Brief communication (Original)

Economic impact of investment in maternal and newborn health care under the National Health Security Scheme of Thailand

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Background: Evidence for the impact of health care spending in the area of maternal, newborn and child health (MCH) in developing countries is limited.
Objectives: To examine the investment and medical care expenses for MCH under Universal Health Coverage (UHC) in Thailand.
Methods: A prevention–appraisal–failure (PAF) cost element method was applied. Using a payer perspective, data related to PAF elements of MCH were collected from the Universal Coverage Scheme (UCS) inpatient claim database, UCS liability claims, the health-budget administration and health resource databases of the Ministry of Public Health, and the population census of The National Statistical Office in fiscal years 2007–2011. The main outcome measures included payments and budgets for MCH at a provincial level.
Results: Investment and medical care costs of antenatal care to prevent and manage complications increased from US$7.77 per person per year (PPPY) in 2007 to US$11.69 PPPY in 2011. The payments to support quality-focused activities ranged from US$0.60 to US$1.19 PPPY, whereas failure costs resulting from postpartum complications and UHC liability claims were US$1.92, 2.24, 2.35, 2.48, and 2.56 PPPY. Univariate regression analyses of year-on-year changes in prevention and appraisal costs for providing MCH and changes in the failure costs showed significant negative associations between 3 of 4 pairs of years
Conclusions: Increased year-on-year costs of preventing MCH problems were associated with a reduction in year-on-year costs incurred for correcting problems. Despite increasing trends for all the costs, this finding indicated improvements in allocation of resources to address MCH challenges in Thailand.

Keywords: Cost-identification and effectiveness analysis, maternal, newborn and child health, Thailand, universal health coverage

Universal Health Coverage (UHC) can be defined as provision of quality health care for all people in a country that meets their basic health needs without them being exposed to financial hardship as a result of the cost of care. Despite international movements towards UHC, health resources are tightly limited in developing countries, including Thailand [1]. Resources must be carefully allocated and spent in a cost-effective manner, particularly in the areas of maternal and child health (MCH) where effective interventions are required [2-4]. The Millennium Development Goals called for a 75% reduction in maternal mortality between 1990 and 2015 (MDG 5). The World Health Organization has recommended

that antenatal care services should be free of charge, planned and implemented within the community, and should yield evidence-based quality of care [3]. Thailand has become a good example for embedding UHC tracking into broader health system performance assessment [5].

Although Thailand had achieved the MDG 5, maternal mortality rate (MMR) is at 48/100,000 live birth, and infant mortality rate is at 14/1000 live births since 2009 [6], it is not clear how the universal coverage scheme (UCS) in Thailand—established in 2003—which allowed the country to achieve UHC—contributed to sustainability or any improvement of the outcomes. Under the UCS, resources allocated for MCH aimed to cover costs of disorder prevention and health promotion under benefit packages for family planning, antenatal care for pregnant women, and well-baby clinics. This care could be provided at the primary care level, in health centers, or in public and private

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hospitals. In addition, the coverage included medical care to prevent and treat antenatal complications, and to ensure the safety of child delivery and newborn care in an inpatient setting. The global budget under the UCS was also allocated for inpatient obstetric services for high risk pregnancy and treatment of related complications. These services could be provided by hospitals at secondary- and tertiary-care levels. The reimbursements were based on the Thai diagnosis-related-group (Thai-DRG) system. In addition, the Ministry of Public Health needed to invest in MCH infrastructure, and be responsible for the cost of health care personnel. In case of morbidity and mortality as a result of adverse events in medical management, patients or their families could file requests to the National Health Security Office (NHSO) to consider payment for damage liabilities.

