

## Medical Data Analysis: Pregnant Women - A Smooth Birth of a Child - A Comparison Study

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**Abstract** — Pregnant women giving birth to a child successfully and smoothly is vitally important to the next generation of human gestation. Gynecologists want to know if any factors help pregnant women give birth to a child more smoothly or not. Thus this research tries to study pregnant women during the birth process, comparing two groups of data, and discussing the real world phenomenon. In this study, pregnant women staying in hospital for days, and an MINLP model was proposed. After the data set from two teaching hospitals in central Taiwan was checked, data was collected from 327 pregnant women, and it was decided that this study offered valuable real data for future study to help further hospital birth simulation studies. According to current data, non-Taiwanese pregnant women's births to a child outperformed Taiwanese women as to its smoothness. It may be down to the fact that they were younger, or moved more frequently than Taiwanese women. However, there were too many factors that influenced giving birth to a child smoothly, so this study only lists the results for clinical personnel reference. Future research should apply more hospitals' data to validate these findings.

**Keywords** — Birth to a Child Smoothly; Pregnant Women; Medical Data Analysis; Dynamic Selection Model; Women Study.

### I. INTRODUCTION

Pregnant women giving birth to a child successfully and smoothly is vitally important to the next generation of human gestation. Gynaecologists want to know if any factors help pregnant women give birth to a child more smoothly or not. This study checked the data set from two teaching hospitals in central Taiwan. Doctors want to realize what, if any, difference there is between Taiwanese and non-Taiwanese women giving birth, and whether this has any impact on the childbirth's smoothness. The data comes from the two hospitals' information systems and obtained permission from the related regulations and laws.

Dr. Chang stated that giving birth to a child smoothly (BACS) or not is decided by uterine contractions, size of the pelvis, and baby size. In general, being young and being more flexible would enable BACS [1]. Thus it is a topic to analyze the degree of BACS within Taiwanese and non-Taiwanese women. Would BACS be higher or lower if pregnant women used a painless childbirth injection is also investigated in this study. Older mothers would usually measure poorly in terms of BACS, and this study also tries to identify the results and performance in Taiwanese and non-Taiwanese women.

This research tries to study pregnant women giving birth to a child smoothly, comparing two groups of data, and discussing the real world phenomenon.

### II. LITERATURE REVIEW

Natural childbirth at home has become popular due to the health concept around us trend. Smooth childbirth become as modern women favorite; furthermore, proceed with more characteristics of this issue. The previous literatures which were related to this study were as follows.

Suzuki et al. [2] studied Japanese nulliparous labor progression with Friedman's classic 1955 curve and Zhang's 2002 curve. They developed a labor curve using retrospective record reviews of 2369 Japanese nulliparas, at term, spontaneous labor onset and singleton vertex deliveries of normal birth weight infants. Their research focused on Japanese women. Our study focused on women who lives on Taiwan. In their study, the new Japanese Suzuki-Horiuchi labor curve with slower cervical dilation in the active phase was like Zhang's and differed from Friedman's curve. Labor length was approximately 5 hours occurring between 4-10 cm compared with Friedman's 2.5 hours and Zhang's 5.5 hours. They found that similar to Zhang's curve, the Suzuki-Horiuchi curve was smooth and more gradually sloped than Friedman's curve. In our study, we studied birth smooth, different to their women labor studies.

Wendland [3] discussed interest in home birth appears to be growing among American women, and most obstetricians can expect to encounter patients who are considering home birth. In 2011, the American College of Obstetricians and Gynecologists (ACOG) issued an opinion statement intended to guide obstetricians in responding to such patients. Comparison with guidelines indicated that ACOG treats home birth as an ethical exception: comparable evidence leads to strikingly

different recommendations in the case of home birth and the case of trial of labor following a prior cesarean. Their research surgery was the based of our studies. Wendland [3] tried to know the home birth as an ethical exception. Our study tried to validate the difference in hospitals. In their study, mothers who choose home birth and for their newborns. Obstetricians need not attend home births. Wendland [3] found that (1) to refer clients to skilled clinicians who will attend home birth, (2) to continue respectful antenatal care for those women choosing home birth, (3) to provide appropriate consultation to home birth attendants, and (4) to ensure that transfers of care are smooth and nonpunitive. Our study was focused on hospital birth, different to the above study.

