RCT
labor
whirlpool
bath

The Effects of Whirlpool Baths in Labor: A Randomized, Controlled Trial

Janet Rush, RN, BScN, MHSc, Susan Burlock, RN, Kim Lambert, RN, Margot Loosley-Millman, BSc, MD, PhD, FRCS(C), Brian Hutchison, MD, MSc, CCFP, and Murray Enkin, MD, FRCS(C), FSOG(C)

ABSTRACT: **Background:** *Showers and tubs in labor were not generally used in our center. When three whirlpool baths (Jacuzzis) were ordered as part of our renovations, a randomized, controlled trial was initiated to explore their effects on narcotic and epidural requirements.* **Methods:** *This study employed an intent-to-treat design, and the sample size was estimated to account for the fact that some women would be unable to use the tub. The experimental group of 393 women was offered the tub during labor and the control group of 392 women received conventional care.* **Results:** *No births occurred in the tub. The tub group required fewer pharmacologic agents than controls (66% vs 59%, $p = 0.06$), experienced fewer deliveries by forceps and vacuum ($p = 0.019$), and were more likely to have an intact perineum than the standard-care group ($p = 0.019$). Labor was longer for the tub group ($p = 0.003$), who coincidentally were more primiparous and in earlier labor on admission. No differences were noted in the low rates of maternal and newborn signs of infection in women with ruptured membranes. A subset of mothers expressed satisfaction with the tub experience and labor support. The cesarean rate among both groups was lower (8.9%) than our overall rate (16.6%) during the study period.* **Conclusions:** *Whirlpool baths in labor have positive effects on analgesia requirements, instrumentation rates, condition of the perineum, and personal satisfaction. Further study of the effects on labor length, pain, influence of labor support, and psychological outcomes is being planned. (BIRTH 23:3, September 1996)*

Showers, baths, and whirlpool baths (Jacuzzis) to alleviate pain and stress are commonplace in both domestic and therapeutic settings. It is curious that, given the phenomenon of labor, a time of intense pain and distress, so few birthing units are equipped with such a familiar comfort measure. Over the past decade, however, interest has grown in the effects of tub bathing as a therapeutic intervention in labor.

Before our study we were aware of descriptive reports suggesting a physiologic or psychological mechanism for outcomes such as pain, relaxation, comfort, control, and the effects on contractions during labor (1–6). Lenstrup et al (7), in a small prospective, nonrandomized trial, reported that cervical dilation may be accelerated. This was not the case in the trial of Bastide et al (8) in Quebec, in which the mean duration of labor was significantly longer among participants using a whirlpool bath during the first stage. No complications were noted in the reports. One small comparison (9) explored the stress response indicators by means of umbilical

Janet Rush is Director of Nursing Research, St. Joseph's Hospital, Hamilton, Ontario, and Assistant Clinical Professor, McMaster University School of Nursing; Kim Lambert is Research Nurse, St. Joseph's Hospital, Hamilton; Susan Burlock is Nurse Manager, Birthing Unit, St. Joseph's Hospital, Hamilton; Margot Loosley-Millman is in the Department of Obstetrics and Gynecology, St. Joseph's Hospital; Hamilton; Brian Hutchison is in the Department of Family Medicine, McMaster University, Hamilton; and Murray Enkin is Professor Emeritus, Department of Obstetrics and Gynecology and Clinical Epidemiology and Biostatistics, McMaster University, Hamilton, Ontario, Canada.

Address correspondence to Janet Rush, RN, Director of Nursing Research, St. Joseph's Hospital, 50 Charlton Ave. East, Hamilton, Ontario, L8N 4A6 Canada.

cord blood sampling, and speculated that levels may be low with use of the tub during labor, given adequate sample size. Burns and Greenish (10) evaluated their one-year experience with tubs against the outcome of narcotic and epidural requirements. Although that review included water-birth participants, pharmacologic pain relief measures were dramatically less in tub users than in nonusers.

