THE ENVIRONMENTAL LOAD OF CHILDBIRTH SETTINGS:DEVELOPMENT AND TESTING OF A MEASUREMENT TOOL

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Numerous studies in environmental psychology have examined the physiological and/or psychological effects of various environments. Examples of such research have included investigations of the neurohormonal effects of selected social and therapeutic environments (Dimascio, Boyd, Greenblatt, & Solomon, 1956; Kiritz & Moos, 1974; Ostfeld & Shekelle, 1967). One characteristic of environments that has received special attention is the "load" of the environment. Mehrabian (1976) has defined "environmental load" as the degree of novelty, complexity and stimulus intensity of an environment. He has described environments as either high-load or low-load settings: high-load settings are novel, complex, high-stimulus settings, while low-load settings are familiar, simple, low-stimulus settings (Mehrabian, 1976, pp. 12-13), and the load of the settings has had demonstrable effects on physiological, cognitive and behavioural functioning (Mehrabian, 1978).

Recently, attention has been paid to the effects of the environment in which women labour and give birth. Alterations in methods of care for women during childbirth, including the increasingly routine use of sophisticated medical interventions (such as electronic fetal monitoring, continuous epidural anaesthesia and intravenous oxytocin), have led to speculation that current North American birth environments can have a negative impact on childbirth outcomes (Norr, Block & Charles, 1977; Richards, 1982). In response to consumer pressure, many hospital labour wards have endeavoured to provide more home-like birthing environments. The redecorated labour rooms are often called "birthing rooms" and are set aside for women who are deemed to be low in obstetrical risk and who desire unmedicated, spontaneous vaginal births.

While there is some evidence that the birthing rooms contribute to positive ratings of their childbirth experiences by the tiny minority of women who labour in them (Klein, 1983; Shaw, 1985), there is little available evidence, to date, concerning the question of whether the environmental load of the labour room influences the physiology and

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psychology of the birth experience. One study of home or hospital birth choosers concluded that the birth environment, in combination with selected psychological attributes of the labouring woman, influenced both length of labour and perceived control during childbirth (Hodnett, 1983). One hypothesis derived from the findings of this study was that efforts directed at decreasing environmental load may effect an improvement in physiological outcomes, such as an improvement in the quality of uterine contractions. In order to test that hypothesis rigorously, a method for quantifying the load of childbirth settings is needed; one which is more precise than the crude low-load (home environment) versus high-load (hospital environment) employed in the aforementioned study.

A validated, objective system of measuring the load of a childbirth setting would make it possible to conduct many diverse, but related, studies on birth environments. Such a measurement tool would permit studies that require the determination of differences in environmental load within settings (e.g. between traditional labour rooms and birthing rooms within a labour and delivery suite). In addition, research could be conducted that would be directed at answering a fundamental question: is it the perceived environment or the environment per se that predicts childbirth outcomes? The investigation described herein represents an initial step in the development of an instrument, the Labour Room Rating Scale (LRRS), to measure the load of a hospital birth setting.

Research Questions

There were three main research questions.

1. Is it possible for women who have recently given birth to rate labour room stimuli, in terms of the degree of their actual or imagined awareness of each stimulus?

2. Are the scores assigned to the stimuli influenced by personal characteristics of the raters; specifically, parity, actual experience with the stimulus and length of time in labour?

3. To what extent is there consensus, in terms of the relative importance of each stimulus?

Methods

The initial step was to identify the stimuli that may be present in labour rooms and of which labouring women may be aware. Each stimulus was considered to be a component of the load of the setting. A list of the stimuli, in the form of a draft of the instrument, was circulated to colleagues

in the Faculty of Nursing and nearby teaching hospitals, and to groups of undergraduate students in maternal-infant nursing. As a result of the comments received, minor modifications were made to the Labour Room Rating Scale (LRRS) and its accompanying instructions.

