

## Relationship between Antenatal Care in Severe Preeclampsia and Maternal and Neonatal Outcomes

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### Abstract

**Objective:** This study aims to evaluate the relationship between the frequency of antenatal care (ANC) visits and maternal and infant outcomes in cases of severe preeclampsia.

**Methods:** The collected data were processed using computerized methods to convert them into analyzable information. Data analysis was conducted to describe the proportion of each variable descriptively. Furthermore, the results were elaborated through descriptive analysis and hypothesis testing.

**Result:** Based on medical record data, 91.7% of patients had undergone antenatal care (ANC) visits; however, only about 80% received pre-eclampsia screening services according to the 10T standard.

**Conclusion:** The study concluded that inadequate antenatal care (ANC) visits were significantly associated with an increased risk of eclampsia and acute renal failure. On the other hand, there was no statistically significant association between ANC compliance and the occurrence of complications such as placental abruption, HELLP syndrome, DIC, and maternal death.

**Keywords:** Antenatal Care; Preeclampsia; Neonatal

## Hubungan *Antenatal Care* Pada Preeklampsia Berat terhadap Luaran Maternal dan Neonatal

### Abstrak

**Tujuan:** Penelitian ini bertujuan untuk mengevaluasi hubungan antara frekuensi kunjungan antenatal care (ANC) dan luaran maternal dan infant pada kasus preeklampsia berat.

**Metode:** Data yang telah terkumpul diolah secara komputerisasi untuk mengubah data menjadi informasi. Analisis data dilakukan untuk melihat gambaran proporsi masing-masing variabel yang disajikan secara deskriptif. Selanjutnya, hasil analisis tersebut diuraikan ke dalam analisis deskriptif dan pengujian hipotesis.

**Hasil:** Berdasarkan data rekam medis, ditemukan bahwa 91,7% pasien telah menjalani kunjungan antenatal care (ANC), namun hanya 80% yang mendapatkan pelayanan skrining preeklampsia sesuai standar 10T.

**Kesimpulan:** Kesimpulan menunjukkan bahwa kunjungan Antenatal Care (ANC) yang tidak memadai memiliki hubungan yang signifikan dengan peningkatan risiko eklampsia dan gagal ginjal akut. Sementara di sisi lain, tidak terdapat hubungan yang signifikan secara statistik antara tingkat kepatuhan ANC dengan kejadian komplikasi seperti solusio plasenta, edema paru, Sindrom HELLP, DIC, dan kematian ibu.

**Kata kunci:** Antenatal Care; Preeklampsia; Neonatal

## Introduction

Indonesia currently ranks second in ASEAN and eighth worldwide in maternal mortality. According to the 2020 census data, the Maternal Mortality Rate (MMR) in Indonesia reached 189 per 100,000 live births. This figure is significantly higher than in other ASEAN countries, where the rate is below 100 per 100,000 live births. Additionally, data from the West Java Provincial Health Service shows that the MMR in West Java in 2020 was 187 per 100,000 live births. In 2023, the number of maternal deaths in West Java increased to 792 cases from 745 cases in 2020. This makes West Java the province with the highest number of maternal deaths in Indonesia. For 2024, the target maternal mortality rate in Indonesia is 183 per 100,000 live births.<sup>1</sup>

Preeclampsia can be defined as a set of symptoms specific to pregnancy that can affect various organ systems clinically. It is a syndrome characterized by a blood pressure of  $\geq 140/90$  mmHg that occurs after 20 weeks of gestation and is accompanied by other organ system disorders. Originally, preeclampsia was defined as the development of hypertension and new-onset proteinuria during pregnancy. Although these two criteria remain the classic definition, some patients present with hypertension and multisystem disorders but do not have proteinuria.<sup>2,3</sup>

Previous reports show that the causes of direct death among mothers include eclampsia, bleeding, and infections that occur during pregnancy or the postpartum period. In addition to these factors, there are also other causes that do not directly involve worsening conditions, such as difficult geography, lack of access to health services, and low socioeconomic status, which limit mothers' ability to obtain healthcare. These factors also affect the quality and frequency of antenatal care (ANC) visits. ANC visits are a planned check-up program during pregnancy

to monitor the health of the mother and fetus, detect complications, and provide education related to pregnancy. WHO recommends a minimum of 8 visits during pregnancy with comprehensive examinations, including blood pressure, proteinuria, and risk assessment. Rules regarding the minimum number of ANC visits for pregnant women in Indonesia have changed over time. Previously, the standard antenatal service in 2014 stipulated a minimum of 4 visits during pregnancy, with visits scheduled once in the first trimester, once in the second trimester, and twice in the third trimester. However, based on the latest guidelines from the Ministry of Health of the Republic of Indonesia in 2020, it is now recommended that pregnant women attend at least 6 ANC visits, with one visit in the first trimester, two in the second trimester, and three in the third trimester.<sup>4,5,6</sup>