Waldenström and Nilsson (11) questioned the safety of tubs if the membranes were ruptured. They matched controls with tub users in a small retrospective review of data from a prior randomized trial. No differences were detected in rates of maternal and newborn infections. Cammu et al (12) considered their randomized, controlled trial to be pilot work in defining a protocol for measuring pain, cervical dilation, and satisfaction. Their results indicated a temporal pain-stabilizing effect of the tub, accelerated dilation, and high satisfaction among tub users.

The paucity of randomized, controlled trials was decried by McClandish and Renfrew in their excellent review article (13), and they suggested that tubs for labor may be yet another intervention fully implemented without rigorous evaluation. Because of the state of the scientific literature and our interest in evidence-based practice, we developed a randomized trial before using the newly installed whirlpool baths in our renovated birthing unit. Financial support from the tub manufacturer for the study was neither requested nor obtained.

Staff nurses initiated the request for a whirlpool bath after attending a conference. They recommended the Parker bath, a therapeutic whirlpool tub that was known in geriatric and rehabilitation settings and had features suggesting comfort and safety in labor. After filling the footwell, the entire side of the tub lifts so the mother can sit, close the door, and recline to the position of her choice using a hydraulic pump handle. The tub is light (190 lbs) and has a temperature-control mechanism (38–39° C). A button in the tub activates two jets that provide whirlpool water action at the feet and lower back, and water can be added with a hand-held shower hose. The tub reverts to upright and empties quickly. The woman can pivot out of the tub to a standing position in seconds. The tub incorporates an integrated backwash and disinfecting system. Although it looked somewhat "clinical" in the labor-birth-recovery rooms, that opinion was not shared by the mothers.

The primary objective of the study was to evaluate pharmacologic pain relief experience among women offered the tub during labor and a control group receiving conventional care. Secondary interests included observations of labor length, satisfaction, and other birth outcomes such as instrumentation, status of the perineum, and signs of infection.

Methods

The study was conducted in a newly renovated birthing unit with 11 labor-birth-recovery rooms in a large teaching hospital in Ontario, Canada. An assessment area was adjacent to the unit where women were triaged for labor before admission. Approximately 3500 births occurred annually, and the cesarean section rate at the time of study was about 17 percent. Obstetricians conducted approximately 85 percent of the births under primary care or shared arrangements with family physicians. Eight registered nurses were scheduled per shift. Discharge from hospital was usually on day 3, with a range of a few hours to 4 days depending on the mother's desire or readiness. The staff maintained a collective professional interest in low intervention labor practices.

All labor-birth-recovery rooms were equipped with monitoring and birthing equipment, and two had Parker baths installed. One small storage room was converted into a communal room for the third tub. Electronic fetal monitors were generally applied intermittently in first stage of labor, except for direct medical indications for continuous monitoring. The labor-birth-recovery rooms were assigned on a first-come basis. A conventional tub and shower was available in the assessment area outside the unit.

This trial of whirlpool baths was carried out from November 1991 until May 1992. Before it began, one nurse provided an in-service program to all staff about the tubs and the study. The protocol related to handling the equipment, safety in getting women in and out of the tub, and issues about cleaning the tub after use. No strict protocol was established about when a woman was to enter the tub, whether or not the whirlpool jets should be used, the frequency or length of time a mother could be in the tub, or if she should have someone in constant attendance. Our aim was to learn by means of the study about these procedural issues. Women were expected to come out of or return to the tub when they desired or if the birth was obviously imminent. If a mother wished to be given epidural analgesia, she would come out of the tub, since the taped catheter on her back would be a contraindication. The project was publicized by posters, a duck logo, and stickers for staff identification badges.

Sample

Consecutively admitted women from the assessment area who met the eligibility criteria and provided writ-

ten consent were randomly allocated to the control group where they received conventional care or to the experimental group in which the tub would be offered if available. Eligible mothers were at term (>37 wks), afebrile (<37.5°C), in labor (>3 cm), not booked for cesarean section, and had no written orders on admission for epidural or continuous electronic fetal monitoring. A translator could be used, if available, for non-English-speaking mothers. Women with ruptured membranes were eligible.