One issue – whether pleasurable and unpleasant stimuli exert differential effects – had to be addressed, prior to the development of the LRRS. There is considerable debate concerning the conceptualization of stress; some contend that it is the magnitude of the change or readjustment, irrespective of the event's desirability, that is the critical dimension (Holmes & Rahe, 1967; Selye, 1974), while others contend that only events that are appraised as undesirable are important (Lazarus, 1966). There is also debate about whether the environmental stimuli per se have physiological and psychological effects or whether the subjective interpretation of the stimuli as favourable or unfavourable is the critical factor (Kiritz & Moos, 1974).

Several incidents that occurred in a study of home birth choosers (Hodnett, 1983) provided indications that stimuli perceived as favourable had deleterious effects on progress in labour. In each instance, increases in favourable stimuli (e.g. the presence of a large number of invited friends and relatives) were associated with a decrease in the quality of labour; a pattern emerged in which labour "came" and "went" with corresponding decreases and increases in the number of people present. While animal studies have supported the hypothesis that environmental changes influence physiological labour processes (Newton & Newton, 1962), no pertinent research that tested this hypothesis on human subjects was found.

In the LRRS, items were included that could be perceived as favourable, mixed, neutral or unfavourable (depending, to some extent, on the individual and the circumstances). Subjects were asked to score the items according to their actual or imagined awareness of the items, independent of perceived favourability or unfavourability.

The process employed to obtain ratings of the relative degree of awareness of each stimulus was similar, but not identical, to that used by Holmes and Rahe (1967) in the development of the Social Readjustment Rating Scale, and by Volicer in the development of the Hospital Stress Rating Scale (Volicer, 1973, 1974; Volicer & Bohannon, 1975; Volicer & Burns, 1977). The method assumes that individuals are able and willing to assign magnitude to the perceived intensity of physical stimuli.

The instructions for the LRRS differed from the instructions in the two scales above in one important respect. The latter scales instructed raters to base the scores for items on their perceptions of how the "average" person would score the items. Data analysis then involved computing an average of

this average (i.e. a mean score or a mean rank score). When attempts have been made to test the assumption that rating of an event is not influenced by personal experience of the event, such attempts are confounded by the fact that those who have experienced the event have been asked to rate it, not based on their experience, but on their estimates of the "average" person's experience. A fundamental aspect of the LRRS study was whether or not there would be differences in scores that were attributable to selected differences in the raters (including personal experience with the stimulus); therefore, it was important that the ratings would reflect each individual's subjective experience. The instructions were as follows.

The experience of being in labour in a hospital labour room involves new people, procedures, and routines to which an individual woman must adjust. This adjustment can depend in part upon the extent to which the woman is aware of her surroundings while she is in labour, regardless of how desirable or undesirable her surroundings are. Some persons are more aware of their surroundings than others, and not all aspects of the surroundings are equal, in terms of their effects on people. The purpose of this survey is to determine the relative effects of various aspects of being in a hospital labour room.

Step 1: Attached is a list of experiences women may have, while in a hospital labour room. You are asked to read each item, and to decide whether or not you have ever experienced the item, e.g. during this recent or any previous labours. Place an "X" in the "Had" or "Did Not Have" column to the left of each item. After you have done this for all of the items, go on to Step 2.

Step 2: You are asked to rate each item, regardless of whether you have ever experienced the item, according to how much you were or would have been aware of the item during your recent labour. A score of 100 has been given to item #1. Your awareness of an item may have changed, as your labour progressed. Score the item, according to your average amount of awareness of the item during your labour.

There are no right or wrong answers. Please try to score each item without consulting anyone else. Your impressions are what matter in this survey.

