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Editor's note: This paper by Drs. Trinh, Dibley, and Byles shows with clarity the benefit of antenatal care and improved outcomes in maternal and infant morbidity and mortality. The data set used, which goes up to 1999, also suggests an improving trend in infant mortality as the economy grows and the GDP increases. These rates of improvement are at a rate of about 7% annually. In fact, infant mortality rates have changed dramatically in the last two decades in Vietnam. UNICEF data (May 2006) shows a pattern of 70/1000 in 1960, 55/1000 in 1970, 44/1000 in 1980, 38/1000 in 1990, 23/1000 in 2000 and 17/1000 in 2004.[1] This number is similar to Thailand at 18/1000 and Malaysia at 10/1000 for 2004.

Actually, the numbers for Vietnam are far better than many of its neighbors', two of the most extreme cases being Lao People's Democratic Republic with an infant mortality rate of 65/1000 and Cambodia at 97/1000.

According to UNESCAP (2005), about 85% of births are assisted by trained professionals in Vietnam; the numbers are higher for many of the neighboring countries.[2]

For this study, the majority of the individuals are rural farm people with very limited education, six years on average. In addition to making the antenatal care services available to rural women, there needs to be a plan to improve rural education, especially for young women.

This is one of the first studies addressing this issue in Vietnam; in time, with the expansion of the economy, the numbers should improve. The dramatic positive change in infant mortality rates should be an indicator for overall improvement associated with reductions in pregnancy adverse outcomes.

A follow-up to this study would be strongly recommended by the Australian research team.

Mark Robson, PhD, MPH

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ANTENATAL CARE ADEQUACY IN THREE PROVINCES OF VIETNAM: LONG AN, BEN TRE, AND QUANG NGAI

Lieu Thi Thuy Trinh, MD, PhD, MSc[a]
Michael John Dibley, MB BS, MPH[a]
Julie Byles, MD, PhD[b]

Vietnam has high numbers of maternal and infant mortality and morbidity. Each year, 1,500 women die and 45,000 others become disabled as a result of pregnancy and childbirth complications.[1] There were 37,700 neonatal deaths in Vietnam in 1999.[2] The maternal mortality rate is 165 per 100,000 live births[3] and the infant mortality rate is around 30 per 1,000 live births.[4,5]

Antenatal care (ANC) has been proven to be effective in preventing pregnancy adverse outcomes.[6] For ANC to be effective, women should have enough visits at appropriate times, with sufficient ANC content. The World Health Organization (WHO) recommends four visits at the 4th, 6th or 7th, 8th, and 9th month for women in developing countries.[7] The Vietnamese government recommends three visits, one during each trimester.[8] WHO recommends three basic components of ANC content: (*1*) biomedical assessment based on medical history, physical examination, and laboratory tests; (*2*) health promotion; and (*3*) care provision.[7]

To measure ANC adequacy, many indicators and indices have been developed in the world. Single indicators are any ANC, number of ANC visits, and duration of pregnancy at entry to ANC. Complex indices that combine number of ANC visits and duration of pregnancy at first visit are the Kessner index,[9] the Graduated Index of Prenatal Care Utilization,[10] the Adequacy of Prenatal Care Utilization Index,[11] and the Prenatal Care Evidence-Based Index.[12] These indices are suitable for developed countries because of the high cut-off points. There has been a modified index in the Philippines with the lower cut-off point of five visits and initial visit within the first three months,[13] but this index might not be suitable for other less developed countries like Vietnam.

In contrast to the numerous methods of measuring ANC utilization, there have been very few indicators or indices available to measure ANC content. Some studies used single indicators such as receiving certain services,[14,15] receiving all or part of procedures or information,[16,17] or average number of services delivered.[18,19]

Studies on overall ANC adequacy that combine ANC utilization and ANC content are even rarer. One study identified used a scoring system, in which weighted scores based on expert opinion were given to items of ANC utilization and content.[20] However, each country or region may weight the importance of each item differently at different times; therefore, this method can only be applied in certain areas at a certain time.

