Clinical review of home uterine activity monitoring (HUAM)

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Preterm birth is associated with significant neonatal mortality and morbidity nationwide. Multiple strategies have been used to attempt to reduce the incidence of preterm births, and none have been entirely successful. The current review contains assessment of recent literature and home uterine activity monitoring. It also makes some suggestions about how and when this diagnostic modality may be used in current obstetric practice.

(Key words: home uterine activity monitoring, preterm birth, pregnancy)

It has long been recognized that preterm birth occurring before 37 weeks has been a significant factor in perinatal mortality and morbidity.\(^1\)\(^-\)\(^3\) Despite a decline in neonatal mortality during the past 20 years, preterm birth affects more than 350,000 babies each year in the United States, and these births contribute to approximately 85% of all neonatal deaths.\(^2\)\(^-\)\(^4\)\(^-\)\(^7\) Low-birth-weight babies account for 60% of all infant mortality, even though they account for less than 7% of the total births. In spite of spending more money on healthcare than any other nation, the United States ranks below 22 other industrialized countries in the rate of infant mortality. Every low-birth-weight infant (<2500 g) costs the United States healthcare system approximately $14,000 to $30,000.\(^8\) For very-low-birth-weight infants (<1500 g), these costs can approach millions. Neonatal intensive care costs in the United States alone exceed $5 billion yearly.\(^9\) Despite many advancements in perinatal care, the incidence of preterm labor and subsequent early or low-birth-weight delivery has essentially remained unchanged.\(^4\)

Reliable and accurate screening systems for the prediction of premature birth have so far been elusive. Consequently, attention has been focused on the detection and management of preterm labor, which can lead to preterm birth. Thus, much effort has been put forth to accurately detect and effectively manage the occurrence of preterm labor.

The effects of tocolytic and other therapy in arresting preterm labor and preventing preterm birth have been limited, because up to 80% of patients in whom preterm labor develops do not seek medical attention until they have ruptured membranes or advanced cervical dilation or both. Successful tocolysis is unlikely after advanced cervical dilation or effacement.\(^10\)\(^-\)\(^12\) For these reasons, the importance of early detection of less-advanced preterm labor has been emphasized.

The early detection of preterm labor has been the focus of a number of preterm birth prevention programs that incorporate the identification of patients at high risk, patient education, self-palpation for uterine contractions, and frequent cervical examinations.\(^13\) Several studies have found this approach to be successful in increasing the proportion of patients with preterm labor who seek care while they are still favorable for tocolytic suppression.\(^13\)\(^-\)\(^16\) These programs, however, have not been uniformly successful.\(^17\)\(^,\)\(^18\) Contributing to the failure of some of these programs is the fact that uterine activity associated with preterm labor often is not accurately perceived by the patient.\(^19\)\(^-\)\(^21\)

In an effort to improve the early detection of preterm labor, a system of care utilizing a home uterine activity monitor...
was developed to extend the benefits of uterine activity monitoring used in the hospital to the home environment. Uterine activity monitoring used in the home allows for early detection of preterm uterine contractions without the patient’s having to be hospitalized.

Some controversy has surrounded the use of this technology, mostly stemming from the unrealistic expectation that it alone would prevent premature birth. In 1991, the US Food and Drug Administration (FDA) approved the home uterine activity monitor manufactured by Physiologic Diagnostic Services (Atlanta, Ga) as a safe and effective method for early detection of preterm labor in women with a history of preterm birth. Approval was not based on the ability of the device to prevent preterm birth. The device was approved because the FDA believed that the home uterine activity monitor had value in its ability to detect uterine contractions indicative of the onset of preterm labor.22 Subsequent FDA approvals for the other home uterine activity monitoring (HUAM) devices occurred in 1995. Studies have shown that appropriate treatment of preterm labor at less-advanced cervical dilation prolongs pregnancy and therefore improves neonatal outcomes.

