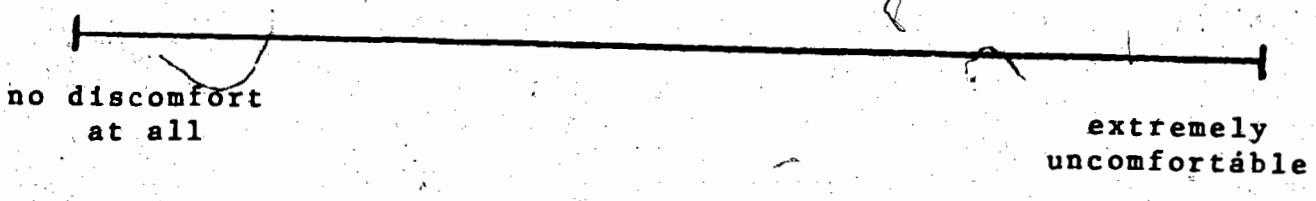
YOU HAVE JUST LEARNED THAT YOUR BABY HAS A GENETIC DISORDER. A DOCTOR OR COUNSELLOR IS DISCUSSING THE POSSIBILITY OF TERMINATING YOUR PREGNANCY THROUGH ABORTION. HOW DO YOU FEEL?

	not at all	somewhat	moderately	very much
calm	1	2	3	4
secure	1	2	3	4
tense	1	2	3	4
strained	1	2	3	4
at ease	1	2	3	4
upset	1	2	3	4
satisfied	1	2	3	4
frightened	1	2	3	4
comfortable	1	2	3	4
self-confident	1	2	3	4
nervous	1	2	3	4
jittery	1	2	3	4
indecisive	1	2	3	4
relaxed	1	2	3	4
content	1	2	3	4
worried	1	2	3	4
confused	1	2	3	4
steady	1	2	3	4

Procedure Discomfort Scale (PDS)

CVS Group

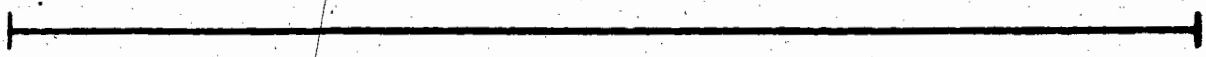
Having just undergone CVS, please mark an "X" on the line below at a point that best describes your feelings during the procedure.



Procedure Discomfort Scale (PDS)

Amnio Group

Having just undergone amniocentesis, please mark an "X" on the line below at a point that best describes your feelings during the procedure.



no discomfort at all

extremely uncomfortable

Followup Questionnaire

Is there anything you would like to have changed?_____

_____

_____

_____

Would you plan to have another child if possible? Yes_____ No _____

If "yes," would you want prenatal testing again? Yes_____ No_____

If "yes," which type would you prefer?

amniocentesis_____

chorion villi sampling_____

If "no," what is the reason for you decision?_____

_____

Is there anything else you'd like to add concerning your genetic counselling, prenatal testing, feelings toward your baby, your present condition or any other topic?_____

_____

_____

_____

APPENDIX B

Summary of Analyses

Analyses of Variance

for Background Variables

Name	Source	df	ϵ	MS	F	p
Age	Group	2		20.37	1.56	.22
	Error	70		13.06		
Number of Children	Group	2		.48	.27	.76
	Error	70		1.78		
Fetal Loss	Group	2		1.38	.94	.40
	Error	70		1.48		

* Results are significant

**Results are significant after correction for multiplicity

Analyses of Variance for Anxiety

Name	Source	df	ε	MS	F	p
CVS:	Time	3	.78	96.11	10.52	.0001*
T1,Tpr.,T2,T3	Error	60		9.13		
CVS:	Time	1		.07	.01	.91
T1 vs. Tpr.	Error	27		5.85		
CVS:	Time	1		135.67	9.45	.006**
Tpr. vs. T2	Error	22		14.36		
CVS:	Time	1		7.71	2.13	.16
T2 vs. T3	Error	20		3.61		
Amnio:	Time	3	1.0	90.92	18.68	.0000*
T1,T2,Tpr.,T3	Error	63		4.87		
Amnio:	Time	1		.43	.11	.74
T1 vs. T2	Error	28		3.86		