To our knowledge, the MCH costs under the UCS in Thailand have not yet been reviewed. Therefore, the present study aimed to explore how much the health system in Thailand spent on maternal and newborn health care under UHC. In other words, we explored the cost of care, including costs in preventing morbidity and mortality, costs in appraising and managing quality, and costs that were the result of failure to prevent morbidity and mortality, including liability claims. We also examined whether increasing costs of preventing the problems in MCH were related to decreasing costs of correcting the MCH problems (failure costs). Insights into the costs and cost structure might ensure financial sustainability and demonstrate whether moving towards UHC contributed to improvement in the MCH in Thailand.

Methods

After review and approval of the study protocol by the Institutional Review Board of the Faculty of Medicine, Chulalongkorn University (approval No. 332/2012, IRB No. 177/55) and permission from National Health Security Schemes Office, a cost-identification study was conducted by retrospective review of secondary data using the protocol as follows.

Target population and study settings

Maternal and newborn health care services provided by the hospitals and health centers under the Ministry of Public Health (MOPH) of Thailand in 2007–2011. The study setting included the providers in 75 provinces of Thailand, excluding Bangkok and Buengkan province. Bangkok was excluded because

of its fragmented health services, whereas the public system of MOPH predominated in other provinces. Buengkan province was a new established province, separated from Nongkai province in the year 2011. Therefore, the Buengkan data was combined with Nongkai for comparability across the study period.

Measurement of costs

Applying a payer perspective, all payments, charges, and reimbursed expenses made by payers of the system were assumed to be costs. The costs of maternal and newborn health care were defined and categorized using a prevention–appraisal–failure cost of quality (PAF) model [7, 8]. According to the PAF model, prevention costs are incurred to provide services that lead to desirable outcomes, while minimizing undesirable ones. Appraisal costs are incurred in identifying, verifying, checking or evaluating services to assure quality of products or services. Prevention costs and appraisal costs produce positive effects on quality of care. By contrast, failure costs are costs incurred because of errors or defects that needed correction. Failure costs also include costs related to any claims consumers make for defective products or damages they may have from using them. The sum of all three categories of the costs become the costs of quality (CoQ). However, it is expected that effective spending on prevention and appraisal costs should reduce failure costs. The relevant costs are defined as follows.

Prevention costs were defined as those costs incurred by a provider to ensure that errors were not made at any of the various stages during the delivery process of that product or service to a consumer. The prevention costs in the present study were estimated based on the costs related to care provided according to the benefit package under the Thai UCS. This package includes services provided in primary care setting for family planning, to prevent and correct complications during pregnancy and to ensure safety of pregnant women, and antenatal and newborn care. The costs were collected directly from the databases of the NHSO. Costs related to health personnel and investment costs in health care infrastructure for maternal and newborn care were gathered from the health-resource databases of the MOPH.

Appraisal costs were defined as costs that related to assuring quality of care at various stages during the delivery of maternal and newborn care services. Unfortunately, they could not be measured

directly. The proxies were obtained from annual expenses of which NHSO paid to engage providers in quality improvement activities by meeting targets of selected quality indicators under its Payment for Performance (P4P) initiatives, such as a percentage of low birth weight and hospital-accreditation status.

Failure costs were defined as costs incurred as a result of failure to prevent morbidity and mortality. They included reimbursements for inpatient hospital care for complicated labors, postpartum complications (e.g. complications following abortion and ectopic pregnancy and molar pregnancy, intrapartum and postpartum hemorrhage, and perineal laceration), maternal death, stillbirths and newborn problems (e.g. birth asphyxia, low birth weight, and prematurity). The following International Statistical Classification of Diseases and Related Health Problems (ICD-10) classifications were used: O00.1, O03−8, O08.6, O08.3, O150−9, O24, O67, O72, O70, O71.4, O75.8, O94, O95, O96, O96.0, O96.1, O96.9, O97, O97.0, O97.1, O97.9, O98, P07.0, P07.1, P07.2, P21.9, P22.0, P22.1, P22.9, and Z29.2. The failure costs were collected from the database for inpatient reimbursement, in which the patients' case mix information was gathered based on the diagnosis-related groups (DRGs) of each inpatient discharge assigned by the Thai-DRG system version 4—used by the Central office for Healthcare Information (CHI) for inpatient reimbursement in the UCS [9, 10].