Several studies show a connection between the frequency of ANC visits and the incidence of preeclampsia. Pregnant women who do not regularly or rarely attend ANC visits are at greater risk of developing preeclampsia. A study at the Health Center Wagir, Malang Regency, found that pregnant women who are not compliant with ANC visits have a 1.63 times higher risk of experiencing preeclampsia compared to those who are compliant. Additionally, other studies show that non-compliance with ANC examinations is one of the factors contributing to the emergence of preeclampsia in pregnant women.<sup>7</sup>

In Indonesia, the challenges in implementing ANC visits include access to health services, especially in isolated areas, and a lack of awareness among pregnant mothers about the importance of ANC. Therefore, efforts to improve education and access to health services become crucial for increasing the frequency of ANC visits and reducing incidents of preeclampsia and its complications. Based on the background above, the researcher is interested in

analyzing “Relationship Between Antenatal Care in Severe Preeclampsia and Maternal and Neonatal Outcomes.”<sup>5,8</sup>

## Method

This study has undergone review and received approval from the Ethics Committee of Dr. Hasan Sadikin General Hospital, Bandung, No. DP.04.03/D.XIV.6.5/291/2025. This is an observational analytic study with a cross-sectional design, followed by a comparative analysis of recorded medical data from patients in two hospitals: Ananda Hospital in West Bekasi and Pekerja Hospital in North Jakarta. This study aims to evaluate the relationship between the frequency of antenatal care (ANC) visits and maternal and infant outcomes in cases of severe preeclampsia. The concept of a cross-sectional study is to measure independent and dependent variables simultaneously. The population in this study includes all pregnant women who gave birth at these hospitals during the study period. The sample is a subset of the population, selected based on specific characteristics, that includes pregnant women diagnosed with PEB during the study.

### Inclusion Criteria

The inclusion criteria in research include:

1. Patients giving birth at Ananda Hospital in Bekasi or Jakarta Pekerja Hospital with a diagnosis of severe preeclampsia based on medical notes.
2. Patient with recorded data related to the total number of ANC visits and pregnancy outcomes.
3. Patients willing to participate in the study by signing the informed consent form.

### Exclusion Criteria

1. Patient with an incomplete medical record.
2. Patients with other comorbidities that can

affect outcomes (e.g., diabetes mellitus) are either uncontrolled or controlled.

3. Patients who cannot be interviewed or fail to provide valid data.

The instrument used for research is a designed data recording form to collect information from medical records of patients at Ananda Hospital in West Bekasi and North Jakarta Pekerja Hospital. This form includes variables such as the frequency of ANC visits, maternal outcomes, and neonatal outcomes.

Secondary data were obtained from the patients' medical records at Ananda Hospital in West Bekasi and Pekerja Hospital in North Jakarta.

The data collected is processed through computerization to transform data into information. The analysis conducted further aims to describe the dependent and independent variables, which can aid in more in-depth analysis. Additionally, this descriptive analysis is used to understand the characteristics of the research subjects, which become the sample. Data analysis to examine the distribution of each variable, presented descriptively, can be summarized as descriptive analysis and hypothesis testing. Large-scale numerical data, such as patient ages, are presented with means, standard deviations, medians, and ranges. For characteristic data in the form of categorical data, such as patient sex and type, coding and presentation as frequency distribution and percentage are used.

## Result

Data collection was conducted to understand the relationship between ANC and preeclampsia and their impact on maternal and neonatal outcomes at Ananda Hospital, Bekasi, and Pekerja Hospital, Jakarta. The sample size in this study consisted of 60 patients, with 30 patients from each hospital. The results of the study are presented in the table below.