* Results are significant

**Results are significant after correction for multiplicity

Name	Source	df	ϵ	MS	F	p
Amnio:	Time	1		5.12	1.06	.31
T2 vs. Tpr.	Error	24		4.83		
Amnio:	Time	1		231.84	39.37	.0000**
Tpr. vs T3	Error	21		5.89		
CVS, Amnio,	Group	2		.06	.00	.99
Non-Part.: T1	Error	71		14.25		
CVS vs. Amnio:	Gp x Tm	2	1.0	34.98	5.55	.006*
T1,T2,T3	Error	82		6.30		
CVS vs. Amnio:	Group	1		.00	.00	.99
T1	Error	59		14.80		
CVS vs. Amnio:	Group	1		137.02	10.02	.002**
T2	Error	50		13.68		
CVS vs. Amnio:	Group	1		4.56	.86	.36
T3	Error	41		5.30		

* Results are significant

**Results are significant after correction for multiplicity

Name	Source	df	ϵ	MS	F	p
CVS attrition: T1	Group	3		44.23	2.71	.07
	Error	25		16.30		
CVS attrition: Tpr.	Group	2		73.75	4.14	.03*
	Error	25		17.80		
CVS attrition: T2	Group	1		28.87	2.41	.14
	Error	21		11.99		
Amnio attrition: T1	Group	3		19.74	2.02	.13
	Error	28		9.77		
Amnio attrition: T2	Group	2		9.25	.62	.54
	Error	26		14.81		
Amnio attrition: Tpr.	Group	1		33.76	3.00	.10
	Error	23		11.24		

* Results are significant

**Results are significant after correction for multiplicity

Analyses of Variance

for Depression

Name	Source	df	ε	MS	F	p
CVS:	Time	3	.82	38.30	3.39	.03*
T1,Tpr.,T2,T3	Error	60		9.13		
CVS:	Time	1		2.57	.21	.65
T1 vs. Tpr.	Error	27		12.31		
CVS:	Time	1		28.17	1.69	.21
Tpr. vs. T2	Error	22		16.67		
CVS:	Time	1		17.36	3.94	.06
T2 vs. T3	Error	20		4.41		
CVS:	Time	1		100.60	8.53	.009**
T1 vs. T3	Error	20		11.80		
Amnio:	Time	3	.89	83.32	11.70	.0000*
T1,T2,Tpr.,T3	Error	63		7.12		

* Results are significant

**Results are significant after correction for multiplicity

Name	Source	df	ε	MS	F	p
Amnio:	Time	1		6.90	1.74	.20
T1 vs. T2	Error	28		3.97		
Amnio:	Time	1		2.42	.56	.46
T2 vs. Tpr.	Error	24		4.30		
Amnio:	Time	1		209.45	23.45	.0001**
Tpr. vs T3	Error	21		8.93		
Amnio:	Time	1		99.00	13.68	.001**
T1 vs. T3	Error	21		7.24		
CVS, Amnio,	Group	2		11.20	.51	.61
Non-Part.: T1	Error	71		22.13		
CVS vs. Amnio:	Gp x Tm	2	.93	23.87	3.45	.04*
T1,T2,T3	Error	82		6.93		
CVS vs. Amnio:	Group	1		.21	.01	.92
T1	Error	59		19.91		

* Results are significant

**Results are significant after correction for multiplicity

Name	Source	df	ϵ	MS	F	p
CVS vs. Amnio: T2	Group	1		51.55	2.87	.10
	Error	50		17.83		
CVS vs. Amnio: T3	Group	1		.00	.00	1.0
	Error	41		14.03		
CVS attrition: T1	Group	3		44.12	2.72	.07
	Error	25		16.22		
CVS attrition: Tpr.	Group	2		18.83	.89	.42
	Error	25		21.22		
CVS attrition: T2	Group	1		1.57	.08	.78
	Error	21		19.98		
Amnio attrition: T1	Group	3		17.62	.84	.48
	Error	28		20.86		
Amnio attrition: T2	Group	2		42.09	2.83	.08
	Error	26		14.86		

* Results are significant

**Results are significant after correction for multiplicity

Name	Source	df	ε	MS	F	p
Amnio	Group	1		111.54	4.77	.04*
attrition: Tpr.	Error	23		23.37		

* Results are significant

**Results are significant after correction for multiplicity

Analyses of Variance for Hostility

Name	Source	df	ϵ	MS	F	p
CVS:	Time	3	.82	6.63	1.30	.28
T1,Tpr.,T2,T3	Error	60		5.11		
CVS:	Time	1		.07	.02	.89
T1 vs. Tpr.	Error	27		3.74		
CVS:	Time	1		1.07	.15	.70
Tpr. vs. T2	Error	22		7.11		
CVS:	Time	1		7.71	2.69	.12
T2 vs. T3	Error	20		2.86		
CVS:	Time	1		14.88	4.21	.05
T1 vs. T3	Error	20		3.53		
Amnio:	Time	3	.82	20.76	4.11	.02*
T1,T2,Tpr.,T3	Error	63		5.05		