Hospital payments were allocated from the global inpatient budget based on the DRG adjusted relative weight (adjusted RW), a unit of health care resource measurement of treatment of patient in each DRG. The payments were calculated from relative use of resources in managing each inpatient case in each DRG and were adjusted for low and high outliers according to an outlier trim point (OT) in the length of hospital stay (LOS), which was divided into three intervals: LOS greater than OT and lower than 2OT ($OT < LOS \leq 2OT$), LOS greater than 2OT and lower than 3OT ($2OT < LOS \ 3OT$), and LOS greater than 3OT ($LOS > 3OT$). For each version of Thai-DRG system, outlier values were statistically calculated for medical cases and surgical cases [11].

In addition, the failure costs also include liabilities related to maternal and newborn care paid because of adverse events in medical management as indicated in the National Health Security Act. Details of the cost variables and their sources were summarized in **Table 1**. Data collection of the study started in 2013 and finished in 2015. All cost data collected were in baht.

Data analysis

The study spanned a 5-year period in which the general inflation ranged between −0.9%−3.8% [12]. All analyses are presented at their nominal rates for ease of understanding of descriptive information, and to avoid assumptions on any differential effects of general inflation and medical inflation, and used a province as a unit of analysis. The approximate rate of exchange rate at the end of 2007−2008 of 33.0 baht per US dollar was applied for international presentation. After data checking and verification, inpatient reimbursement data collected from patients' case mix information records from 2007−2011 were entered into a MySQL database (Oracle, Cupertino, CA, USA) and imported as a large format text file. Then, data were processed with an SQL command set specifically written to process data for data cleaning, resulting in 2,146,938 records for newborn services, and 2,839,816 records for obstetric care, or 4,986,754 records in total. Combining provincial data, the data were analyzed using descriptive statistics, including percentage, mean and standard deviation. To examine whether increases in prevention and appraisal costs might lead to decreases in failure costs at a provincial level, univariate linear regression analyses were conducted to explore associations between year-on-year changes in the prevention (P) and appraisal (A) costs, and year-on-year changes in failure (F) costs. All of the analyses were conducted using STATA software (version 11.0; College Station, TX, USA). To protect patients' rights to privacy and ensure confidentiality, the researchers were blinded to all patient identifiers.

Results

As shown in Table 2, the per capita operating costs of providing maternal and child health services related to the benefits under the universal coverage scheme (UCS)—or P1 in **Table 2**—comprising (P1a) family planning and antenatal care, and (P1b) in-patient care for prenatal conditions and prevention of premature labor increased year-on-year (with the sole exception of P1b in 2010). The 5-year costs of the key infrastructures and health personnel (P2), spent by the Ministry of Public Health did now show any particular trend. These costs included support for medical equipment, ultrasound, blood banks, ambulance

for emergency obstetric care, and labor costs for specialized health personnel in obstetrics, pediatrics, and midwives. The appraisal costs remained quite stable, except for the year 2010 in which the per capita amount was almost doubled compared with the amount for 2009. Further investigation indicated that this increase was because of a one-year change in the P4P policy by the NHSO. Finally, the failure costs increased over the same period. The amounts reimbursed on inpatient care for complicated labors, postpartum conditions, and newborn problems (EF1), rose from US$1.83 per person per year in 2007 to 2.47 per person per year in 2011. However, the liability claims under the NHSO Act (EF2) remained stable.

