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Article

Process value of care safety: women's willingness to pay for perinatal services

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Abstract

Objective: To evaluate the process value of care safety from the patient's view in perinatal services.
Design: Cross-sectional survey.
Settings: Fifty two sites of mandated public neonatal health checkup in 6 urban cities in West Japan.
Participants: Mothers who attended neonatal health checkups for their babies in 2011 (n = 1316, response rate = 27.4%).
Main Outcome Measure: Willingness to pay (WTP) for physician-attended care compared with midwife care as the process-related value of care safety. WTP was estimated using conjoint analysis based on the participants' choice over possible alternatives that were randomly assigned from among eight scenarios considering attributes such as professional attendance, amenities, painless delivery, caesarean section rate, travel time and price.
Results: The WTP for physician-attended care over midwife care was estimated 1283 USD. Women who had experienced complications in prior deliveries had a 1.5 times larger WTP.
Conclusions: We empirically evaluated the process value for safety practice in perinatal care that was larger than a previously reported accounting-based value. Our results indicate that measurement of process value from the patient's view is informative for the evaluation of safety care, and that it is sensitive to individual risk perception for the care process.

Key words: patient safety, process value, patient preference, perinatal care

Introduction

Facing fiscal pressure and the demand for lean in healthcare, providers and policy makers are regarding safety improvement in hospital care as a pivotal attribute for value-based care [1–3]. The value of safety is often evaluated as the cost of avoidable health damage [4], or actual cost for safety practice [5] from provider's point of view. Although recent concerns with patient-centered care requires active involvement of patient's preference in safety management [1, 6], the value of safety care from the patient's point of view, which may not be comparable with that of providers, has not yet been fully explored.

Indeed, recent letters have indicated that the concept of safety is multi-faceted and may not be common between healthcare providers and patients. A recent review indicated that patients/consumers see safety as the preventability of dreadful experiences and/or trust in the system rather than as health outcomes [7, 8]. Such non-health value of safety is difficult to quantify in terms of health outcomes such as QALY [9] or in terms of monetary cost through conventional accounting-based evaluation [10]. Instead, patients' value for

safety could be realized through the economic evaluation of non-market goods such as willingness to pay (WTP) [11].

There have been several studies that measured patients' WTP for hospital safety practices such as the prevention of falls and maintenance medication for respiratory disease [12, 13]. However, these studies had a narrow focus on medical outcomes and might not accurately reflect the non-health value of health safety practices [14, 15]. A previous review argued that non-health value as well as health value should be incorporated into the evaluation of health services [9].

However, the evaluation of non-health process value for safety is challenging because such evaluation is based on patients' perception of risk, which is shaped through both personal and vicarious experiences [16]. Currently, there is limited knowledge available about how the process value of safety is affected by an individual's risk perception.

To close this knowledge gap, we focus here on women's preference for safety in perinatal care. Perinatal care has a couple of advantages when it comes to evaluating the non-health value of safety care from the consumers' point of view. First, the process of perinatal care, such as the mode of delivery (e.g. vaginal vs. caesarean), and the professional attendance (e.g. midwives vs. obstetric physicians) are both major decision points for perinatal women. One of the primary reasons behind a woman's decision is her concern about safety in terms of securing the wellbeing of the expected baby and the avoidance of unpleasant perinatal experiences due to complication/accidents. Here, value is not limited to health outcomes but also includes non-health values revealed in the process choice [17, 18]. Second, previous experiences with delivery, either personal or vicarious, will give rich information to gravida women for the choices they make in terms of safety.

The main purpose of this paper is to evaluate the process value of safety care in perinatal services through stated patient preference. We also examine the effect of patients' risk perception on the valuation of safety practice.

Methods

Participants and setting

For the purposes of our study, the Japanese perinatal care market has some advantages in that Japanese perinatal care is delivered through the free market without price regulation or insurance coverage, and the observed choice behaviors of perinatal women should thus accurately reflect their preferences. However, a public subsidy that supports pregnant women is available and helps to secure economic accessibility of this service. Under the free access policy of Japan's healthcare delivery system, this subsidy allows them to freely choose the modes and facilities of perinatal services [19, 20].