The sample size was based on available data on epidural or narcotic requirements of women who would be eligible for the study. The baseline rate was estimated to be 60 percent. We wished to detect a 10-percent absolute reduction in the rate of pharmacologic analgesia during labor with a two-tailed α set at 0.05 and β at 0.20. Approximately 400 subjects per group would be required to detect such a 10-percent reduction in the overall rate. We recognized that not all women offered the tub would use it but that one-half to one-third would. Assuming a control group rate of 60 percent, a 10-percent overall reduction in the rate of analgesia to 50 percent would require a 15-percent reduction among tub users if 65 percent of eligible mothers used the tub, and a 20-percent reduction if half of them used it. Based on these calculations, a sample of less than 400 per group would give rise to a substantial risk of failing to detect a clinically important effect of the whirlpool bath on analgesia.

Procedure

After assessment and written consent, random allocation was done by selecting a consecutively numbered envelope for either a primipara or a multipara. The sealed, opaque envelope contained a folded card with group assignment and study number. The order of assignment was based on two lists (400 each, one for primiparas and the other for multiparas) of computer-generated random numbers with a blocking factor of both four and six for each list. The envelope also contained yellow data-collection sheets for the mothers' charts and a blue "poolside" protocol for tub subjects. The group assignment could not be discerned from the size or weight of the envelope. A log was kept in the assessment area of all women admitted in labor, regardless of study participation, to ensure full description of the population during the study period.

All women in the experimental group were offered the whirlpool tub in their labor-birth-recovery room or in the communal room. If the woman did not wish to use the tub, no pressure to do so was applied and the reasons were documented. Data were collected about the frequency and length of each tub use. Data were also collected about parity, gestational age, rupture of membranes, vaginal birth after cesarean (VBAC), presentation, labor length (from admission), birth position, birth outcome, status of the perineum, drug use, meconium, attendant, newborn weight, Apgar scores, and signs of maternal or newborn infection. The mother's assigned nurse in the birthing unit collected all data. Infection outcomes were obtained by chart review at discharge, and any notations of symptoms (with or without swabs, identified organism, treatment) were documented.

A subsample of women were questioned regarding their use and satisfaction with comfort measures in labor. Every Wednesday, one of the two charge nurses on the postpartum unit delivered questionnaires to the first six mothers in numerical room order who were in tub and control groups. The questionnaire identified nine comfort measures (epidural analgesia, narcotic, shower, ordinary tub, whirlpool, walking, coaching, massage, having a nurse sit with the woman), areas to check off (if requested, used, would use again), and large spaces for comments.

A student research assistant ensured the completeness of all data-collection forms except the satisfaction questionnaires. She and the director of nursing and the nurse manager, who were investigators, monitored the study maneuvers.

Although the caregivers were obviously not blind to group assignment, protocol sheets were sent with the mother to the postpartum unit and then directly to the study office. No analysis was done during the study period.

Data Analysis

All data from the study sheets were analyzed with Minitab software (14). After obtaining a complete data set, tests were performed to compare the experimental and control groups' characteristics using χ^2 and t test analyses at the 0.05 α level of significance, calculating two-sided probability values. The primary and other outcomes of interest were subjected to χ^2 analysis of proportions between groups ($\alpha = 0.05$, 2-sided p values). Odds ratio estimates (with 95% confidence intervals and 2-sided p values) were calculated for the reference variables of no drugs, spontaneous birth, and intact perineum versus the observed outcomes of drug use, instrumentation or cesarean section, and perineal damage, respectively (15). Other information and outcomes of interest were collected, analyzed, and described.