ANC in Vietnam is low. Seventy-one percent of women had any ANC in 1997[21] and 87% in 2002.[22] Other studies on local scale also show the low level of ANC.[23–25] Information on ANC adequacy in Vietnam is limited, not only because of the small number of studies, but also because of the limited information that these studies provide. These studies use only single indicators; none of them use any index to provide comprehensive information on overall ANC adequacy.

Furthermore, these studies use different cut-off points. The cut-off points for duration of pregnancy at first visit were six months[21,22] and 20 weeks,[23] which do not comply with the Vietnamese government guideline nor with WHO guidelines.[7] The cut-off point for the number of visits varies between three[24] and four visits.[21,22]

The objectives of this study were to propose and apply a set of indicators and indices to measure ANC adequacy levels in the three provinces and to select the most suitable index to measure ANC adequacy in this setting, using the data collected by the Vietnam Australia Primary Health Care Project.

To our knowledge, this is the first study in Vietnam that uses the indices to provide comprehensive information on ANC adequacy levels. This information will be useful for future interventions to improve ANC in the three provinces and in other similar provinces of Vietnam. The selected index can be used in other studies in Vietnam and similar developing countries. It also can be modified easily to suit each specific study.

METHODS

The Vietnam Australia Primary Health Care Project, supported by the Australian Agency for International Development, conducted a cross-sectional survey in 1999 to gain information on health care for women and children in the three provinces of Long an, Ben tre, and Quang ngai. Samples were selected by cluster sampling method; 155 communes (60 each in the provinces of Long an and Quang ngai, 35 in Ben tre) were selected using a standard "probability proportionate to size" cluster sampling method. Two hamlets were selected by simple random selection within each commune, and 12 households were selected by systematic random sampling in each hamlet. All women in the households at reproductive age and women who had children at preschool age were invited to participate in the survey.

There were 5,653 women at reproductive age in the selected households. Among them, 4,836 women had completed the questionnaire (85% response rate). Twenty-seven percent of those (n=1,335 women) had given birth from January 1995 to December 1998: 459 in Long an (33.6%), 259 (25.7%) in Ben tre, and 617 (40.7%) in Quang ngai. Information on aspects of ANC during the previous pregnancy and demographic characteristics were obtained by interviewing women. Surveyors were health care workers from national and local health institutions trained prior to the surveys and under the supervision of a team of international and national consultants.

Proposed indicators and indices to measure ANC adequacy in Vietnam

Apart from any use of ANC with the clear "Yes" or "No" response, there have been different cut-off points for the same indicators in Vietnam. The following section proposes the cut-off points for indicators and new indices to be used in this study.

ANC utilization

Duration of pregnancy at first ANC visit. Due to the low ANC utilization in Vietnam, the less conservative recommendation from WHO of four months[7] was used instead of three months as recommended by the Vietnamese government.[26] Duration of pregnancy at entry to ANC was classified into "Early" (first visit within four months), "Intermediate" (first visit after four months but before seven months), "Late" (first visit after seven months), "Missing" (did not remember the duration of pregnancy at first visit or the information was not recorded), and "No care" (no ANC).

Number of ANC visits. Because of the low proportions of women reporting four of more visits in the Demographic Health Survey (DHS) 1997 (15%) and DHS 2002 (29%), the less conservative recommendation of three visits from the Vietnamese government[26] was used instead of WHO's recommendation of four visits.[7] The proportion of women with four or more visits was

also reported. Number of ANC visits was classified into "Enough" (three or more visits), "Intermediate" (two visits), "Not enough" (one visit), "Missing" (not remember or not recorded), and "No care."

Utilization index.
Figure 1 describes the utilization index. A woman was classified as having sufficient utilization of ANC if she had three or more visits and the initial visit within the first four months.

ANC content. Thirteen items were asked in the survey. These items made up a typical minimum ANC content in Vietnam. There were seven items on bio-medical assessments (body weight, blood pressure, fundal height, foetal heart rate, vaginal examination, urine testing, and ultrasound), four items on care provision (tetanus toxoid immunization, provision of tablets or advice on iron/folate supplement, malaria prevention, and preparation for safe delivery), and two items on health promotion/education (resting and nutrition).