Another advantage is that municipal governments are legally required to provide free postnatal health checkups of all infants residing in Japan at the age of 1.5, 3, 18 and 36 months. We took advantage of this requirement and recruited women at 52 health checkup sites for their 3-month-old infants in 6 cities in the metropolitan area of Western Japan on one or two days for each site from 1 February 2011 to 28 February 28. We originally recruited the 12 largest municipalities in the area to obtain the largest possible sample at each site; 6 of these 12 municipalities approved and agreed to join our project. A consecutive convenience sample of 4810 women with Japanese literacy was recruited by a researcher, who explained that the women would answer a paper-based self-administered questionnaire with no monetary incentives. Those who agreed to participate were asked to complete the questionnaire and mail it back within 1 week. This survey had no exclusion criteria except that the respondents were required to have Japanese literacy. The respondents who answered questions regarding service selection and income were subject to conjoint analysis. Response rate was 27.4 % (N = 1316). This study was approved by the Medical Ethical Committee of the University of Tokyo.

Experimental design

We used conjoint analysis to estimate WTP. The self-administered questionnaire we distributed included a discrete binary choice format asking respondents to select their preferred perinatal service scenario from two possible scenarios, the details of which are presented shortly. Study design and analysis followed the current guidelines for conducting conjoint analysis [21].

First, we identified attributes of safety practices and their levels of perinatal service through literature review. The mode of delivery (vaginal vs. caesarian section) and types of professional attendance were identified as attributes associated with women's preference for safety [17, 18]. Many obstetrics guidelines recommend physician-attended care over midwife care for high-risk childbirth [22–25]. In Japan, perinatal care is generally supplied at university hospitals, general hospitals, obstetrics specialty hospitals and midwife clinics. With the exception of midwife clinics, delivery care services require physician attendance and supervision over midwife care ('physician-attended care'). University hospitals and general hospitals are regarded as tertiary hospitals that can provide high-tech care including neonatal intensive care unit (NICU) services and specialty services for patients in serious condition with complications. Obstetric specialty hospitals provide care for perinatal patients without complications and emergency conditions. Patients with emergency conditions are often referred to nearby tertiary hospitals. Finally, midwife

Table 1 Attributes and levels used in survey

Attribute	Level
Type of professional attendance	Physician-attended care (university hospital, general hospital, obstetric specialty hospital) vs. Midwife care without physician attendance (Midwife clinic)
Amenity	Single-bed room with private toilet, Single-bed room, General ward (four beds)
Painless delivery	Anesthetizing or not
Institutional rate of caesarean section (%)	0, 15, 30
Travel time to facility (min)	10, 30, 60, 80
Price (USD)[a]	1667, 3333, 5000, 6667

[a]JPY: 200 000, 400 000, 600 000, 800 000.

clinics have no physician in attendance ('midwife care without physician attendance'). We originally set these four types of facilities related to the types of professional attendance as attribute levels of safety care. Since there was no significant difference of coefficients among university, general and obstetric specialty hospitals, we re-categorized them into physician-attended care.

We also reviewed literature to identify other attributes related with women's decisions of perinatal care, such as amenity, painless delivery, institutional rate of caesarean section, and travel time to a facility [26–29] and defined levels that cover the range of actual perinatal services in Japan (Table 1).

With the identified attributes and their levels, we created several sets of scenarios based on an orthogonal design using the statistical software JMP version 6 (SAS Institute Inc., Cary, NC, USA). More specifically, in each scenario, the respondent woman was placed in a hypothetical situation in which she expected another childbirth. She was asked to choose one of two facilities with six attributes of different levels, assuming that the facilities were otherwise of identical quality. We prepared 56 scenarios by taking the level balance and minimal overlap and arranged them into 8 scenario sets, each of which contained 7 different scenarios plus a common dominant scenario with the same levels of attributes between the choice alternatives except for price. We randomly assigned one scenario set to each respondent.