Results

Approximately 1500 babies were born during the study period. According to the study log, 1055 women were admitted from the assessment area. Those booked for elective induction or cesarean delivery would have bypassed this area. Ninety-seven women did not meet the study criteria (electronic fetal monitoring ordered on admission, 30; <37 wks, 24; epidural order, 22; elevated temperature, 9; not in labor, 2). The most common reasons for noninclusion among the remaining 158 were precipitous, imminent birth, 54; and maternal request for immediate epidural analgesia, 52; followed by induction, 19; emergency cesarean, 6; refusal, 9; language barrier, 9; inadvertently missed, 4; skin infection, 2; bleeding, 2; and stillbirth, 1.

Eight hundred women consented to participate. Seventy-six percent were attended by obstetricians and the proportions were not statistically significant between groups (χ^2 3.65, p = 0.16). During the data entry it was observed that the admission temperature of 13 subjects (5 tub, 8 controls) was not recorded. It was also learned during data analysis that 28 women (10 tub, 18 controls) did not meet one or more of the eligibility criteria. These 41 women were nonetheless randomized, and given the intent-to-treat study design, their outcomes were included in the overall analysis. The results of χ^2 analysis were flagged where their inclusion altered the findings (Tables 1–3). Fifteen women were labeled as withdrawn, 4 were discharged home undelivered (2 in each group), and records of 11 were lost (6 tub, 5 control). A total of 785 records were analyzed, 393 in the tub and 392 in the control group (Figure 1). As expected, some women (183/393, 46%) did not actually use the tub but were still considered experimental subjects with the intent to treat.

Table 1. Summary of Analgesic and Anesthetic Agents Used by Tub and Control Groups

Drug	*No. (%) Tub Group*	*No. (%) Control Group*	*Statistic*
Epidural and/or narcotic	235 (59.8)	259 (66.1)	0.069*
Narcotic	0 (0)	5 (1.3)	0.025
None, local	152 (38.7)	127 (32.4)	0.066
Other (TENS, N_2O, GA, spinal)	5 (1.3)	4 (1)	0.740
Missing data	2	1	

**p = 0.044 when the 41 ineligibles were withdrawn from the analysis.*
TENS = transcutaneous electrical nerve stimulation; N_2O = nitrous oxide; GA = general anesthesia.

Table 2. Spontaneous and Assisted Birth Outcomes Between Tub and Control Groups

Variable	*No. (%) Tub Group*	*No. (%) Control Group*	*Statistic*
Spontaneous birth	293 (74.5)	275 (70)	0.168
Forceps and/or vacuum	65 (16.5)	86 (22)	0.055*
Cesarean section	35 (8.9)	31 (8.0)	0.615

**p = 0.011 when 41 ineligibles were withdrawn from the analysis.*

Table 3. Status of the Perineum Between Tub and Control Groups

Variable	*No. (%) Tub Group*	*No. (%) Control Group*	*Statistic*
Episiotomy ± laceration	135 (35)	147 (40)	0.157
Intact	129 (31)	99 (25.2)	0.019
1st-degree laceration	59 (15)	76 (19.4)	0.345
2nd-degree laceration	58 (14.8)	56 (14.3)	0.839
3rd-degree laceration	4 (1)	4 (1)	1.00
4th-degree laceration	2 (0.5)	0 (0)	0.211
Missing data	1		