ANC content was reported in terms of the total number of items provided to a woman and classified as "Fair" (10 or more items, or more than 75%), "Intermediate" (7 to 9 items or from 50% to 75%), "Poor" (0 to 6 items or less than 50%), "Missing" (unable to recall or not recorded), and "No care."

Results were also reported in percentages of women who received each item and percentages of women who reported all or part of the bio-medical assessment or care provision/health education.

All items of ANC content were counted equally. This approach was used to avoid inappropriate weighing of the importance between different components of the content that change over time and between countries. For example, the roles of care provision and prevention were much less stressed in the past than currently. In addition, it is complex to construct the weighting for each item of ANC content and therefore may limit the application.

ANC overall adequacy. Figure 2 describes the index. A woman was classified as having adequate ANC if she had enough utilization of ANC and reported a fair ANC content.

Selection of the most suitable index to measure ANC adequacy

ANC adequacy levels, measured by different indicators and indices, were compared to each other. The most suitable index would be the one that provided comprehensive information on ANC adequacy levels, reflected reasonable ANC adequacy levels so that results are sensitive to change, was less prone to bias, and was easy to use for health care workers at provincial and district levels.

Statistical issues

Data was analysed using the "survey commands" in STATA version 8.0.[27] Adjustments were made for sampling weights, the cluster sampling design, and stratification of the cluster sampling.

Data was checked for missing values. Most outcomes had a small number of missing values; however, 171 women were missing values on one or more of 13 items of ANC content. Most of them (111) had missing value(s) on only one or two items. When considering the range of the classification of ANC content, the definition of missing cases could be redefined. A case was considered as having fair content if there were 10 or more items reported, regardless of other missing values. Similarly, a case with no services provided would still be classified as having poor content, even if there were up to six missing values. The cases that were not allowed to have any missing values were those with six and nine items. These cases could be miss-classified even when only one missing values occurred.

Figure 1. Proposed index to measure ANC utilization among women in Vietnam

Utilization index	*Duration of pregnancy at first visit*			
	Fair (≤4 months)	*Intermediate (5–6 months)*	*Late (7–12 months)*	*Missing*
≥3	Sufficient	Intermediate	Insufficient	Missing
2	Intermediate	Intermediate	Insufficient	Missing
1	Insufficient	Insufficient	Insufficient	Missing
Missing	Missing	Missing	Missing	Missing
0	No care	No care	No care	No care

ANC = antenatal care

Figure 2. Classification of ANC adequacy

	ANC content			
Utilization index	*Fair*	*Intermediate*	*Poor*	*Missing*
Sufficient	Adequate	Intermediate	Inadequate	Missing
Intermediate	Intermediate	Intermediate	Inadequate	Missing
Insufficient	Inadequate	Inadequate	Inadequate	Missing
Missing	Missing	Missing	Missing	Missing
No care	No care	No care	No care	No care

ANC = antenatal care

RESULTS

Characteristics of the women

The Table presents the characteristics of the women. The women had a mean age of 29 years; most were married and had low education, with the mean level of schooling being six years. The majority were farmers (64%), most were Kinh, and almost half were non-religious.

Women in Long an and Ben tre were similar, perhaps because their provinces are next to each other. Women in Quang ngai were different; there were more married women, more were farmers, more belonged to minority ethnic groups, and more were Christians.

There were 40 missing values on duration of pregnancy at initial visit and 86 missing values on ANC content. These resulted in 40 missing values for utilization index and 120 for the overall adequacy index. There was no significant difference between women with and without missing values.