Csermely *et al.* [4] analyzed a large dataset of the Hungarian Case-Control Surveillance of Congenital Abnormalities, including 21,494 cases with different isolated congenital abnormality and their 34,311 matched controls of first and high birth order of pregnant women. Birth order is a contributing factor in the origin of some isolated congenital abnormalities. Their findings were that there was a higher risk of certain congenital abnormalities in pregnant women with first or high birth order, which was worth considering in the clinical practice. From their study, we can learn their comparison study skills.

Alemayehu and Mekonnen [5] discussed the low utilization of skilled birth attendants sustained high maternal mortality. The aim of their study was to assess its magnitude and correlates in Northwest Ethiopia. Their research focused on skill part of birth. Our study focused on a large sample size and normal condition analysis. In their study, they studied was conducted on 373 randomly selected women who gave birth in the 12 months preceding the survey. Correlates were identified using binary logistic regression. Skilled birth attendance was 18.8%. Cultural practices in health facilities (65.5%), expecting smooth delivery (63.4%), and far distance (62%) were the main barriers. Urban residence, primary-plus level of education, frequent ANC visits, living nearby the health centers, and a problem during labor were positively correlated with skilled birth attendance utilization. They found that stakeholders should enhance girls education beyond primary level and ANC services and shorten distances to health facilities. Our study can refer their study to discuss women smooth birth problem.

Czeizel *et al.* [6] stated an association between periconceptional folic-acid-containing multivitamin supplementation and significantly reduced risk of congenital heart defects (CHDs). These findings were confirmed in observational multivitamin studies in the USA, and studies in the Netherlands and China regarding folic acid. Their objective was to estimate the possible preventive effect of folic acid supplementation for different CHDs during their critical period of development. In their study, folic acid in pregnant women associated with reduced prevalence of severe congenital heart defects in

their children; however, they proposed a national population based case and control case comparison study. Yee *et al.* [7] proposed mode of delivery preferences in a diverse population of pregnant women. In their study, among the 240 participants, 90.8% had a stated preference for vaginal delivery. The different population generated the different results.

Jiang *et al.* [8] discussed institution-based or hospital-based childbirth, with the ultimate goal of universal access to skilled birth attendance (SBA), had been selected as a key strategy to reduce the maternal mortality rate in many developing countries. In China, the question of how to engage traditional birth attendants (TBAs) in the advocacy campaign for SBA poses a number of challenges. Their paper aimed to demonstrate how TBAs in rural regions of China had been integrated into the health system under a policy of institutional delivery. Their research focused on country side Chinese women childbirth. Our study focused on central of Taiwan women. In their study, a total of 33 individual interviews were conducted with regional and local politicians, policy makers, health managers, health providers, civil society members, village cadres for women affairs, former TBAs, village maternal health workers, mothers and their mother-in-laws. They found that since 1998, TBA traditional role of providing in-home care during childbirth had been restructured and their social role had been strengthened in rural Guangxi. TBAs were redesigned to function as the linkage between women and the health system. A new policy in 1999 shifted the role of TBAs to village maternal health workers whose responsibilities were mainly to promote perinatal care and institution-based delivery of pregnant women. This successful transformation involved engaging with government and other actors, training TBAs for their new role, and providing incentives and sanctions for human resources management. In Taiwanese, our birth rate was low. The factors in humanity environments was different to Guangxi women in China.

Villadsen *et al.* [9] studied We the Danish MAMA ACT study as a strategic perspective on how to move forward, and described methodological steps in intervention development. Based on a mixed method needs assessment, the MAMA ACT study aimed to enhance the communication between migrant women and midwives during antenatal care regarding warning signs of pregnancy. How to access acute care was their concern. Their research focused on migrant women, its very similar to our research. They used health system interventions for improved maternal and child health among migrants should be based on thorough needs assessments, contextual understanding and involvement of the target group and health-care providers. In their study, they presented the Danish MAMA ACT study as a strategic perspective on how to move forward, and described methodological steps in intervention development. Based on a mixed method needs assessment, their study aimed to enhance the

communication between migrant women and midwives during antenatal care regarding warning signs of pregnancy and how to access acute care. They found Danish results to academics' field.