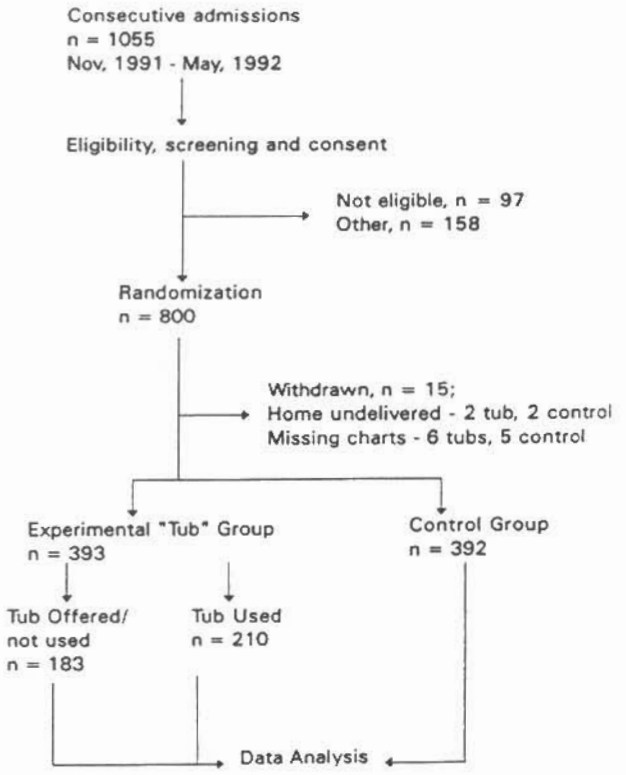

Fig. 1. Derivation of Study Sample

A summary and analysis of descriptive variables (counts, percentages, means, standard deviations) among women in the two groups are detailed in Tables 4 and 5. Women and newborns did not differ in terms of demographic and clinical characteristics considered important to the outcomes. The tub group included both the users and those who were offered but did not use the tub (intent-to-treat). Subanalyses were done on the actual tub users. Of statistical significance, these women were likely to be primiparous ($p = 0.003$) with less cervical dilation on admission to the birthing unit ($p = 0.011$), and had significantly long first ($p = 0.003$) and second ($p = 0.03$) stages of labor.

The most frequent reasons for nonuse of the tub were change of mind, pain or distress, an early request for epidural analgesia, or unavailability of a tub (Table 6). Seventy-three percent of women used the tub only once, 21 percent twice, and the remaining mothers, three to six times. The mean total time in the tub was 54 minutes (SD 46.7 min, median 40 min, maximum 315 min).

Our primary outcome was pharmacologic (epidural, narcotic) requirement (Table 1). Narcotic use was typically very low, but the tub group were significantly less likely to have the drugs ($p = 0.025$). Just over half of all women in the study had epidural analgesia during first stage. Frequencies of narcotic and epidural were summed, and χ^2 analysis revealed statistically significant findings favoring the tub group ($p = 0.04$) when the 41 ineligible women were withdrawn. The statistic was insignificant for the full sample ($p = 0.069$). Applying the reference variable of no pain medication and/or local anesthesia (for perineal repair) versus pain agent, odds ratios were estimated (Table 7). Statistical significance was similar to the χ^2 estimation.

Comparisons were not statistically significant for position at birth. Eighty-eight percent of all women gave birth in a Fowler's or back-lying position and 10 percent on their side. Approximately 90 percent of all women gave birth in their labor-birth-recovery room, and the proportion requiring a case or operating room setting was not statistically significant. The χ^2 analysis revealed significant findings related to forceps and vacuum ($p = 0.055$), with statistical significance in the secondary analysis ($p = 0.011$) favoring the tub group. The odds ratio estimation of instrumentation and cesarean section versus spontaneous birth revealed

Table 4. Characteristics of Study Groups: Categorical Variables and χ^2 Analysis ($\alpha = 0.05$, 2-sided p values)

Variable	*No. (%) Tub Group*	*No. (%) Control Group*	*p*
Multipara	195 (49.7)	197 (50.26)	0.97
SROM	186 (47.33)	179 (45.78)	0.94
Pre-SROM	73 (18.72)	74 (18.88)	0.99
VBAC	22 (5.60)	32 (8.16)	0.15
Oxytocin	71 (18.07)	73 (18.62)	0.99
Dystocia	58 (14.76)	54 (13.78)	0.96
Amniotomy (AROM)	187 (47.58)	190 (48.47)	0.99
LBR delivery	349 (88.80)	346 (88.27)	0.99
Meconium	76 (19.34)	80 (20.41)	0.91
Twins	2 (0.51)	4 (1.02)	0.97

SROM = spontaneous rupture of membranes; pre-SROM = pre labour spontaneous rupture of the membranes; oxytocin = oxytocin used to induce or augment labor; VBAC = vaginal birth after cesarean; AROM = artificial rupture of the membranes; LBR delivery = single room for labor, birth, and recovery.