Importance of early detection
Early detection and treatment of preterm labor has been recognized as key factors in the prevention of preterm births. Each year, more than 400,000 women have preterm labor and are candidates for tocolytic therapy. If preterm labor is inhibited, the patient may be discharged from the hospital to a comprehensive obstetric care program, which includes HUAM combined with frequent nursing-initiated contact with the patient. The success of tocolytic therapy in inhibiting labor is highly dependent on the status of the cervix at the initiation of tocolysis. Unfortunately, studies have indicated that 70% to 80% of women in whom preterm labor develops are seen only after they have ruptured membranes or advanced cervical dilation, making successful long-term tocolysis unlikely.11,12,23

One of the major factors limiting the effectiveness of a preterm-birth-prevention program is an inability to identify labor early enough to initiate effective tocolytic therapy. The failure of tocolytic agents to significantly decrease the number of preterm deliveries may be due in part to this failure to recognize preterm labor early (before advanced cervical change), leading to either ineffective tocolytic therapy or no treatment at all.

Clinical studies have demonstrated that daily HUAM in high-risk patients increases the proportion of patients with preterm labor who seek care while still favorable for tocolytic suppression, thus resulting in a decrease in the incidence of preterm births.24-26 These studies have also demonstrated that a home uterine activity monitor is a more reliable method of quantifying contractions than is self-palpation and allows earlier detection of the onset of preterm labor.

Effect of prolongation of pregnancy
Prolongation of gestation in a pregnancy complicated by preterm labor should be a primary goal of any prematurity-prevention program. Clinicians universally agree on the importance of extending gestation to a more advanced gestational age at which neonatal morbidity and mortality will be reduced. Robertson and associates26 recently documented the decline in the incidence of neonatal morbidity and mortality with advancing gestational age at birth in a sample of 20,680 pregnancies from centers across the United States. Morrison and colleagues27 proposed a gestational-age model for predicting the increase in neonatal hospital days with earlier gestational age at birth. They found that women receiving HUAM had less cervical dilation at the diagnosis of preterm labor than did women who were not monitored. Women receiving HUAM had significantly greater prolongation of pregnancy and had infants of greater birth weight, fewer days in the neonatal intensive care unit (NICU), and fewer babies requiring oxygen therapy and mechanical ventilation.28 With NICU costs ranging from $1,500 to $3,000 per day, costs of these interventions are significant. Thus, prolongation of pregnancy, not simply a narrowly defined preterm birth rate, should be of prime consideration in evaluating programs for improving neonatal outcomes.

The HUAM system of care
The HUAM device was developed to extend the benefits of objective monitoring of preterm uterine contraction activity normally found in the physician’s office or hospital to the patient’s home environment. A HUAM system of care was developed to support the monitoring of preterm uterine contraction activity at home with patient education, daily provider-initiated contact, and 24-hour/7-days-a-week nursing or provider support for these services.

Home uterine activity monitoring does not prevent preterm labor or delivery; it provides supplemental education to the patient and clinical data to the physician in an effort to prolong gestation and maximize pregnancy outcomes through appropriate clinical interventions. The system is intended to augment the usual high-risk obstetric care prescribed for these patients by their obstetrician. It utilizes obstetric nursing for education, daily patient assessment, data collection, data interpretation, data archiving, and a variety of technologies for the accurate collection of data from the patient’s home. The system is designed to provide:

- In-depth and ongoing patient and family education concerning the patient’s pregnancy and her clinical condition;
- Daily patient assessment;
- Detection of uterine activity that may be indicative of the onset of preterm labor in select at-risk patients and to alert the clinician to the need for prompt medical attention; and
- Timely, objective, and subjective clinical information to the clinician for the assessment of individual patient response to prescribed modes of therapy and to make appropriate modifications to these pre- prescribed therapeutic regimens, such as bed rest and tocolytics.

One component of HUAM is a home uterine activity monitor, which has been previously found to be more reliable than patient self-palpation in detecting preterm uterine contractions.19,21

Review of clinical trials
Early detection of preterm labor
Recent studies utilizing tocodynamometry have confirmed that there is an identifiable increase in uterine contractions before the onset of preterm labor24,29-31 and that these prodromal contractions may not be recognized by the patient.24 Nageotte and colleagues31 reported that increased uterine activity is associated with a significant number of women having preterm labor. Uterine activity was documented in two study groups compared by gestational week. Patients destined for preterm...
labor had a significantly higher contraction frequency than patients destined for spontaneous labor at term.