* Results are significant

**Results are significant after correction for multiplicity

Name	Source	df	ε	MS	F	p
Amnio:	Time	1		11.66	2.50	.12
T1 vs. T2	Error	28		4.66		
Amnio:	Time	1		2.00	.77	.39
T2 vs. Tpr.	Error	24		2.58		
Amnio:	Time	1		32.82	6.43	.02
Tpr. vs T3	Error	21		5.10		
Amnio:	Time	1		10.02	2.68	.12
T1 vs, T3	Error	21		3.74		
CVS, Amnio,	Group	2		6.57	.90	.41
Non-Part.: T1	Error	71		7.29		
CVS vs. Amnio:	Gp x Tm	2	.96	8.08	1.52	.23
T1,T2,T3	Error	82		5.31		
CVS vs. Amnio:	Group	1		.74	.11	.74
T1	Error	59		6.64		

* Results are significant

**Results are significant after correction for multiplicity

Name	Source	df	ϵ	MS	F	p
CVS vs. Amnio: T2	Group	1		14.01	.96	.33
	Error	50		14.64		
CVS vs. Amnio: T3	Group	1		1.51	.21	.65
	Error	41		7.03		
CVS attrition: T1	Group	3		8.27	1.22	.32
	Error	25		6.79		
CVS attrition: Tpr.	Group	2		9.50	1.08	.36
	Error	25		8.81		
CVS attrition: T2	Group	1		6.46	.47	.50
	Error	21		13.78		
Amnio attrition: T1	Group	3		1.42	.21	.89
	Error	28		6.90		
Amnio attrition: T2	Group	2		18.82	1.23	.21
	Error	26		15.33		

* Results are significant

**Results are significant after correction for multiplicity

Name	Source	df	ε	MS	F	p
Amnio	Group	1		21.65	1.70	.21
attrition: Tpr.	Error	23		12.72		

* Results are significant

**Results are significant after correction for multiplicity

Analyses of Variance for Maternal Attachment-Self

Name	Source	df	ϵ	MS	F	p
CVS:	Time	3	.92	108.46	31.65	.0000*
T1,Tpr.,T2,T3	Error	60		3.43		
CVS:	Time	1		64.29	20.49	.0001**
T1 vs. Tpr.	Error	27		3.14		
CVS:	Time	1		12.52	5.25	.03
Tpr. vs. T2	Error	22		2.39		
CVS:	Time	1		52.60	22.91	.0001**
T2 vs. T3	Error	20		2.30		
Amnio:	Time	3	.71	186.59	36.45	.0000*
T1,T2,Tpr.,T3	Error	63		5.12		
Amnio:	Time	1		11.66	5.50	.03
T1 vs. T2	Error	28		2.12		

* Results are significant

**Results are significant after correction for multiplicity

Name	Source	df	ϵ	MS	F	p
Amnio:	Time	1		62.72	19.48	.0002**
T2 vs. Tpr.	Error	24		3.22		
Amnio:	Time	1		114.57	32.11	.0000**
Tpr. vs T3	Error	21		3.57		
CVS, Amnio,	Group	2		.49	.03	.97
Non-Part.: T1	Error	71		15.45		
CVS vs. Amnio:	Gp x Tm	2	.82	29.53	7.00	.003*
T1,T2,T3	Error	82		4.22		
CVS vs. Amnio:	Group	1		.62	.04	.83
T1	Error	59		14.06		
CVS vs. Amnio:	Group	1		92.68	7.37	.009**
T2	Error	50		12.58		
CVS vs. Amnio:	Group	1		1.37	.19	.67
T3	Error	41		7.27		

* Results are significant

**Results are significant after correction for multiplicity

Name	Source	df	ϵ	MS	F	p
CVS attrition: T1	Group	3		6.09	.48	.70
	Error	25		12.79		
CVS attrition: Tpr.	Group	2		1.90	.14	.87
	Error	25		14.01		
CVS attrition: T2	Group	1		1.49	.13	.72
	Error	21		15.21		
Amnio attrition: T1	Group	3		21.87	1.44	.25
	Error	28		15.21		
Amnio attrition: T2	Group	2		4.02	.28	.76
	Error	26		14.52		
Amnio attrition: Tpr.	Group	1		5.13	.36	.55
	Error	23		14.25		