Table 5. Characteristics of Study Groups: Continuous Variables and *t* Test Analysis ($\alpha = 0.05$, 2-sided p values)

Variable	*Tub Group Mean (SD)*	*Control Group Mean (SD)*	*p*
Maternal age (yrs)	27.72 (5.16)	27.86 (5.28)	0.70
Gravida	2.07 (1.2)	2.05 (1.3)	0.80
Parity	0.74 (0.92)	0.75 (1.0)	0.83
Weeks' gestation	39.47 (1.30)	39.44 (1.32)	0.71
Birthweight	3466 (454)	3495 (494)	0.39
1-minute Apgar score	8.26 (1.19)	8.30 (1.21)	0.65
5-minute Apgar score	9.15 (0.69)	9.16 (0.65)	0.78
Cervical dilation on admission	3.84 (1.78)	3.81 (1.78)	0.82
Length, 1st stage labor (min)	403 (596)	405 (555)	0.96
Length, 2nd stage labor (min)	56.7 (61.0)	57.9 (57.6)	0.78
Length, 3rd stage labor (min)	8.26 (8.74)	8.1 (10.9)	0.87

Table 6. Reasons Why Tub Was Not Used

Variable	*Number (n = 183/393)*
Distressed, active	64
Refused	49
Epidural request	32
Tub not available	16
Meconium or fetal distress	15
Induction, augmentation	4
Language barrier	3

no statistical significance (p = 0.07 and p = 0.89, respectively). Applying χ^2 analysis, significantly more women in the tub group had an intact perineum (p = 0.019). Odds ratios were estimated for the outcomes relating to perineal damage against the variable of intact perineum, and smaller statistical significance was observed.

The χ^2 analysis for signs of maternal and neonatal infection for all 785 women and their babies did not show statistically significant differences of the observed rates between groups. Maternal signs in the tub group included temperature, 4; red episiotomy, 3; urinary tract infection, 3; *Streptococcus* B, 2; and upper respiratory infection or flu, 2. In the control group, 5 mothers had elevated temperature, followed by red episiotomy, 3; and red cesarean incision, 1. Newborn signs included elevated temperature and weepy eyes (tub group temperature, 2/5, eyes 3/5; control group temperature 1/2, eyes 1/2). No treatment was required for neonatal signs of infection. No significant differences were found in birthweights and Apgar scores between groups.

The questionnaire about comfort measures was completed by 68 tub users and 39 control mothers. This component of the study aimed to provide preliminary understanding of the responses to the tub taken against the various other comfort measures used by mothers. Our intention was to analyze the variance among the measures; however, the mothers preferred to write comments rather than check boxes. The data were

Table 7. Odds Ratio Estimations of Outcomes Between Groups versus the Reference Variables of No Pain Medication, ± Local Spontaneous Birth and Intact Perineum

Reference Variable	*vs Outcome*	*Tub*	*Control*	*OR (95% CI)*	*2-Sided p*
No. analgesia or local only for perineal repair	Epidural ± narcotic	235	259	0.76 (0.55–1.03)	0.072
	Narcotic only	0	5	0 (0–0.7)	0.02
	Other	5	4	1.04 (0.21–5.37)	1.0
	Missing data (2)				
Spontaneous birth	Forceps +/or vacuum	65	86	0.71 (0.4–1.03)	0.07
	Cesarean section	35	31	1.06 (0.01–1.83)	0.89
Intact perineum	Episiotomy +/or laceration	135	147	0.70 (0.4–1.01)	0.06
	1° laceration	59	76	0.59 (0.37–.93)	0.02
	2° laceration	58	56	0.79 (0.49–1.2)	0.35
	3° laceration	4	4	0.76 (0.14–4.2)	0.73
	4° laceration	2	0	0 (0–4.5)	0.5
	Missing data (1)				

especially rich in two areas: satisfaction with the tub and having a coach or nurse directly with them during labor. Women generally wanted to try something new, and the words most frequently used about the tubs were relaxation and pain relief. Some thought the tub slowed contractions, whereas others expressed how quickly labor advanced once in the tub. Helpful comments about tub construction included the need for more room to move around, that added jets would have enhanced comfort, and the benefit of adding more water to cover the abdomen.