Table 1. Cost variables and data analyses

Variables	Data	Source	Analytical method	Data collection
Prevention Cost				
P1a: Cost of care based on benefit packages (e.g. antenatal care, family planning, post-natal care, vaccine)	Value of budget allocation for providing services according to benefit package	Budget allocation according to benefit package report	Summation of prevention–promotion–Express Demand budget allocation per province	NHSO budget allocation
P1b: Reimbursement for prenatal complications	Reimbursement according to DRG compared with adjusted RW	In-patient database according to DRG	Summation of reimbursement with adjusted RW standard price NHSO paid out each year	Collect from NHSO reimbursement
P2a: Investment in service infrastructure	Investment budget	MOPH's health-resource database	Standard price from Budget Bureau	Bureau of Policy and strategy MOPH
P2b: Health personnel	Salaries of obstetric health personnel	Specialist payment record	Annual summation of medical staff payment	Data from Bureau of Policy and Strategy, MOPH
Appraisal cost				
A1: Cost according to service quality indicators	Payment made to service units based on quality indicators	Pay for performance	Expense according to quality indicators	NHSO annual budget allocation
Failure cost				
EF1: Cost from comprehensive obstetric service with complications or newborn service with complications	Reimbursement according to DRG compared with adjusted RW	In-patient database according to DRG	Summation of reimbursement with adjusted RW standard price NHSO paid out each year	Collect from NHSO reimbursement
EF2: Liabilities according to NHSO Act	Payment for Liabilities	Liabilities fund	Summation of total Liabilities	NHSO's Law Office

DRGs, diagnosis-related groups; NHSO, National Health Security Office; RW, relative weight is a unit of health care resource measurement of treatment of patient in each DRG = mean charge per DRG/aggregate mean charge; MOPH, Ministry of Public Health; adjusted RW is RW of DRG adjusted according to NHSO methodology [9, 11]. The payments were adjusted for low and high outliers according to an outlier trim point (OT) in the length of hospital stay (LOS), which was divided into three intervals: $OT < LOS \leq 2OT$, $2OT < LOS \leq 3OT$, and $LOS > 3OT$. For each version of Thai-DRG system, outlier values were statistically calculated for medical cases and surgical cases.

Table 2. Amount of budget by type of Cost of Quality (US$ per Universal Coverage per person per year)

Type		Categories	2007 Mean (min, max) n = 75	2008 Mean (min, max) n = 75	2009 Mean (min, max) n = 75	2010 Mean (min, max) n = 75	2011 Mean (min, max) n = 75
CoQ		Total cost of quality (CoQ = P+A+F)	10.31 (6.45, 16.97)	12.47 (6.61, 18.64)	12.76 (8.15, 19.10)	12.98 (9.45, 18.76)	14.87 (6.64, 21.27)
P		Prevention cost (P=P1+P2)	7.77 (4.12, 14.48)	9.63 (4.39, 17.52)	9.81 (5.61, 15.78)	9.41 (6.36, 14.55)	11.69 (4.73,18.27)
	P1	Operating cost (P1=P1a+P1b)	4.16 (2.15, 5.32)	5.43 (3.15, 6.32)	5.59 (3.26, 6.38)	5.88 (3.75, 6.47)	8.04 (5.18, 8.98)
	P1a	Benefit package: Prevention and prenatal care	1.13 (0.70, 2.36)	1.19 (0.94, 2.45)	1.25 (1.00, 2.61)	1.27 (1.09, 2.52)	1.32 (1.30, 2.98)
	P1b	Reimbursement for prenatal complications	3.03 (1.70, 3.36)	4.34 (2.14, 5.17)	4.34 (2.13, 4.61)	3.91 (1.09, 4.52)	4.98 (1.94, 5.11)
	P2	Spending on service infrastructures (P2=P2a+P2b)	3.61 (1.44, 4.45)	4.20 (2.12, 5.06)	4.23 (1.24, 5.09)	3.52 (2.14, 4.25)	3.65 (1.09, 4.56)
	P2a	Cost for specialist health personnel	1.42 (1.06, 4.32)	2.77 (1.15, 3.11)	3.11 (1.53, 3.21)	1.85 (1.14, 3.18)	1.26 (1.02, 2.97)
	P2b	Investment for equipment	2.29 (1.03, 4.15)	1.53 (1.25, 3.24)	1.12 (1.03, 2.15)	2.67 (1.94, 3.97)	2.39 (1.94, 3.28)
A		Appraisal cost					
	A1	Cost of pay for performance	0.63 (0.33, 1.03)	0.60 (0.24, 0.73)	0.60 (0.33, 1.24)	1.19 (0.55, 1.48)	0.63 (0.33, 0.82)
F		Failure Cost (F=EF1+EF2)	1.92 (1.06, 3.67)	2.24 (1.06, 4.18)	2.35 (1.30, 4.61)	2.48 (1.45, 4.64)	2.56 (1.58, 4.61)
	EF1	DRG-based payment for inpatient care	1.83 (1.00, 3.55)	2.18 (1.06, 4.15)	2.27 (1.30, 3.48)	2.39 (1.45, 3.55)	2.47 (1.58, 4.12)
	EF2	Liabilities	0.09 (0.00, 0.11)	0.06 (0.00, 0.03)	0.08 (0.00, 0.11)	0.07 (0.00, 0.09)	0.09 (0.00, 0.09)