Tappis et al. [10] studied assessing the association between health facility characteristics and other individual or household factors with a women likelihood of skilled birth attendance in north-central Afghanistan. Data from a 2010 household survey of 6879 households in 9 provinces of Afghanistan were linked to routine facility data. They used hierarchical logistic regression models to assess determinants of skilled birth attendance. Their research focused on skilled childbirth. Our study covered skilled birth and non-skilled birth. They aimed at Afghanistan people; our study aimed at Taiwanese. In their study, women who reported having at least one antenatal visit with a skilled provider were 5.6 times more likely to give birth with a skilled attendant than those who did not. The odds of skilled birth attendance were 84%. Their study did not show any direct linkages between facility characteristics and skilled birth attendance but provided insights into why studies assuming that women seek care at the nearest primary care facility may lead to misinterpretation of care-seeking patterns. They found that a 36 percentage point gap between women who receive skilled antenatal care and those who received skilled birth care. Nearly 60% of women with a skilled attendant at their most recent birth bypassed the nearest primary care facility to give birth at a more distant primary care facility, hospital, or private clinic. Distance and transport barriers were reported as the most common reasons for home birth. In their study, we would know convenience issue would let their country women to choice childbirth at home or at hospital.

Chao et al. [11] discussed two case reports in successful childbirth after extracorporeal membrane oxygenation in previous pregnancy. Kizilirmak and Baser [12] studied determined the effect of education that is given information about the delivery room, labor and coping strategies with the fear of pain of childbirth in primigravida women. Their study was conducted experimentally using pre-post tests and a control group. A total of 99 primigravida women with 50 in the study group and 49 in the control group at a maternity hospital in a city of middle region of Turkey were recruited to the study. Data were collected using the Pregnant Introduction Form, Interview Form After Delivery and Wijma Delivery Expectancy or Experience Questionnaire (W-DEQ), version A. In the first of their interview session, no significant difference was found between W-DEQ-A scores of the study and control groups. The mean pre-education W-DEQ-A score was 61.1 while it was 42.0 post-education in the study group. The post-education W-DEQ-A score was 58.5 in the control group while it was 42.0 in the study group. In last, they found that it was determined that positive perception regarding birth was provided and fear of childbirth decreased with the

preparation education for birth. Our study learned this skills. We divided research subjects into two groups.

Oliveira et al. [13] stated several studies had shown that pelvic floor injuries during a vaginal delivery can be considered a significant factor in the development of pelvic floor dysfunction. Such disorders included a group of conditions affecting women like urinary incontinence, pelvic organ prolapse and fecal incontinence. Their research used numerical simulations to the clarification of the mechanisms behind pelvic floor disorders. In their study, they aimed to propose a mechanical model implemented in the finite element method context to estimate the damage in the pelvic floor muscles by mechanical effects during a vaginal delivery of a foetus in vertex presentation and occipitoanterior position. The constitutive model adopted had already been successfully used in the simulation of childbirth and the structural damage model added had previously been applied to characterize the damage process in biological soft tissues undergoing finite deformations. They used math methodology try to solve the proposed problem. The constitutive parameters were fit to experimental data available in the literature and the final proposed material model was suitable to estimate the mechanical damage in the pelvic floor muscle during a vaginal delivery. Their computational model predicted major un-happened damages. They found that the use of PCEA provided better postoperative analgesia and decreased the amount of opioid consumption postoperatively compared with patient-controlled intravenous analgesia. Our study could be classified into extend their numerical prediction research. But we have our numerical model.

Although several literatures were related to skilled childbirth, there is only a limited amount of literature available on pregnant women giving birth to a child smoothly, and discussing Taiwanese women.

### III. PROBLEM FORMULATION

This research adapts minimization of pregnant women staying in the hospitals' days,  $D$ , as the basic model. A dynamic selection model [14][15], previous research, helps this study construct a more precise problem formulation.

In this study,  $s_i$  denotes arrival day into hospitals of pregnant women  $i$ ;  $l_i$  denotes leaving day from hospitals of pregnant women  $i$ ;  $n$  denotes number of pregnant women;  $A_i$  denotes age penalty of pregnant women  $i$  (due to the larger age women, the lower body strength);  $T_i$  denoted a Taiwanese or non-Taiwanese pregnant woman  $i$ ; if  $i$  is selected, then equal to 1; otherwise equal to 0, a binary variable;  $Inj_i$  denotes use of painless childbirth injection of pregnant women  $i$ ; if  $i$  is selected, then equal to 1; otherwise equal to 0, a binary variable.  $Cap$  denotes hospitals capacity constraints.