* Results are significant

**Results are significant after correction for multiplicity

Analyses of Variance

for Maternal Attachment-Others

Name	Source	df	ϵ	MS	F	p
CVS:	Time	3	.95	55.57	15.65	.0000*
T1,Tpr.,T2,T3	Error	51		3.54		
CVS:	Time	1		40.69	10.14	.004**
T1 vs. Tpr.	Error	25		4.01		
CVS:	Time	1		7.60	2.69	.12
Tpr. vs. T2	Error	18		2.83		
CVS:	Time	1		25.00	15.74	.001**
T2 vs. T3	Error	17		1.59		
Amnio:	Time	3	.90	134.14	28.43	.0000*
T1,T2,Tpr.,T3	Error	60		4.70		
Amnio:	Time	1		66.45	21.09	.0001**
T1 vs. T2	Error	27		3.15		

* Results are significant

**Results are significant after correction for multiplicity

Name	Source	df	ϵ	MS	F	p
Amnio: T2 vs. Tpr.	Time	1		67.69	25.60	.0000**
	Error	23		2.64		
Amnio: Tpr. vs T3	Time	1		30.86	5.93	.02
	Error	20		5.21		
CVS: self vs. others, T1	Group	1		5.35	.73	.40
	Error	26				
CVS: self vs. others, Tpr.	Group	1		.48	.13	.72
	Error	25		3.68		
CVS: self vs. others, T2	Group	1		1.68	.94	.35
	Error	18		1.79		
CVS: self vs. others, T3	Group	1		.25	.22	.65
	Error	17		1.12		
Amnio: self vs. others, T1	Group	1		2.32	.61	.44
	Error	30		3.79		

* Results are significant

**Results are significant after correction for multiplicity

Name	Source	df	ε	MS	F	p
Amnio: self vs. others, T2	Group	1		41.14	7.84	.009**
	Error	27		5.18		
Amnio: self vs. others, Tpr.	Group	1		17.52	5.30	.03
	Error	23		3.30		
Amnio: self vs. others, T3	Group	1		3.43	1.0	.33
	Error	20		3.42		
CVS, Amnio, Non-Part.: T1	Group	2		1.81	.11	.89
	Error	68		15.95		
CVS vs. Amnio: T1,T2,T3	Gp x Tm	2	.89	14.54	3.91	.03*
	Error	74		3.72		
CVS vs. Amnio: T1	Group	1		3.04	.21	.65
	Error	56		14.45		
CVS vs. Amnio: T2	Group	1		49.36	4.37	.04
	Error	45		11.29		

* Results are significant

**Results are significant after correction for multiplicity

Name	Source	df	ε	MS	F	p
CVS vs. Amnio: T3	Group	1		1.37	.19	.67
	Error	37		7.27		
CVS attrition: T1	Group	3		15.51	1.04	.40
	Error	22		14.96		
CVS attrition: Tpr.	Group	2		12.00	1.03	.37
	Error	22		11.63		
CVS attrition: T2	Group	1		Analysis precluded by zero variance		
	Error	18				
Amnio attrition: T1	Group	3		15.13	1.09	.37
	Error	27		13.83		
Amnio attrition: T2	Group	2		43.30	3.81	.03*
	Error	25		11.37		
Amnio attrition: Tpr.	Group	1		35.29	3.10	.09
	Error	22		11.39		

* Results are significant

**Results are significant after correction for multiplicity

Analyses of Variance

for Concern about Abortion

Name	Source	df	ϵ	MS	F	p
CVS:	Time	1		24.45	1.51	.23
T1 vs. Tpr.	Error	27		16.15		
Amnio:	Time	1		25.52	3.54	.07
T1 vs. Tpr.	Error	23		7.22		
CVS, Amnio,	Group	2		24.38	.41	.67
Non-Part.: T1	Error	70		60.14		
CVS vs. Amnio:	Group	1		1.76	.03	.86
T1	Error	58		58.30		
CVS vs. Amnio:	Group	1		125.72	2.60	.11
Tpr.	Error	50		48.34		

* Results are significant

**Results are significant after correction for multiplicity

Analysis of Variance
for Procedure Discomfort

Name	Source	df	SS	MS	F	p
CVS vs. Amnio: Tpr.	Group	1		129.98	10.58	.002*
	Error	51		12.28		

* Results are significant

**Results are significant after correction for multiplicity

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