Discussion and Conclusions

Our initial enthusiasm for evaluating whirlpool baths in labor was prompted not only by the potential for decreased analgesia requirements but also by the potential benefits in the frequency of perceived pain, dystocia, operative birth, and the effects on maternal confidence, control, and satisfaction. Although we originally planned to examine the other outcomes fully, the installation of the tubs preceded the opportunity for complete funding, necessitating a modified protocol. Some mothers saw the tubs on their prenatal tour and on admission, and our trial was quickly mounted in its revised form. Mothers were aware that the whirlpool bath was available only if they were selected for the experimental group, but they could use a conventional tub if randomized to the control group. Only six of the control mothers used the conventional tub.

Some ineligible mothers were inadvertently assigned to the study, and efforts will be made in our future project to audit this aspect closely. Outcomes for the full study population are reported together with any statistically significant findings observed in the analysis of the purer, eligible group.

Our principal aim was to explore pharmacologic requirements, and the sample size was set to account for a proportion who would not use the whirlpool bath. Taken as a whole group, the eligible experimental mothers required statistically significantly less pain relief (narcotic, epidural) than controls. This finding is viewed with caution because of the number of women who did not actually use the bath, the small number of women who were inadvertently included as subjects, and the small, albeit clinically significant, differences observed.

A full analysis of actual tub users was not done because this was not our design. We did, however, investigate some characteristics of these women. Primiparous mothers in earlier labor were most likely to choose the tub. Notwithstanding their parity and low cervical dilation on admission, the tub group experienced a significantly longer labor than the other group, as was observed in Bastide's (8) trial. We did not define rules about the stage of labor or cervical dilation at which women could enter the whirlpool. Whether the tub slows down contractions and dilation remains controversial and requires further study. Dystocia diagnosis and oxytocin administration between groups were not significantly different.

We were encouraged by the significant effect of the tub on lower instrumentation rates. These mothers had a high likelihood of an intact perineum, which would correspond with the low instrumentation rate. The cesarean birth rate for participants in both groups was markedly less than the overall rates for that period, supporting the accepted view that study subjects generally achieve healthier outcomes.

Waldenström and Nilsson (11) suggested that caution be exercised in cases of membrane rupture. Our protocol screened for women in whom close monitoring would be prescribed, for example, grossly meconium-stained liquor. We observed no adverse maternal and newborn outcomes related to signs or overt maternal and newborn infection. Our conversations with other birthing units centered principally on this infection concern, despite no scientific evidence precluding tub use by women with ruptured membranes (16).

The small subset of participants who completed questionnaires about comfort measures provided valuable information in terms of their positive expressions about the tub, suggestions about tub design, and their sense of fear, control, and support requirements in labor. Our protocol did not direct nurses to be continuously present while women were in the tub. Having observed the positive comments about the tub and a companion or nurse to sit with them begs the question as to whether the intervention had the added benefit of bringing increased support to the bedside (or poolside!) or whether the only benefit was derived from the support (17). Future trials could monitor the presence of a support person to explore the individual and the interaction effects. A more in-depth evaluation could explore the concern about the size of the tubs and how important it may be for women to move about more freely in them.

It is noteworthy that this was a real-time trial of a new intervention in our unit. Even showers and conventional baths were not available before the opening of the renovated birthing unit. Our staff is senior, with an average tenure of 14 years. It can be suggested that our intent-to-treat group, women who did not use the tub, would have been smaller and more women would have been encouraged to use the tubs if staff were more familiar with what was then considered a controversial innovation. Physicians were supportive and, like the nurses, had to adapt to yet another piece of equipment in the room. These limiting effects have since abated, and we are considering adding tubs in all rooms. It

would be of interest to determine nurses' responses and reactions to this intervention.