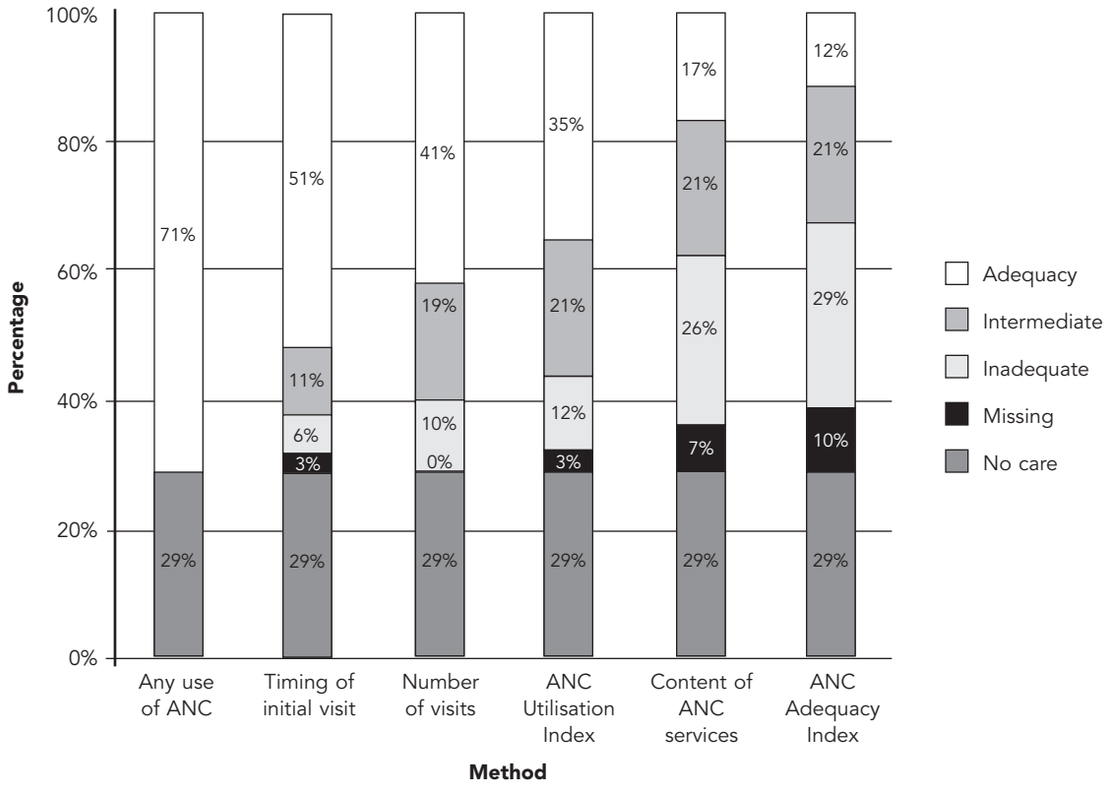
ANC adequacy levels

Figure 3 presents results on ANC adequacy level. The use of ANC services was low, with 418 women not having any ANC (29%; 95% confidence interval [CI] 25, 33) and only 917 women making any ANC visits (71%; 95% CI 67, 75).

Table. Demographic characteristics of women

	Long an n=*459 (34%)* *Percent*	*Ben tre* n=*259 (26%)* *Percent*	*Quang ngai* n=*617 (41%)* *Percent*	*Total* N=*1335* *Percent*
Women's age (years)				
<20	4	2	3	3
20–29	57	57	51	54
30–39	31	36	37	35
40+	9	4	10	8
Mean age	29	28	30	29
Marital status				
Married	97	100	94	97
Non-married (widow, divorced, separated, never married)	3	1	6	3
Education				
No schooling or incomplete primary school	34	33	32	33
Completed primary school	40	45	35	39
Completed secondary school and higher	26	22	33	28
Mean years	6.0	6.0	6.3	6.1
Occupation				
Farmer	60	49	79	64
Non-farmer	20	22	14	18
Unemployed	21	29	8	18
Ethnicity				
Kinh	100	99	80	92
Ethnic minority	0	1	20	8
Religion				
None	32	49	53	45
Buddhist	38	35	11	27
Christian	19	9	35	23
Others	12	7	1	6

Figure 3. Comparison between indicators and indices to measure ANC adequacy



The women entered ANC late; 656 women (51%; 95% CI 47, 55) had first visits within four months of pregnancy. The average duration of pregnancy at first visit among women who had any ANC was 3.7 months. Only 526 women (41%) had first visits within three months.

The number of visits was low; 530 women (41%; 95% CI 38, 45) made three visits or more. The mean number of visits for women who attended any ANC was 2.6. The maximum number of visits was nine. Only 104 women (8%) had four visits or more.