The LRRS was then tested on a convenience sample of 314 postpartum women in two Toronto teaching hospitals. After approval was received from a human subjects ethics review committee and from the hospitals, informed consents were obtained from English-literate women who had spent at least one hour in labour in a hospital labour room. A pilot test of the instrument, using 30 subjects, yielded no problems in comprehension of the instructions

or in ability to complete the instrument; because no changes were necessary, the data from the pilot test were included in the final analyses. When the instructions regarding completion of the instrument were reviewed with the subjects, each was reminded that she should complete the items solely in terms of her own perceptions. The original LRRS consisted of 29 items (Table 1). Subjects were asked to indicate, beside each item, whether or not they had experienced the item. In addition, they responded to questions about parity, prior experiences as hospital patients, labour length, length of time spent in the labour room and numbers of familiar and unfamiliar people who were with them during labour.

Data Analysis

The level of statistical significance was set at $p < .05$. The data were analyzed as follows, using the statistical programs described in the SPSSx User's Guide (1983). Means, ranges and standard deviations were computed. Outlier scores, defined as scores greater than three standard deviations from the mean, were dropped from further analyses; the descriptive statistics were then re-computed. Comparisons between the mean scores of the raters in one hospital and those in the other hospital, using Students *t* tests, yielded non-significant differences; this allowed the data from the two settings to be combined. Students *t* tests were then employed to compare the mean scores on each item of the following subgroups: primigravidas and multigravidas, those with and without previous hospitalizations and those who had actually experienced each item versus those who had not experienced the item. Pearson correlations were computed, to determine if relationships existed between the magnitude of the item scores and the following variables: length of labour, length of time spent in the labour room and numbers of familiar and unfamiliar people present. Finally, Kendall's Coefficient of Concordance yielded mean rank scores for the items, and the *w* statistic provided an indication of the degree of consensus in the sample with respect to their relative awareness of each item.

Findings

Of 314 respondents, 142 were primigravidas and 172, multigravidas; 184 had been hospitalized before, for reasons other than childbirth. The mean length of time spent in the labour room was 7.77 hours, range = 46, SD = 6.39. Parity did not appear to influence item scores. On all items, there was a non-significant difference between the mean scores of primigravidas and multigravidas. Similarly, previous experience in a hospital labour room did not influence magnitude of scores. Prior non-obstetrical hospitalization influenced only the scores assigned to "outside windows" and "being shaved". In both instances, subjects who had been hospitalized previously tended to assign higher scores to the items.

In general, labour length and length of time spent in the labour room did not influence item scores significantly. There were a few exceptions, however. There were weak but significant inverse relationships between labour length and (a) "other hospital sounds" ($r = -.1067$, $p < .04$), and (b) "presence of other equipment" ($r = -.1119$, $p < .03$); and between length of time spent in the labour room and "unfamiliar bed" ($r = -.1359$, $p < .02$), "unfamiliar surroundings" ($r = -.1028$, $p < .05$), and "bright lights" ($r = -.1562$, $p < .004$).

Table 1

The 29 Items in the Original LRRS

1. The colour and decor of the labour room[a]
2. Being in an unfamiliar bed
3. Unfamiliar surroundings
4. Bright lights in the labour room
5. Being in a very warm or very cool labour room
6. Being in a very large or very small labour room
7. Being in a labour room without outside windows
8. Odors
9. The presence of unfamiliar hospital staff – physicians, nurses, students, housekeeping, etc.
10. Sounds made by hospital staff outside the labour room
11. Having another labouring woman share the same room with me
12. Sounds made by other women in labour
13. Incoming personal telephone calls
14. Music
15. Other hospital sounds
16. Restrictions in where I was permitted to be while in labour (such as bedrest only, or allowed in chair but not in hallway)
17. Restrictions in what positions I was allowed to assume while in the labour bed
18. Having an "I.V." with medication in it to induce or speed up labour
20. Having a fetal monitor on
21. The presence of other medical equipment, such as oxygen and suction equipment, in the labour room
22. Vaginal examinations
23. Rectal examinations
24. Having my "water broken" by a physician
25. Having an enema
26. Being shaved
27. Receiving oxygen during labour
28. Continuous epidural anaesthesia
29. The presence of familiar people in the labour room, such as my husband, friends, relatives, personal physician