Although some nonpharmacologic interventions may not decrease the length of labor, many have attempted to influence and measure pain perception (18). Pain in labor has been strongly correlated with maternal confidence in the ability to handle labor (19). We recommend that further research be conducted to measure pain perception accurately among mothers attempting to use the tub, a familiar, natural comfort measure that they can use ad libitum and with confidence. A second randomized, controlled trial is being planned at this time to extend the evaluation to consider pain and relaxation scores, physiologic markers of hydrotherapy (urine output, blood pressure), and responses relating to control and satisfaction among other birth and postpartum outcomes.

Acknowledgments

The authors acknowledge the support of St. Joseph's Hospital Foundation for funding the data analysis. The study could not have been completed without the incredible cooperation of the nursing staff of the birthing and postpartum units at St. Joseph's Hospital, Hamilton, nursing students (Kim Lambert and Elizabeth Blodget) from McMaster University, and Unna Valliappan from Mohawk College "Futures" program. Recognized also are Drs. C. Goldsmith and E. Duku for their assistance in supervising the data analysis, and Dr. E. Hodnett for her help in preparing this report.

References

1. Brown C. Therapeutic effects of bathing during labor. *J Nurse Midwifery* 1982;27(1):1–16.
2. Odent M. Birth under water. *Lancet* 1983;31:1476–1477.
3. Milner I. Waterbirths for pain relief in labour. *Nurs Times* 1988;84(1):39–40.
4. Church LK. Water birth: One birthing center's observations. *J Nurse Midwifery* 1989;34(4):165–170.
5. Aderholt KJ, Perry L. Jet hydrotherapy for labor and postpartum pain relief. *Matern Child Nurs J* 1991;16:97–99.
6. Goodlin RC, Engdahl Hoffman KL, Williams NE, Buchan P. Shoulder-out immersion in pregnant women. *J Perinat Med* 1984;12:173–177.
7. Lenstrup C, Schantz A, Beerget A, et al. Warm bath during delivery. *Acta Obstet Gynecol Scand* 1987;66:709–712.
8. Bastide A. A randomized controlled trial of a whirlpool bath on labour, birth and postpartum. In: Chalmers I, ed. *Oxford Database of Perinatal Trials*, version 1.2, disk issue 8, record 5789. Oxford: Oxford University Press, 1992.
9. Gradert Y, Hertel J, Lenstrup C, et al. Warm tub bath during labour. *Acta Obstet Gynecol Scand* 1987;66:681–683.
10. Burns E, Greenish K. Pooling information. *Nurs Times* 1993; 89(8):47–49.
11. Waldenström U, Nilsson CA. Warm tub bath after spontaneous rupture of the membranes. *Birth* 1992;19(2):57–63.
12. Cammu H, Clasen K, VanWeltere L, Derde M-P. "To bathe or not to bathe" during the first stage of labour. *Acta Obstet Gynecol Scand* 1994;73:468–472.
13. McClandish R, Renfrew M. Immersion in water during birth: The need for evaluation. *Birth* 1993;20(2):79–85.
14. Minitab. *Release 10 for Windows*. State College, PA: Author. 1994.
15. CYTEL Software Corp. *StatXact Statistical Software for Exact Non-Parametric Inferences*. Cambridge, MA: Author, 1992.
16. Siegel P. Does water enter the vagina? *Obstet Gynecol* 1960; 15:660–661.
17. Hodnett ED. Support from caregivers during childbirth. In: Enkin MW, Keirse MJNC, Renfrew MJ, Neilson JP, eds. *Pregnancy and Childbirth Module*. Cochrane Database of Systematic Reviews, review no. 03871, May 1994. Cochrane Updates on Disk. Oxford: Update Software, 1994.
18. Leventhal EA, Leventhal H, Shacham S, Easterling DV. Active coping reduces reports of pain from childbirth. *J Consult Clin Psychol* 1989;57(3):365–371.
19. Lowe NK. Explaining the pain of active labor: The importance of maternal confidence. *Res Nurs Health* 1989;12:237–245.