Statistical analysis

In this study, respondents were presented with a pairwise choice of perinatal care and their choice was regarded as an expression of preference on the basis of a comparison of values in possible scenarios [30]. Assuming a linear function, the value placed on the attributes can be defined as

$$V = \beta_C \mathrm{PROF} + \beta_R \mathrm{AMENI} + \beta_A \mathrm{PAINLESS} + \beta_{Ca} \mathrm{CAESAREAN} + \beta_T \mathrm{TIME} + (\beta_P + \beta_{IP} \mathrm{INCOME}) * \mathrm{PRICE} + e, \quad (1)$$

where PROF and AMENI are the dummy variables for the types of professional attendance and amenity, PAINLESS is the dummy variable for the institutional capacity of giving painless delivery, CAESAREAN is the institutional rate of caesarean section, TIME is the travel time to the facility, INCOME is the household income and PRICE is the price of service. Unobservable factors in the function are represented by e. We assumed normally distributed e and considered the potential correlation from repeated observations on each respondent, hence we used a random-effect probit model for conjoint analysis.

Since it is known that one's household income will alter the value attached to monetary unit [31–33], our model includes the cross term of price and household income to adjust for individual values of price. We estimated the adjusted price as follows:

$$\beta_{Pi} = \beta_P + \beta_{IP} * \mathrm{INCOME}_i, \quad (2)$$

$$\mathrm{PRICE\_}adj_i = \frac{\beta_{Pi}}{\beta_{P\mathrm{med}}} * \mathrm{PRICE}, \quad (3)$$

where β_{Pi} is individual i's value of price and $\beta_{P\mathrm{med}}$ is the value of price for a person who earns the median of family income in the respondents as the reference income (41 600 USD, or 5 million JPY). The income-adjusted price is estimated from the ratio of the β_{Pi} and $\beta_{P\mathrm{med}}$.

The WTP for each attribute is obtained from the ratio of the estimated parameters of the attributes and the adjusted price. Confidence intervals of WTPs were obtained as bootstrap percentile intervals.

McDaniels *et al.* found that personal experience of exposure to risk is a major factor in determining the level of risk perception [16]. With this in mind, we identified the women's history of pregnancy complications (threatened premature delivery, anemia, breech presentation, hypertension, hyperemesis gravidarum and other conditions) as an indicator of a high-risk perception to examine the effect of risk perception on WTP for safety. Analysis was conducted using Stata for Windows version 8.2 (Stata Corp., College Station, TX, USA).

Results

The characteristics of respondents and the status of previous perinatal care that respondents received are presented in Table 2. Average age among respondents who experienced the first birth was 31.1 years, which is similar to the numbers in another national survey [34]. Of the respondents, 23% had experienced complication during previous pregnancy and/or delivery, such as threatened premature labor, anemia, breech presentation and pregnancy hypertension.

The results of the probit analysis are shown in Table 3. All attributes had significant coefficients for perinatal care selection. The coefficient of physician-attended care was 0.434, and the coefficient of a rise in service price by 100 USD was −0.042. Therefore, the crude estimate of WTP of physician-attended care is approximately 1000 USD (0.434 / 0.042 × 100 = 1000).

The significant positive interaction between price and household income suggested that a pregnant woman with higher income would have a higher WTP. Thus, we estimated WTP adjusted for the median income level as presented in Table 4. The WTP for physician-attended care over midwife care was 1283 USD.

With respect to the other attributes, the WTP for painless delivery was relatively small, amounting to 6% of the average

Table 2 Sample characteristics and previous perinatal care that respondents received

Characteristic	$N = 1316$
Age	31.9 (4.6)
Years of education	14.2 (1.7)
Household income (Unit: USD 1000)	51.4 (34.8)
Parity	1.61 (0.78)
Complications during previous pregnancy and delivery	293 (22.7%)
Previous perinatal care that respondents received	
Type of professional attendance	
Physician-attended care	1274 (97.8%)
Midwife care	29 (2.2%)
Amenity	
Single-bed room with private toilet	464 (35.7%)
Single-bed room with no private toilet	294 (22.6%)
General ward	436 (33.5%)
Delivery and other experiences	107 (8.2%)
Caesarean delivery	203 (15.6%)
Painless delivery	34 (2.6%)
Travel time to facility	20.0 (19.7)
Price (Unit: USD)	3980 (813)

Table 3 Results from random-effect probit model of women's choice of perinatal care