[a] The anchor item, with a pre-assigned score of 100

Table 2

Effects of Personal Experience with the Stimulus on Item Scores in the LRRS

Item	Significant Positive Effect		
	Yes	No	Effect not known[a]
Labour Room decor			x (anchor item)
Unfamiliar bed	x		
Unfamiliar surroundings	x		
Bright lights	x		
Warm/cool room	x		
Large/small room	x		
No outside windows	x		
Odors	x		
Unfamiliar staff			x
Sounds by staff			x
Another patient sharing labour room			x
Sounds made by other labouring woman	x		
Telephone calls			x
Music			x
Other hospital sounds	x		
Restrictions in where subject could go		x	
Restrictions in position	x		
"Plain" I.V.	x		
I.V. with oxytocin	x		
Fetal monitoring	x		
Presence of other equipment	x		
Vaginal exams	x		
Rectal exams			x
Amniotomy	x		
Enema		x	
Perineal shave		x	
Receiving oxygen	x		
Epidural anaesthesia	x		
Presence of familiar people			x

[a] For 5 items, less than 12% of the sample experienced the item, and therefore statistical comparisons were not valid. The two items concerning presence of unfamiliar or familiar people were experienced by all subjects, as was the anchor item.

Personal experience with the stimulus did have a significant influence on 18 items. In each instance, the group who had experienced the stimulus had a higher mean score for the item than the group who had not experienced the stimulus (Table 2). There were only three items – enema, perineal shave and restrictions in where the subject was permitted to be during labour – in which personal experience had a non-significant influence. In the remaining items, the numbers in either the "did experience" or "did not experience" group were too small for valid comparisons. For example, approximately four per cent of the subjects shared a room with another labouring woman (n = 12), ten per cent underwent rectal examinations (n = 33), while 11 per cent heard music during labour (n = 37). Because of the influence of personal experience on the other item scores, the five items that were experienced by fewer than 40 subjects were dropped from further analyses. For the sake of consistency, all final mean scores were calculated on the scores of those who actually experienced the items.

Additional analyses of the data yielded further evidence that experience with a stimulus resulted in improved ability to score the stimulus. Initially, on 14 items, between 14% and 28% of the total sample assigned a score of 100 to the item. Because 100 was the preassigned score to the "anchor" item, this finding suggests that these subjects were unable to differentiate among some items. When the scores of subjects who did not experience the items were removed, all scores of zero and nearly all scores of 100 were thereby eliminated.

In addition to the five items that were dropped from the final scale, because too few subjects had had personal experience with the stimulus, two other items were also eliminated. The two items were the only two that were not inanimate: "presence of familiar people" and "presence of unfamiliar people". There was a significant positive correlation between the number of unfamiliar people and the magnitude of the corresponding item score ($r = .1444$, $p < .007$). Thus, a mean score would not be an accurate reflection of the impact of this stimulus. In contrast, all subjects had at least one familiar person with them during labour, but very few (n = 5) had more than two. Therefore, it was impossible to determine to what extent larger numbers of familiar people would influence item scores.

The revised LRRS consisted of the 22 items, including the anchor item, that were experienced by the majority of the sample and for which a mean score was a valid indication of relative impat. Table 3 lists the 22 items, in descending order of magnitude, with obtained mean scores and mean rank scores of the subjects who experienced the items. When Kendall's Coefficient was computed, the results indicated a significant level of agreement among the subjects on their relative awareness of the items ($w = .1924$, $p < .0001$). In other words, regardless of variations in the magnitude