**Patient perception of preterm uterine contractions**

Uterine self-palpation, although advocated by some investigators, has limited efficacy in the detection of preterm contractions. Pregnant patients at risk for preterm labor perceive only 8% to 17% of preterm uterine contractions, \(^{19,21}\) and patient educational programs do not appear to improve the perception of uterine activity.\(^{20}\)

Newman and colleagues\(^{19}\) reported on patient perception of uterine activity in 44 women at high risk for preterm labor. All patients received instruction in self-detection of uterine activity and were given a tocodynamometer designed for overnight use. Patients detected only 15% of their preterm uterine contractions during the study. The authors concluded, “self-detection of uterine activity may not be reliable as the only means for the earliest detection of uterine activity.”\(^{19}\)

Brustman and associates\(^{20}\) confirmed the result of the Newman study in a prospective study of 38 high-risk women monitored at home for uterine activity during a 21-day period. Patients received education on self-palpation of uterine activity at initiation of the study and each 3 days thereafter. The study found, “patients perceived fewer than 10% of all contractions documented electronically,” despite repeated education in self-palpation.\(^{20}\)

Beckmann and coworkers\(^{21}\) conducted a retrospective study of 778 patients at risk for preterm labor who received self-palpation instruction and HUAM services. The objective of the study was to determine the accuracy of maternal perception of preterm uterine contractions. Women correctly identified only 17.4% of contractions throughout pregnancy, but they incorrectly identified contractions 44.6% of the time. The study, confirming the result of both the Newman and Brustman studies, concluded, “self-palpation is not a reliable tool for identification of uterine contractions in women at risk for preterm labor.”\(^{21}\)

Goldenberg and associates\(^{33}\) reported on the Alabama Preterm Birth Prevention Project in which high-risk patients in the treatment group received increased care, including weekly education about the signs and symptoms of preterm labor. They were compared with a similar group of high-risk patients that received standard high-risk prenatal care. The study found that education of the patients on self-palpation combined with more frequent provider contact did not improve obstetric outcomes. The authors concluded, “there were...no significant differences in mean birthweight, mean gestational age, or preterm delivery rate between the two groups.”\(^{33}\)

Iams and colleagues,\(^{24}\) in a prospective trial of 51 women in whom preterm labor developed while using an ambulatory tocodynamometer found, ...

...ambulatory monitoring provides additional valuable information not available to women using self-palpation...in the current analysis, subjects reporting symptoms alone had the highest rate of tocolytic failure, related to the advanced cervical dilatation at entry...subjects identified on the basis of uterine activity (use of a home uterine activity monitoring device) did much better in that respect.

All patients enrolled in the Iams study received self-palpation instruction, daily nursing contact, and use of an ambulatory tocodynamometer. In 24% of the patients, preterm labor developed, identified by the uterine activity monitoring device alone.\(^{34}\)

Martin and colleagues,\(^{35}\) replicating the 1990 Iams study, in a prospective, multicenter, randomized trial of 155 women at risk of early labor, reported, Studies continue to support the inaccuracies of self-palpation of uterine contractions...given that...the perception of these contractions is often incorrect, it is appropriate that we provide objective surveillance of uterine activity for women at high risk of preterm labor.

All patients in the Martin study received self-palpation instruction, daily nursing contact, and used an ambulatory tocodynamometer. Increased uterine activity was detected by the monitor, without patient-reported signs and symptoms, in 31% of the patients.\(^{33}\)

Fangman and coworkers\(^{36}\) studied a cohort of 1143 pregnant women to assess the long-term results of an established prematurity-prevention program, including risk screening, increased intensity of contact with the prenatal care provider, and enrollment of high-risk patients in prematurity-prevention class, which included education on self-palpation. The authors concluded, Although there were potentially preventable preterm births, they were most frequently at advanced gestational ages and most often the result of patient failures to respond to the symptoms of preterm labor.

Thus, the results from the clinical trial indicate that programs that rely solely on maternal self-palpation of preterm uterine contractions are not only unreliable, but they also are likely to fail in detecting early preterm labor.