	Coefficient	95% CI	*P*-value
Type of professional attendance[a]			
Physician-attended care	0.434	0.380–0.487	<0.001
Amenities (reference; general ward)			
Single-bed room with private toilet	0.432	0.377–0.487	<0.001
Single-bed room	0.256	0.202–0.309	<0.001
Painless delivery	0.086	0.050–0.123	<0.001
Institutional rate of caesarean section	0.005	0.003–0.006	<0.001
Time to visit to facility (1 min)	−0.018	−0.019 to −0.017	<0.001
Price (100 USD)	−0.042	−0.043 to −0.038	<0.001
Price* Household income (100 USD)	$0.155 * 10^{-4}$	$0.122–0.188 * 10^{-4}$	<0.001

[a]Reference; midwife care.
$N = 9320$, Individual = 1171, Log-likelihood = −4733.6, AIC = 9485.2.

Table 4 Estimated WTP (USD) for perinatal services between women who have and have not had risk experience

	All samples ($N = 1171$)	Previous risk experience	
	WTP (95% CI)	Experience ($N = 260$) WTP (95% CI)	No experience ($N = 894$) WTP (95% CI)
Type of professional attendance (Reference group is midwife care)			
Physician-attended care	1283.3 (1086.6–1392.7)	1713.0 (1422.3–1970.9)	1167.0 (976.2–1267.0)
Amenity (reference group is general ward)			
Single-bed room with private toilet	1279.2 (1208.7–1536.8)	1114.7 (886.5–1474.4)	1310.2 (1264.7–1581.3)
Single-bed room	757.5 (710.8–1045.2)	880.1 (676.7–1288.7)	701.0 (669.1–982.7)
Painless delivery	255.8 (100.9–316.4)	381.0 (156.7–541.3)	216.9 (63.3–266.8)
Institutional rate of caesarean section (per 10% reduction)	13.3 (12.5–23.1)	19.8 (15.5–34.7)	11.1 (10.3–20.3)
Time to visit (per 1 min reduction)	51.7 (50.8–56.5)	53.8 (50.7–61.0)	51.8 (50.6–56.1)

respondent's payment for previous perinatal care. The estimated WTP for a 10% increase in the institutional rate of caesarean section from the average rate (equivalent to an increase from 15.6% to 17.1%) was 21 USD. The WTP for a single room with a private toilet was 1.6 times higher than that for a single room with no private toilet. The estimated WTP for a 1-min decrease in travel time from the average travel time was 5 USD.

We examined the effect of risk perception on the WTP for safety practice by comparing respondents with and without previous complication experiences. The WTP for physician-attended care among women who had experienced complications in a prior delivery was 1713 USD, which was 1.5 times higher than that of women who had not experienced complications.

We further examined the influence of the respondent women's socioeconomic characteristics on their WTP for safety care. The estimated WTP for physician-attended care was 1538.6 USD (95% CI = 1241.3–1712.9) for women in the higher age group (>32 years: 50th percentile) and 1083.5 USD (95% CI = 867.2–1272.3) for women in the lower age group. The WTP among women with a higher education level (>13 years) and lower education was 1549.4 USD (95% CI = 1247.8–1775.3) and 1189.5 USD (95% CI = 948.4–1352.5), respectively. The WTP in the higher income group (>4.2 million USD: 50th percentile) and lower income group was 1396.0 USD (95% CI = 1176.6–1540.3) and 1005.1 USD (95% CI = 656.1–1242.8), respectively. The WTP in the higher parity group (>1 child: 50th percentile) and lower parity group was 1217.0 USD (95% CI = 998.7–1362.1) and 1363.8 USD (95% CI = 1138.1–1505.1), respectively.

Discussion

We have evaluated the process value for safety practice in Japanese perinatal care by comparing the preference of physician-attended care to that of midwife care, which was estimated as 1283 USD. Kaseki *et al.* previously reported on the basis of cost accounting of safety practice and avoidable events in hospitals that the additional cost for physician-attended care compared to midwife care was 583 USD [35]. Several other studies estimated WTPs for safety medical outcome as 60–200 USD [12, 13]. These previous numbers are less than the estimation we obtained in this study. A recent review indicated that the process of care has an additional value to patients independent of subsequent health outcomes [14]. The gap between empirical estimation in this study and the previously reported value may be due to non-health processes such as avoiding fear/stress about the delivery that is further influenced by one's previous birth experience and attitudes/beliefs on the natural process of delivery, which may have been ignored in previous study frames [17, 18, 26].