Table 3

Mean Scores and Mean Rank Scores of the 22-item Revised LRRS

Item	No. Who Experienced it	Mean[a]	Mean Rank[a]
Continuous epidural anaesthesia	139	308	17.98
Having a fetal montior on	267	245	19.06
Having an "I.V." *with* medication in it to induce or speed up labour	124	232	16.83
Having my "water broken" by a physician	170	231	16.55
Vaginal examinations	299	227	19.09
Sounds made by other women in labour	206	226	16.95
Restrictions in what positions I was allowed to assume while in the labour bed	137	222	17.55
Receiving oxygen	109	215	15.02
Having an "I.V." *without* medication in it	126	193	14.93
Restrictions in where I was permitted to be while in labour	127	185	14.50
Having an enema	92	178	15.72
Being shaved	86	151	14.40
Being in a very small or very large room	172	146	12.32
Brights lights in the labour room	112	141	12.46
Odors	66	140	10.26
Being in a very warm or very cool labour room	125	131	13.73
The presence of other medical equipment, such as oxygen and suction	183	127	11.47
Being in a labour room without outside windows	202	109	11.24
Unfamiliar surroundings	230	106	11.72
The colour and decor of the labour room[b]	314	(100)	n/a
Other hospital sounds	188	94	9.39
Being in an unfamiliar bed	229	93	9.75

[a] All means and mean ranks were calculated from the scores of those who actually experienced the stimuli, and means were rounded to the nearest whole number.

[b] The anchor item: because score was pre-assigned, means and mean ranks

of the scores they assigned, subjects tended to experience the same relative degree of awareness of the items.

On examination, the 12 items with the highest mean scores differ from the 10 with the lowest mean scores. Of the top 12, eleven involve either restraints, restrictions in movement, or physical intrusiveness. In contrast, all of the ten lowest-scoring items are unintrusive stimuli.

Discussion

Of particular interest is the finding that experience with a stimulus had a significant positive influence on the magnitude of the assigned score. One of the criticisms of the conclusions reached in life change research has been that the highest-weighted events are the rarest events (Zimmerman, 1983). This is not the case with the LRRS. The highest-weighted stimuli are very common ones in the hospitals used for data collection. For example, in the study sample, 44% had continuous epidurals, 85% had electronic fetal monitoring, 54% had amniotomies and 39% had intravenous oxytocin during labour. Similar results were obtained in a recent Toronto study of low-risk childbearing women (Hodnett, 1983). The 29 original items were ones with which all or most of the sample would be familiar prior to labour. They were either common environmental stimuli or common obstetrical procedures which are discussed in prenatal classes, the mass media, the lay childbirth literature and in physicians' offices. Nevertheless, direct personal experience had a significant impact on the mean scores of the majority of the items. This finding is contrary to that of previous researchers (Holmes & Rahe, 1967; Volicer, 1973, 1974; Volicer & Bohannon, 1975; Volicer & Burns, 1977).

The instructions for completion of the instrument in the present investigation may have influenced these results. In the previous studies using this method, subjects were asked to score the items, according to how the "average" person would score them. Thus an individual's scores may have reflected perceptions of the average between those who had and had not experienced each stimulus. In the present study, because ratings were based solely on self-perception, differences between those who experienced and those who did not were more readily detected.

Physical intrusiveness seems to be a major factor in degree of awareness of a stimulus during labour. However, high scoring of certain items may have been influenced by the reason for their usage; subjects' awareness may have been influenced by the rationale they were given for having the procedure. For example, while electronic fetal monitoring is often administered as a routine practice in the two hospitals used for data collection, oxygen therapy and intravenous oxytocics are usually employed

only when complications arise. Knowledge that a complication has arisen may increase anxiety and increase the subject's attention to the stimulus.

The issue of the meaning of the stimulus to the individual, including the extent to which it is perceived as desirable or undesirable, remains unresolved. The Holmes and Rahe (1967) model predicts that both positive and negative events are associated with an increased probability of illness. Nevertheless, subsequent research is nearly unanimous in finding that, when a list of events is separated into subscales of positive and negative items, the undesirable events are more strongly related to physical and psychological pathology. The latter finding is consistent across varied subject samples, dependent variables and life event measures (Mueller, Edwards & Yarvis, 1977a, 1977b; Vinokur & Selzer, 1975). All items of the "final" LRRS (with the possible exception of the anchor item) can be considered to have at least a partially negative impact.