**Efficacy of HUAM in detecting preterm labor**

A number of controlled trials have been published assessing the efficacy of HUAM in the detection of early preterm labor.\(^{25,26,37,38}\) The overwhelming majority of these studies have shown the benefit of HUAM in prolonging pregnancy in women at risk for preterm labor.

Katz and colleagues,\(^{24}\) in a descriptive study, examined the effect of HUAM in a group of women at risk for preterm labor. Medical records were examined for 152 women, 76 of whom received HUAM in addition to standard high-risk care, which included patient education on preterm labor, self-palpation for uterine contractions, and routine clinic visits. The Katz team found patients receiving HUAM had preterm labor detected at less cervical dilation than those not receiving HUAM. Overall, the preterm delivery rate was less in the group receiving HUAM. The authors concluded, “Pregnant women may not accurately perceive uterine contractions as detected by ambulatory tocodynamometry.”\(^{24}\)

Morrison and associates,\(^{25}\) conducted a randomized prospective study of women at risk for preterm labor to assess the value of HUAM in detecting preterm labor. Sixty-seven women were randomly assigned to receive HUAM or self-palpation to detect uterine contractions. Of these 67 patients, 18 (27%) had multifetal gestations. Patients in the HUAM group were found to have preterm labor detected earlier, at less cervical dilation and effacement, and to have greater prolongation of pregnancy. Significantly more patients in the HUAM group delivered at term. The authors concluded that HUAM resulted in an increased number of suitable candidates for tocolysis.

Watson and colleagues,\(^{26}\) conducted a randomized trial on 67 women success-
fully treated for preterm labor and placed on either HUAM and daily nursing support or prescribed a standard-care treatment protocol. Recurrent preterm labor occurred in 15 (45%) of monitored patients and 19 (56%) of standard-care patients. The risk of preterm birth for patients with recurrent preterm labor was significantly reduced in the HUAM group (preterm birth 47% in the HUAM group vs 84% in the standard-care group; \( P = .025 \)). The relative risk of delivering due to failed tocolysis was 2.8 for the standard-care group versus the HUAM group. The authors found that HUAM and nursing support were helpful in achieving term birth through earlier detection and treatment of recurrent preterm labor.

Dyson and associates\(^4^0\) enrolled a total of 394 women to assess the effectiveness of an educational preterm-delivery-prevention program and to determine whether the addition of HUAM improved pregnancy outcomes. Both the educational and HUAM programs were still favorable for long-term suppression. This resulted in a decreased incidence of preterm births and improved outcome when compared with similar high-risk patients who did not participate in these programs. In this randomized, prospective study, addition of HUAM to the educational program was found to significantly improve outcomes in twin gestations, but not in singleton gestations. Dyson’s group reported a reduction in NICU admission from 43.9% for women relying on education and self-palpation to 27.9% for women using HUAM services, and a reduction in infant hospital stays from 10.2 days to 5.6 days, respectively. The authors noted that the number of singleton pregnancies was too small to rule out possible benefit from HUAM in that group.\(^4^0\)

In a recent randomized, retrospective trial that led to FDA approval of an HUAM device, Mou and associates\(^2^8\) addressed the effectiveness of the HUAM device alone compared with self-palpation of uterine activity for early detection of preterm labor in a study of 377 women at risk for preterm labor. The study found that the monitoring device had greater independent value in identifying patients in preterm labor earlier and with less cervical dilation than did self-palpation of uterine activity alone. Singleton pregnancies had greater birth weight, fewer days in the NICU, and fewer babies requiring oxygen therapy and mechanical ventilation. Use of the HUAM device reduced the rate of NICU admissions from 43% to 15%, compared with that for women relying on self-palpation. The average NICU length of stay was reduced from 24.9 days for infants of mothers using self-palpation to 10.0 days for infants of mothers using the HUAM device.\(^2^8\)

Wapner and associates\(^4^1\) conducted a recently completed multicenter, prospective, randomized study of 218 patients at high-risk for preterm birth. Two hundred eighteen women at high risk for preterm birth were prospectively randomly assigned to receive either standard high-risk care and HUAM or standard high-risk care alone. Neither group received daily nursing support. The study demonstrated that the HUAM device, used even in the absence of daily nursing contact, allowed detection of preterm labor at less advanced cervical dilation and resulted in greater prolongation of pregnancy.\(^4^1\)