This study also revealed the effect of risk perception on WTP for care safety. As shown in previous studies [17, 18], women with previous risk experiences stated a 1.5 times higher WTP for physician-attended care compared with women without risk experiences. This larger value attached to process-related safety by individuals with a higher risk perception may indicate that regardless of the objective rate of risk events, individuals are willing to pay to ease their level of anxiety evoked by a personal risk perception [16]. Previous studies have shown that the values for safety delivery are associated with women's fear and beliefs regarding birth [18, 31]. This further

suggests that information provision and support to reduce anxiety about process-related safety will have a non-ignorable value for women who have experienced pregnancy complications.

Our results demonstrate the importance of valuation in the design and evaluation of healthcare safety from the patient's point of view, in addition to conventional evaluation based on clinical outcomes and practice costs. Evaluation of healthcare based only on clinical outcomes may lead to neglect of the non-health value of care [14]. The wider range of attributes involved in a patient's process value may provide a wider window to find ways to reduce the perceived risk and enhance the patient's sense of safety as well as ensure more efficient pricing of the services.

The differences in the WTP for safety care by age, education and income were considerable, but smaller than the differences by risk experience. In general, a higher socioeconomic status leads to a higher estimation of WTP. Women of older age and with a higher socioeconomic status may better understand the value of safety or be better able to afford the service. How age and socioeconomic status affect the WTP for safety practice deserves further research.

Generally, measurement of preferences through hypothetical scenarios is challenging because the respondents are asked to make a choice based on experiences of possible alternatives that they may not have actually had. In this study, we invited women who had already undergone a delivery in a facility as a reference experience. However, the women had not necessarily experienced all alternatives presented in the hypothetical scenarios. Further studies involving more sophisticated experience-based preference measurement are needed.

The rates of hospital births and caesarean sections in Japan are comparable with those in some other advanced countries [17, 36], and we believe that the non-health value of care safety should be recognized in countries with high accessibility to professionally attended care and low perinatal mortality of infants and mothers. On the other hand, we assume that the health value of safety is still a dominant issue in in developing countries with limited access to professional perinatal care.

Although this study indicated promising role of process valuation, it has some limitations in terms of evaluating safety practices. First, women's socioeconomic characteristics may affect their preference for attributes of safety practices. In this study, only the household income of respondents is controlled to estimate WTP. Other socioeconomic characteristics such as their educational attainment are not included in this analysis. Second, respondents are women who have had prior childbirth experiences. More studies that include general women are needed in order to accurately measure the value of perinatal care safety. Third, perinatal care is a very specific kind of healthcare, and the generalizability of the estimated non-health value of care safety in this study should be carefully considered. Perinatal care is suitable for evaluation of the non-health value of safety care because women place high priority on safety when making care choices, and their choice behaviors are visible. However, the attributes of care safety that are significant to users' choice behaviors would differ according to the types of healthcare. Fourth, our sample was only from urban areas and the survey response rate was low, which may have led to possible selection bias in our results. Unfortunately, we have no information regarding the characteristics of the non-participants. Compared with the data on the vital statistics of women who gave birth in the same area in the same year [37], the age and parity of women in this study were comparable. Further studies are necessary to confirm the generalizability of our results.

Conclusion

We have empirically evaluated the process value for safety practice in perinatal care and elicited a considerable magnitude of process value that was larger than the previously reported accounting-based value. Our results indicate that it is both plausible and preferable to measure process value from the patient's point of view for evaluation of safety care that may be sensitive to individual risk perception level. This will enable us to broaden our scope in service design/evaluation so that we can enhance the patient's sense of safety in medical practice.

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Appendix

Hypothetical situation

- You are pregnant. There are two facilities for childbirth,and you have to choose one.
- The facility has six attributes, and the attributes are different between the two facilities.
- The condition of the facility excluding 6 attributes is the same as condition of your last birth.

Example scenario

	A	B
Facility	University hospital	Midwife clinic
Amenity	Single-bed room	Single-bed room with private toilet
Painless delivery	Available	Not available
Rate of caesarean section	30%	0%
Travel time to facility	30m	10m
Price	3,333	6,667

Appendix : Hypothetical situation and example scenario.