The undesirable or physically intrusive items may receive higher scores because of the greater amount of adaptation required by the individual. However, determining the desirability or undesirability of an event is not always clear-cut. For example, a vaginal examination may be uncomfortable and embarrassing, but it may be requested by the labouring woman because of her desire to know if labour is progressing satisfactorily. If the results indicate significant progress has been made, she will feel relief and renewed confidence. Similarly, electronic fetal monitoring has been shown in many studies (Butani & Hodnett, 1980; Shields, 1969; Starkman, 1976) to produce ambivalent reactions in subjects. Confidence that the fetus is not distressed may be coupled with physical discomfort because of restrictions in mobility or episodes of fear and anxiety when the fetal heart rate is "lost" when equipment malfunctions. Future tests of the instrument should include examinations of each item, in terms of the extent of its subjective desirability for each subject.

There is an unresolved debate in the life events research literature, concerning the use of subjectively-weighted versus consensually-derived item scores. A parallel question arises in childbirth events research. The issue that should be addressed next is whether environmental load can be scored "objectively" via consensual validation, which results in magnitudes assigned to each stimulus, to be used in subsequent research, or whether environmental load must be subjectively determined by each individual. Previous research has demonstrated that stimulus screening ability is a stable personality trait, describing an individual's ability to attend to environmental stimuli selectively (Mehrabian, 1978), and that stimulus screening is a predictor of childbirth outcomes (Hodnett, 1983). The obvious question is: Is awareness of an event related to stimulus screening ability? In other words, do non-screeners (those who react acutely to environmental

stimuli) score childbirth stimuli higher than screeners? A study of the relationship between stimulus screening ability and LRRS item scores would shed light on this question.

Regardless of the outcome of such investigations, there are serious methodological obstacles to be overcome before research that links environmental load and childbirth outcomes can be undertaken. At present, there are many confounding variables that must be considered. For example, two of the highest-scoring items involve medications (oxytocics and epidural anaesthetics) that can result in obstetric complications and influence length of labour. As previously noted, other top-scoring procedures may be instituted as a result of the onset of complications. For the present time, the LRRS should be tested further on samples of low-risk women who experience uncomplicated labours, and for whom the procedures are employed for reasons other than maternal or fetal risk factors. Consideration of suitable outcome measures in such research must involve a careful scrutiny for potential confounding variables and rigorous efforts to control for these.

Furthermore, the issue of the impact of familiar and unfamiliar people remains unresolved; yet, this is a critical dimension of the birth environment, for both patients and caregivers. While the other environmental stimuli can be conceptualized as having a unidirectional influence (they have an impact on the labouring woman and not vice versa), the presence of other people invariably involves reciprocal interactions between the woman and the people with her – she influences them, and they, her. Thus, their impact on her may be mediated by many interpersonal factors. Further research is necessary before conclusions can be reached about the relative impact of human beings on environmental load.

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RÉSUMÉ

L'influence environmentale dans les milieux d'accouchement: Le développement et l'épreuve d'un instrument

Les récentes tentatives d'humaniser les milieux d'accouchement étaient fondées sur l'hypothèse que la nature du milieu exerce un effet sur l'issue de l'accouchement. Toutefois, on sait peu de choses sur les caractéristiques de ce milieu qui permettent de prédire l'issue psychosociale ou physiologique d'un accouchement. Les études de psychologie de l'environnement donnent à penser que le fardeau environnemental d'un cadre influe sur les processus autonomes et cognitifs. Une étude a été effectuée dans le dessein d'élaborer un instrument, l'échelle d'évaluation de la salle d'accouchement, lequel permet de mesurer le fardeau environnemental des milieux d'accouchement. Il en ressort qu'il faut régler d'importants problèmes de méthodologie avant de pouvoir réaliser des études qui déterminent l'incidence du fardeau environnemental sur l'issue d'un accouchement.

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