Grimes and Schulz\(^4^6\) conducted a critique of five select trials\(^2^5,28,37,40,42,43\) evaluating HUAM and, using their own criteria, noted that most of the HUAM trials examined contained methodological deficiencies. The authors performed their own statistical analysis of each individual trial and reported that four of the five trials demonstrated no significant benefit from monitoring, despite the fact that the original investigators reported beneficial results. Not included in the analysis by Grimes and Schulz was the largest randomized controlled trial of HUAM conducted to date, the study by Mou and associates,\(^2^8\) which reported that use of HUAM provided statistically significant earlier detection of preterm labor and improved neonatal outcomes. Grimes and Schulz made no apparent attempt to control bias in the review of these trials by pooling data or other techniques to minimize the risk that the reviewers and their readers would be misled by random errors. Because of the lack of proper statistical technique, the Grimes and Schulz\(^4^6\) review has often been criticized as biased by not taking into account the sizes of the individual studies and the precision with which each study measures the treatment effect. Thus, large and small studies in the review received equal weight, despite the fact that larger studies showed improved neonatal outcome in the HUAM patient groups. Unfortunately, much of the criticism of the HUAM trials found in the American College of Obstetricians and Gynecologists Committee on Obstetrics: Maternal-Fetal Medicine Opin-

ion Number 115\(^3^7\) was based on this critique by Grimes and Schulz.

A recent meta-analysis of randomized controlled HUAM trials conducted by Colton and colleagues\(^4^8\) indicates statistically significant benefits of HUAM in improving neonatal outcomes. Meta-analysis was performed to assess the totality of evidence in the HUAM trials regarding treatment effects. Data from clinical trials were pooled, and the effect estimate of each study was weighed by the inverse of its statistical precision. In this way, the size and precision of individual trials were taken into account. Data were extracted from seven peer-reviewed and published trials of HUAM\(^2^5,28,37,40,42,44,43\) in an unblinded manner, and additional data were solicited from principal investigators when necessary. HUAM was found to be associated with a 54% reduction in the risk of preterm labor with cervical dilation greater than 2 cm and a 20% reduction in the risk of preterm birth for all groups studied. Infants born to mothers using HUAM also had a higher average birth weight.

The Collaborative Home Uterine Monitoring Study Group (CHUMS) reported the results of a randomized controlled trial of HUAM in which patients received twice-daily nursing contact with either active (data revealed) or sham (data concealed) HUAM devices.\(^4^9\) The study concluded that uterine activity data when added to daily nursing contact were not linked to either diagnosis or lower rates of preterm birth. The study did not contain a standard-of-care (no daily nursing contact) group, and therefore, the study results were not generalizable to a typical obstetric population. In addition, the study had a dropout rate of greater than 34%, so many patients for whom HUAM was intended never received its benefit. Many outcome categories collected in the study demonstrated trends toward improved outcomes but did not reach statistical significance because of insufficient numbers of patients enrolled in various risk subgroups. This study was sharply criticized after its publication\(^4^6\) for its conclusions.

Rust and coworkers\(^5^1\) studied HUAM in women with twin pregnancies having preterm labor. In this retrospective analysis, 32 women with twin pregnancies not having HUAM at an earlier gestational age were prescribed HUAM after an arrested episode of preterm labor (group 1). This group was compared with 31 women with twin pregnancies for
whom HUAM was prescribed at 20 weeks gestational age and then, after development of an episode of preterm labor subsequently arrested, were continued on HUAM (group 2). The two groups were similar in demographics and gestational age at occurrence of preterm labor. Mean cervical dilation at diagnosis of preterm labor was less in group 2 (1.1 cm vs 2.3 cm). Birth weights in group 2 were greater than in group 1 (2340 g vs 918 g), and NICU admissions were less (group 2, 18% admitted; group 1, 85% admitted). The authors concluded that HUAM use before the onset of preterm labor in twin gestation was beneficial.