Overall utilization was low, with 452 women (35%; 95% CI 31, 39) having three or more visits and initial visits within four months.

ANC content was poor; only 17% of all women reported 10 or more items. The mean number of items reported among women who had any ANC was seven, or 53% of the 13 items asked. Nine percent of women reported receiving all biomedical assessments; 8.6% reported receiving all care provision/health promotion; and 17 women or 1.8% reported receiving all items.

Overall ANC adequacy level was low; only 12% of the women had adequate ANC. A very small proportion (2.9%) of women had four or more visits as recommended by WHO.7

Among women who attended ANC, 57% (526 of 917) entered ANC within the first three months of pregnancy and 58% (530 of 917) had three or more visits as recommended by the government. Only 11% had four or more visits (104 of 917).

Selection of the most suitable indicators/indices

Figure 3 shows that the proportions of women classified as having optimum ANC reduced enormously when the more complicated and more conservative methods were used—from 71% for any use of ANC to 12% for ANC adequacy index. Single indicators of using any ANC, duration of pregnancy at entry to ANC, and number of ANC visits reflected only single aspects of ANC and may overestimate ANC utilization.

In contrast, the utilization index reflects multiple aspects of ANC utilization. The cut-off points of three visits and initial visits within four months gave a result of 35%, which was sensitive enough to any change. Other combinations such as four visits and four months as recommended by WHO gave a low result of 7% and would not be sensitive enough to change.

For ANC content, indicators on proportions of women receiving each item of ANC content reflect only single aspects of ANC content and gave various results depending on the item. The indicators on the proportions of women receiving all or part of biomedical assessment or care provision/health promotion also reflect only single aspects of ANC content and gave low results. The ANC content index reflects comprehensive information on ANC content, but was severely affected by recall biases and therefore gave low results (17%). Consequently, the proportion of women with adequate overall ANC was also very low (12%) and thus not sensitive to change.

Comparison between provinces. There were significant differences in levels of ANC adequacy in the three provinces. Figure 4 illustrates the differences. Long an and Ben tre were similar. Quang ngai had much poorer ANC as measured by all indicators and indices. For example, only 20% women in Quang ngai had sufficient ANC utilization compared with 45% in Long an and 46% in Ben tre.