The MINLP (Mixed integer non-linear programming) model to minimize pregnant women staying in the hospitals' days,  $D$ , is as follows:

$$d_i : l_i - s_i$$

$$\text{Min } D = \sum_{i=1}^n d_i \cdot T_i \cdot \text{Inj}_i \cdot A_i \quad (1)$$

$$s.t.$$

$$\sum_{i=1}^n d_i \leq \text{Cap} \quad (2)$$

$$T_i, \text{Inj}_i \in \{0,1\} \quad (3)$$

The objective (1) is to find a minimization of pregnant women staying in hospitals' days,  $D$ . In Eq. (2), these are hospital capacity constraints. Eq. (3) declares artificial binary decision variable constraints.

IV. DATA COLLECTION

The experiments of the proposed approach was proceeded with on the basis of medical data analysis. In the data set within the database, the subjects collected were 327 pregnant women staying in the two hospitals in central Taiwan. There were 28 non-Taiwanese pregnant women and 299 Taiwanese pregnant women. There were 42 pregnant women using painless childbirth injection and 285 who were not. The data collection period was from Jan 1st 2014 to Dec 31st 2015.

V. RESULTS AND DISCUSSION

This study analysed the results of the 327 pregnant women staying in two hospitals and listed in basic descriptive statistics as shown in tables I. In table I, the average age of the women was 32 and S.D. was 5; staying in hospital days was 3.87 and S. D. was 1.42. The max age of a pregnant woman was 46 and the minimum was 16. The maximum term a pregnant woman stayed in a hospital was 8 and the minimum was 2 days.

The descriptive statistics of Taiwanese vs. non-Taiwanese pregnant women was as shown in table II. Based on Table I, pregnant women staying in hospital days was 3.87, thus this study adapted this value as standard to examine BACS. The successful rate of Taiwanese pregnant women was 66.2% and non-Taiwanese pregnant women was 71.4%. However, there were too many factors that influenced this indicator, as formula (1) stated age, painless childbirth injection, level selection of staying in hospital days, and real world sample size, as the number of non-Taiwanese were fewer. Thus, if we only did a Chi-square test, it was close to significant, but null hypotheses were not easy to reject. The reason was that in the real world we cannot proceed with the pure experiment design, and therefore it had to be considered that it maybe a mixed interger non-linear model phenomenon.

The results only answered the main question of the proposed thinking. To construct this whole new model to stimulate further ideas is difficult when faced with large medial data and variables, some of which cannot be processed by experimental design, but a trend or answer is wanted. These two distribution data sets in Table I and II maybe offered parameters of pregnant women staying in hospitals for some academic field to do further simulation studies. Due to research purposes, this study did not yet run a whole simulation model to predict the future phenomenon.

TABLE I. DESCRIPTIVE STATISTIC OF HOSPITALS' PREGNANT WOMEN

Categories	Mean	S. D.	Max	min
Age	32	5	46	16
Pregnant women staying in the hospitals' days	3.87	1.42	8	2

TABLE II. DESCRIPTIVE STATISTIC OF TAIWANESE VS. NON-TAIWANESE PREGNANT WOMEN

Categories	Taiwanese	non-Taiwanese
BAC based on 4 days as level	66.2%	71.4%

VI. CONCLUSION

Pregnant women giving birth to a child is vitally important. Gynaecologists want to know if any factor helps pregnant women give birth to a child more smoothly or not. This study checked the data set from two teaching hospitals in central Taiwan. Doctors want to realize if non-Taiwanese women giving birth to a child smoothly outperforms that of Taiwanese women. In this study, a pregnant women staying in the hospital days, MINLP model was proposed. Through 327 pregnant women staying in two hospitals where data was collected, this study offered valuable real data for future studies to proceed in hospital simulation studies. According to current data, non-Taiwanese pregnant women give birth to a child more smoothly on a more regular basis than Taiwanese women. It maybe because they were younger, or more flexible than Taiwanese women. However, there were too many factors influencing BACS, and this study only lists the results for clinical personnel reference. Future research should apply more hospitals' data to validate these findings.

CONFLICT OF INTEREST

The authors confirm that this article content has no conflicts of interest.

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