CoQ, Cost of Quality; P+A+F, Prevention–Appraisal–Failure; The average reimbursement rate of the Universal Coverage System in 2009 was US$245.45 per adjusted relative weight of diagnosis-related groups; payments were adjusted for low and high outliers according to an outlier trim point (OT) in the length of hospital stay (LOS), which was divided into three intervals: OT < LOS ≤ 2OT, 2OT < LOS ≤ 3OT, and LOS > 3OT according to National Health Security Office methodology [9, 11]. The exchange rate at the end of year 2007"2011 was on average 33.0 Thai baht per US dollar.

The linear regression analyses of the year-on-year changes in the failure costs and the year-on-year changes in prevention and appraisal costs for providing maternal and child health services, as shown in **Table 3**, demonstrated significant negative associations in 3 of 4 pairs—the cost changes between 2008 vs 2007, 2009–2008, and 2010–2009. The provincial increases in the prevention and appraisal costs tended to be associated the provincial decreases in the failure costs required for treating maternal and newborn complications, and liability costs for maternal and child care. Specifically, for every dollar of year-on-year increase in prevention and appraisal costs, the failure cost decreased by 1.16 dollars from 2007 to 2008, 1.28 dollars from 2008 to 2009, and 1.12 dollars from 2009 to 2010.

Table 3. Pairwise univariate linear regression analyses of the year-on-year changes of the failure costs and the year-on-year changes in prevention costs and appraisal costs (n = 75 provinces in Thailand)

Year-on-Year	Regression coefficient (r)	95% Confidence intervals		P
		Lower	Upper	
2008 vs 2007	−1.16	−1.44	−0.72	0.002
2009 vs 2008	−1.28	−1.84	−0.62	<0.001
2010 vs 2009	−1.12	−1.73	−0.74	<0.001
2011 vs 2010	−0.47	−1.62	+0.68	0.43

Discussion

In light of the Universal Health Coverage in Thailand, we found that at least over the period from 2007 to 2011, the country increased spending on maternal and child health services, both in preventing the MCH problems and in correcting the problems. Although the nation-wide numbers showed increases in all three categories of the prevention–appraisal–failure (PAF) costs, the negative associations between the year-on-year changes indicated that for each province, those with increases in prevention and appraisal costs, tended to have decreases in the failure costs. This implied effective allocation of MCH resources.

We demonstrated Thailand has had continuous improvement in maternal and child health outcomes. **Table 2** shows that the allocated operating UCS budget to promote the health of pregnant women and prevent maternal and newborn morbidities and mortalities increased every year over the study period. The year-on-year increases in these amounts were 30.5% in 2007–2008, 2.9% in 2008–2009, 5.2% in 2009–2010, and 36.7% in 2010–2011. These well surpassed the general inflation rates of the Thai economy during that time (−0.9%−3.8%) [12]. However, the spending on service infrastructure varied without any definite trend. We hypothesized that the infrastructure for MCH was not expanded over the study period, but rather remained roughly the same, both in terms of health personnel and equipment. Further investigation is needed to determine whether there might be any significant deterioration of service infrastructure in any provinces or areas.