Dyson and colleagues reported on three groups of obstetric patients receiving over 4 years either weekly nursing contact, daily nursing contact, or daily nursing contact and HUAM. The authors concluded that women who have daily contact with a nurse, with or without HUAM, have no better pregnancy outcomes than women who have weekly contact with a nurse. The study did not contain a standard-of-care control group and excluded from entry patients who typically receive HUAM services, those with current preterm labor. No effort was made to control tocolytic or steroid use, except that use of all tocolytics was stopped at 35 weeks, even though outcomes such as delivery at 37 weeks or greater were analyzed. The HUAM device used in this study was not FDA approved.

Corwin and associates analyzed outcomes of 339 high-risk women with singleton pregnancies randomly assigned to receive either standard high-risk care alone or standard high-risk care with HUAM. Women in the monitored group had prolonged pregnancy survival and were less likely to deliver preterm. Infants born to monitored women were less likely to be of low birth weight and were less likely to be admitted to an NICU.

Brown and coworkers evaluated an HUAM device in an Indiana Medicaid population where patients receiving both education and daily nursing contact were randomly assigned to additionally have HUAM or no HUAM. All patients had been stabilized for preterm labor in the hospital before discharge to the home. The study was designed to enroll enough patients to show a highly optimistic 50% or greater reduction in preterm birth at less than 37 weeks. However, because preterm labor treatment (including tocolytics) was withheld after 35 weeks, the researchers changed the study end point after the study began to preterm birth at less than 33 weeks. According to the authors, the study was terminated early (inadequate patient sample size) because of “the reality of time [that would be] required to obtain an adequate sample size of high-risk women to have enough patients to show statistically significant differences between the study groups.” With only nine less-than-35-week preterm births occurring in the HUAM group and 12 in the no-HUAM group, the study results (a 27% reduction of preterm birth in the HUAM group) were inconclusive, although NICU ventilation days and percentage less than or equal to 37-week delivery trends all favored the HUAM group.

McLean and colleagues, in a critical review of 96 studies concerning prediction or early diagnosis of preterm labor, concluded,

**Electronic monitoring of uterine activity** is the only method so far demonstrated to result in earlier recognition of preterm labor...when programs involving patient education and electronic uterine activity monitoring are implemented...there is an unequivocal improvement of the frequency of early diagnosis. Early diagnosis programs appear to improve the ability of standard tocolytic therapy to prolong gestation.

Clinical studies have, on the whole, proven the value of HUAM for early detection of preterm labor. Early detection permits earlier clinical interventions, greater prolongation of pregnancy, and improved pregnancy outcomes when compared with self-palpation programs.

**Appropriate use of the HUAM system of care**

Iams and associates stated in a recent review that approximately two thirds of all preterm infants were delivered spontaneously because of preterm labor, whereas one third were delivered because of medical complication. Roughly half of the spontaneous preterm deliveries were associated with rupture of the membranes. Arias and colleagues, in a study of 355 liveborn infants weighing between 500 g and 2500 g, reported the following causes of preterm birth:

- Prematurely ruptured membranes, 35%.
- Preterm labor, 30%.
- Other hypertensive disorders, congenital malformations, placental abruptio, and placenta previa, 35%.

Leveno and colleagues described a similar distribution of causes for preterm births before 34 weeks’ gestation.

Risk scoring systems have provided mixed results in accurately identifying those patients at risk for preterm labor; however, certain individual factors are well recognized as being associated with increased incidence of preterm labor. Roberts and colleagues, in a review of patients at high risk for preterm delivery because of twin gestation and previous preterm labor and delivery, reported that 46% of patients with multietal gestations had preterm labor and 36% delivered before 37 weeks’ gestation. The same review found that 41% to 68% of patients with a history of one or more preterm deliveries had preterm labor and that 30% to 47% delivered preterm. Because of limited ability of a screening program to identify all women who will have preterm labor, use of the HUAM device is normally restricted to those patients determined by their physician as having the highest risk for preterm labor, such as those with a history of prior preterm labor or delivery, multiple gestations, and preterm labor in the current pregnancy. This utilization appears appropriate.

The goals of HUAM are to enhance the early detection of preterm labor and support obstetric management through intensive education, uterine activity monitoring, and increased surveillance of patients at high risk for preterm birth and, as such, should be available for use today to help physicians improve pregnancy outcomes. Consensus on major risk factors and proper utilization would bring order and objectivity and serve the best interests of mothers and their children.