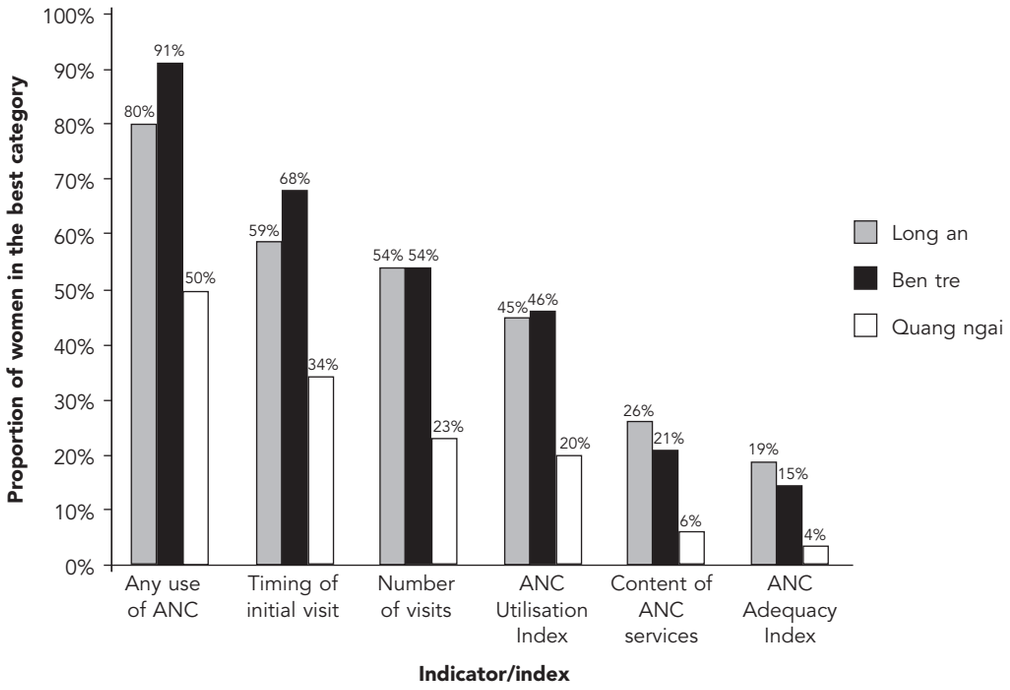
DISCUSSION

This study attempted to measure ANC adequacy levels in three provinces of Vietnam and to select the most suitable index in this setting. Measurements by various indicators and indices showed low levels of ANC adequacy, with Quang ngai province having the lowest levels. The utilization index of three visits and initial visit within four months was most suitable.

The ANC adequacy levels were far below the objectives of the Vietnamese government. The government's aim is that all pregnant women have at least one ANC visit but, only 71% of women had any ANC in this study. None of the provinces met the recommendations for its region, either. Only 23% of the women in Quang ngai had three or more visits, while the goal for the Centre Coast region was 50%. Fifty-four percent of women in both the provinces of Long an and Ben tre had three or more visits, while the goal for the Mekong Delta region was 75%.[8]

The results confirm that ANC adequacy levels were low but are increasing in Vietnam. The study was conducted in 1999, with 71% of women having had any ANC. This was higher than studies conducted in 1988 (50%),[28] in 1992 (30%),[25] and in 1994 (66%).[24] It is similar to results from a more recent study in 1997 (72%),[21] but lower than in 2002 (87%)[22]. The reason for the increase in ANC adequacy is likely due to overall development in Vietnam since economic reform. Vietnam is developing rapidly, with its yearly gross domestic product (GDP) increasing by about 7%.[28] The government has more funds to improve

Figure 4. Comparison of ANC adequacy levels between provinces



maternal health care programs and women also have better resources to obtain ANC.

The lower levels of ANC adequacy in Quang ngai were not a surprise because Quang ngai belongs to the Centre Coast region, one of the least developed regions; the two other provinces belong to the Mekong Delta, the most developed region in the country. GDP in Quang ngai was 2.2 million in Vietnam dollars, much lower than the 4 million in Vietnam dollars in Long an and the 3.5 million in Ben tre in 1999. Quang ngai had 33 communes without community health care centres, while Long an had seven and Ben tre had none.[2]

In this study, a large proportion of women who had any ANC entered ANC early (72%), which is similar with results from other developing countries.[14] However, only a small proportion of women who had any ANC had four or more visits (11%), while this figure in other developing countries was 50% or more.[14] Instead, the majority of women who had any ANC made three visits (58%). This may be due to women's compliance with the guideline from the government of having three visits, and supports the recommendation that the government change its recommendation to four visits in the future, when the level of ANC utilization increases.

Results on ANC content were similar to other studies in the developing world in that more clinical assessments were reported than laboratory tests.[14] This was due to lack of equipment and skilled technicians in developing countries. However, the result of more procedures reported than advice was similar with studies in both developing and developed countries.[14,16] This confirms that ANC services throughout the world are still focusing on the traditional approach, with more priority given to assessments than to health promotion.

The sample size was large enough to gain precise estimates of ANC outcomes. With the randomly selected sample and the response rate of 85%, the studied subjects were expected to be reasonably representative. The study has several limitations, however. The data was collected a few years ago, and the levels of ANC adequacy may have changed, but due to limited information on ANC adequacy in the three provinces, the results are still the most comprehensive information available on ANC adequacy in these provinces. The data was collected by interviewing, which was prone to recall biases, especially for items of ANC content. To accommodate this, the cut-off point of 75% of items was used to define "fair content," instead of 100%.

To increase ANC adequacy levels, the government should consider changing the recommendation to four ANC visits. Priority should be given to less developed regions. The ANC utilization index of three visits and the first visit within four months should be used in the future to study and monitor ANC in Vietnam. There should be more studies on ANC content and overall adequacy to establish sets of essential ANC content items and clear cut-off points, not only in Vietnam and the developing world, but also in the developed world. Whenever possible, pregnancy cards and records should be used to reduce recall biases.

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