The overall failure costs in MCH also rose. Deep investigation of the reimbursement database showed that, during the 5-year period, there were increasing numbers of abortions and related complications, and ectopic and molar pregnancies, summed annual rates

for O03–8 at 7.7%, 8.0%, 8.1%, 8.3%, and 8.4%, for the years 2007 to 2011 respectively. There were also increasing numbers of cesarean sections, from 21.1% to 23.7% of all deliveries. Although the increasing failure costs might indicate more problems in maternal and newborn care, the overall maternal mortality rates (MMR) during 2007 to 2011 decreased (62.51, 58.25, 46.69, 45.06, and 36.69 per 100,000 live births, respectively) [13].

The increase in the prevention and appraisal costs in each province were likely associated with reduction in the failure costs as indicated in **Table 3**. The relationships may appear confusing because all the PAF costs increased over time. However, the regression analyses focused on year-on-year changes, instead of the absolute annual numbers, to examine if an increase of prevention and appraisal costs over a year would correspond to a decrease in failure costs over the same year-on-year period. This hypothesis was confirmed in 3 of the 4 pairs of years. The findings appeared consistent with studies of health care financing and utilization of maternal health services in developing countries by Kruk et al. [2] and Liabsuetrakul et al. [14], which found that government financing was associated with better access to some essential maternal health services, and total health expenditure is significantly associated with utilization of skilled birth attendants and rate of cesarean section. As positive trends for the prevention costs might imply better access to care, or more care for prospective mothers, our study indirectly supported the findings by others [15-18] from a resource perspective at the macro level that better service arrangements helped reduce maternal morbidity and mortality. However, it remains difficult to say much about the effects of investment in infrastructure because of the varying per capita amounts over the 5-year period.

Not only are the 3 coefficients with statistical significance in **Table 3** all negative, they were larger

than minus one. This means that every additional dollar that was allocated to preventing problems led to more than one dollar reduction of failure costs. The investment in prevention is clearly worthwhile. We believe that the benefit might be even more favorable if we could account more accurately for details of cost items in the infrastructure category. Some MCH resources were shared with other medical and surgical care specialties, such as the cost of blood banks. By contrast with this positive hypothesis, one might argue that the failure costs increased because the prevention and appraisal costs did not adequately increase, particularly those related to the infrastructure. If this was the case, we would expect other outcomes like MMR to also rise. Our counter-argument might be that the care was improved to a level where mortality was reduced. Therefore, higher survival rates would increase the costs of care, a situation found in other studies [1, 19]. The inability to quantify costs per death averted was a limitation of the present study.

There were some other limitations to our findings. Although using claim data might help us explore the entire situation in terms of resources spent, the question needs further study to examine epidemiological details not available in the database to provide us with greater insight into what did happen more, and what less. More information on resource allocation within each province would, then, provide opportunities to determine how to allocate and use resources efficiently to provide effective maternal and child care. Finally, we used the perspective of the payer, namely the National Health Security Office of Thailand and the Thai Ministry of Public Health, in studying costs. It is possible that looking at costs from a provider or patient consumer perspective might yield different conclusions. For example, the liability claims under the NHSO Act was only a proxy of the cost of damages caused by morbidity and mortality. The amounts of compensation were fixed by regulations and judgement of committees who performed assessments. Moreover, we did not account for how much preventing maternal and child morbidity and mortality might help reduce indirect costs for patients' families. Future studies in these areas are warranted to determine best practices at the provincial level, to learn from and share among others nationally and internationally, and to add sufficient evidence to convince policy makers to invest more in MCH.

Conflict of interest statement

The authors declare that there is no conflict of interest in this research.