There is a concern that use of HUAM could lead to overtreatment of preterm contractions with tocolytic agents and result in increased maternal and fetal side effects. Iams and associates have previously made the point, “In some clinical situations caution and delay in diagnosis may have little adverse impact on the course of the disease, but such is not the case in preterm labor.” Although waiting for both contractions and symptoms may improve specificity, the more appropriate goal is high sensitivity so as not to miss any of the potentially treatable patients.

There is no evidence to date that HUAM leads to overdiagnosis of preterm labor or the overuse of tocolytic agents. Tocolytic agents are used for those patients demonstrating persistent uterine contrac-
tions in the presence of documented cervical change. Until the process (or processes) responsible for the events leading to uterine contractions is identified, the pharmacologic armamentarium will be limited to the treatment of symptoms of labor, including uterine contractions. Because of the inconsistent ability of patients to accurately identify uterine contractions, relying solely on self-palpation for the diagnosis of preterm labor and initiation of tocolytic therapy may result in either the inappropriate underuse or overuse of tocolytic agents or, more important, delay in diagnosis of preterm labor.

**Cost-effectiveness of HUAM services**

Dyson and associates

found that the monitoring device represents approximately 17% of the total cost of HUAM services. This leaves 83% of costs related to nursing and overhead. With national providers of HUAM services, it is estimated that the monitoring device represents less than 10% of the total cost. This incremental cost, however, is more than offset by a reduction in the amount of nursing time and maternal hospitalizations required to validate patient-perceived uterine contractions and other signs of preterm labor. The HUAM device has been studied with third-party payer Medicaid and military patient populations and found to be cost-effective in all instances.

Kosasa and coworkers, in a prospective study initiated by a major health insurance carrier to determine the cost-effectiveness of HUAM found "earlier detection of preterm labor and better management of oral tocolysis in the monitored group resulted in earlier initiation of maternal tocolytic therapy, which ultimately decreased the preterm birth rate and hospitalization days in the NICU." The total group of high-risk patients realized a net savings to the institution was $152,965 (9.9 days per admission), whereas infants of self-palpation patients spent a total of 324 days (29.5 days per patient). Infants of patients who had HUAM spent a total of 153 days in the NICU (10.9 days per admission), whereas infants of self-palpation patients spent a total of 324 days (29.5 days per admission) in the NICU. The authors of this study conducted in 1987 reported:

- Lengths of antepartum hospitalization and neonatal intensive care were significantly shorter for patients receiving home uterine activity monitoring.
- The estimated direct cost savings to our institution was $152,965 or $4934/pregnancy.

These studies confirm that the 10% to 17% incremental cost related to using a uterine activity monitor as a component of a comprehensive HUAM service is more than offset by the value of additional objective information available from the monitor. The availability of this objective information has been shown to reduce the number of unnecessary antepartum hospitalizations, as well as to reduce the number of NICU days.

**Comment**

Prevention of prematurity is the most challenging problem in obstetrics today. Early determination of preterm labor or recurrent preterm labor is an important step toward effective intervention and prolongation of pregnancy. Early diagnosis allows the physician to monitor uterine activity, consider tocolytic therapy, assess fetal lung maturity, and administer corticosteroids, if indicated, and to initiate transfer to a tertiary care facility in a timely manner.

The HUAM device is designed to provide in-depth and ongoing patient and family education concerning the patient’s pregnancy and her clinical condition, daily patient assessment, detection of uterine activity that may be indicative of onset of preterm labor in select high-risk patients, and to alert clinicians of the need for prompt medical attention as well as to provide timely, objective and subjective clinical information. The system was not designed to diagnose or prevent preterm labor—only to assist in the early detection of signs and symptoms of preterm labor. HUAM does not prevent labor or delivery; it provides supplemental education and objective data in any effort to prolong gestation and maximize pregnancy outcomes through appropriate clinical interventions. The system is intended to augment the high-risk obstetric care prescribed for these patients by their obstetrician.

HUAM should not be routinely used in normal pregnancies, and physicians should be as discriminating in the use of the HUAM device as they are with other diagnostic modalities.

**References**