References

1. Fleschler RG, Knight SA, Ray G. Severity and risk adjusting relating to obstetric outcomes, DRG assignment, and reimbursement. J Obstet Gynecol Neonatal Nurs. 2001; 30:98-109.

2. Kruk ME, Galea S, Prescott M, Freedman LP. Health care financing and utilization of maternal health services in developing countries. Health Policy Plan. 2007; 22: 303-10.

3. World Health Organization. Making fair choices on the path to universal health coverage: Final report of the WHO Consultative Group on Equity and Universal Health Coverage. Geneva: WHO; 2014.

4. World Health Organization. Tracking universal health coverage first global monitoring report. Geneva: WHO; 2015.

5. World Health Organization. Tracking universal health coverage first global monitoring report. Geneva: WHO; 2015.

6. Office of National Economic and Social Development Board. Thailand Millennium Development Goals report 2009, Bangkok Office of National Economic and Social Development Board; 2009.

7. Juran JM, Godfrey AB, Hoogstoel RE, Schilling EG, editors. Juran Quality Handbook. Singapore: McGraw-Hill; 1998.

8. Campanella J, editor. Principles of quality cost: principle implementation. Milwaukee, Wisconsin: The American Society for Quality: Quality Cost Committee of the Quality Management Division; 1999.

9. National Health Security Office. Thai DRGs Version 4.0 Volume 1. Bangkok: National Health Security Office; 2007. [in Thai]

10. Pongpirul K, Walker DG, Winch PJ, Robinson C. A qualitative study of DRG coding practice in hospitals under the Thai Universal Coverage scheme. BMC Health Serv Res. 2011; 11:71. doi: 10.1186/1472-6963-11-71.

11. Upakdee N, Pannurunothai S. Formula for adjusted relative weight of Thai Diagnosis Related Group Version 5. J Health Sci. 2014; 23:1098-107.

12. Bank of Thailand. EC_EI_027 Macroeconomic indicators of Thailand 1/. [online] 2017. [cited 2017 Feb 9]. Available from: *http://www2.bot.or.th/statistics/ ReportPage.aspx?reportID=409*

13. Thailand Development Research Institute. Health outcomes and health equity report. Bangkok: Thailand Development Research Institute; 2011.

14. Liabsuetrakul T, Oumudee N. Effect of health insurance on delivery care utilization and perceived delays and barriers among southern Thai women. BMC Public Health. 2011; 11:510. doi: 10.1186/1471-2458-11-510.

15. Bhutta ZA, Darmstadt GL, Haws RA, Yakoob MY, Lawn JE. Delivering interventions to reduce the global burden of stillbirths: improving service supply and community demand. BMC Pregnancy Childbirth. 2009;9(Suppl 1):S7. doi: 10.1186/1471-2393-9-S1-S7.

16. Haws RA, Yakoob MY, Soomro T, Menezes EV, Darmstadt GL, Bhutta ZA. Reducing stillbirths: screening and monitoring during pregnancy and labour. BMC Pregnancy Childbirth. 2009; 9(Suppl 1): S5. doi: 10.1186/1471-2393-9-S1-S5.

17. Menezes EV, Yakoob MY, Soomro T, Haws RA, Darmstadt GL, Bhutta ZA. Reducing stillbirths: prevention and management of medical disorders and infections during pregnancy. BMC Pregnancy Childbirth. 2009; 9(Suppl 1):S4. doi: 10.1186/1471-2393-9-S1-S4.

18. Zanconato G, Msolomba R, Guarenti L, Franchi M. Antenatal care in developing countries: the need for a tailored model. Semin Fetal Neonatal Med. 2006; 11: 15-20.

19. Ringborg A, Berg J, Norman M, Westgren M, Jonsson B. Preterm birth in Sweden: what are the average lengths of hospital stay and the associated inpatient costs? Acta Paediatr. 2006; 95:1550-5.