**Table 1** Summary of Patients' Characteristics

| Variable                                 | N (60)     |
|------------------------------------------|------------|
| Parity                                   |            |
| Nulliparous                              | 15 (25.0%) |
| Primipara                                | 19 (31.7%) |
| Multipara                                | 25 (41.7%) |
| Grand multipara                          | 1 (1.7%)   |
| Maternity place                          |            |
| Ananda hospital                          | 30 (50.0%) |
| Pekerja hospital                         | 30 (50.0%) |
| ANC visit                                |            |
| No ANC                                   | 5 (8.3%)   |
| <6 times without preeclampsia screening  | 7 (11.7%)  |
| >=6 times without preeclampsia screening | 0 (0.0%)   |
| >6 times with preeclampsia screening     | 43 (71.7%) |
| >=6 times with preeclampsia screening    | 5 (8.3%)   |
| maternal complications                   |            |
| Solution placenta                        | 4 (6.7%)   |
| Edema lungs                              | 3 (5.0%)   |
| Fail kidney I                            | 1 (1.7%)   |
| HELLP syndrome                           | 8 (13.3%)  |
| DIC                                      | 0 (0.0%)   |
| Eclampsia                                | 1 (1.7%)   |
| Mothers without complications            | 45 (75.0%) |
| Maternal death                           | 0 (0.0%)   |
| Neonatal complications                   |            |
| Birth weight <2500                       | 16 (26.7%) |
| Gestational age <37 weeks                | 19 (31.7%) |
| APGAR <7                                 | 12 (20.0%) |
| NICU Care                                | 19 (31.7%) |
| IUFD                                     | 2 (3.3%)   |
| No neonatal complications                | 31 (51.7%) |
| Complications                            | 3 (5.0%)   |

Information: Categorical data is displayed with amount, frequency, and percentage, while numerical data is shown with mean, median, standard deviation, and range. ANC: Antenatal Care, NICU: Neonatal Intensive Care Unit, DIC: Disseminated Intravascular Coagulation, IUFD: Intrauterine Fetal Death, APGAR: Appearance, Pulse, Grimace, Activity, and Respiration.

Table 1 describes the characteristics of the research patients. For patients with nulliparity, it ranges from 15% to 25.0%. Primipara patients account for up to 19 cases or 31.7%, multipara patients for as many as 25 cases or 41.7%, and grandmultipara patients for 1 or 1.7%. Regarding the place of delivery, 30 patients (50.0%) gave birth at Ananda Hospital, and the remaining 30 patients (50.0%) at Pekerja Hospital. For ANC visits in the non-ANC category, the number ranges from 5 cases to 8.3%. Patients with fewer than six screenings for preeclampsia account for 7 cases or 11.7%, while those with six or more screenings all have 0 cases (0.0%). Patients with fewer than six screenings with screening for preeclampsia make up 43 cases or 71.7%, and those with six or more screenings with screening account for 5 cases or 8.3%. In terms of maternal complications, placental abruption was observed in 4 cases (6.7%), Pulmonary edema in 3 cases (5.0%), and acute renal failure in approximately 1.7%. HELLP syndrome was present in 8 cases (13.3%), DIC in 0 cases (0.0%), and eclampsia in 1 case (1.7%). No maternal complications were reported in 45 cases (75.0%), and there were no maternal deaths.

This study involved 60 patients with severe preeclampsia from Ananda Hospital in West Bekasi and Pekerja Hospital in North Jakarta. Based on medical records, it was found that 91.7% of patients had attended antenatal care (ANC) visits, but only 80% received preeclampsia screening services according to the 10T standard. As many as 8.3% of patients did not undergo ANC at all. The Indonesian Ministry of Health (2020) recommends a minimum of six ANC visits, including comprehensive examinations such as blood pressure measurements, proteinuria testing, and risk screening. WHO even recommends eight visits to enhance early detection of pregnancy complications. Research by Padila et al. showed that pregnant women who received ANC according to

standards had a lower risk of preeclampsia complications.<sup>4</sup> The findings in this study support that most patients who experienced complications did not receive complete or standardized ANC.

These findings reinforce the idea that ANC is a crucial method for early detection and intervention of pregnancy risks, including preeclampsia. While some patients do attend ANC in adequate numbers, the quality of care remains the key factor in successfully identifying complications. The consistency of this study's results with previous research, both nationally and internationally, shows that enhancing the quality of ANC services should be a top priority in the healthcare system.<sup>7,8,9</sup> Improving education for pregnant women and training healthcare workers on preeclampsia screening are essential steps to reduce maternal and infant mortality rates.

## Discussion

Table 1 presents the characteristics of research patients. For patients with nulliparity, it ranges from 15% to 25.0%. Primipara patients account for up to 19 cases or 31.7%, multipara patients for as many as 25 cases or 41.7%, and grandmultipara patients for 1 or 1.7%. Regarding the place of delivery, 30 patients (50.0%) gave birth at Ananda Hospital, and the remaining 30 patients (50.0%) at Pekerja Hospital. For ANC visits in the non-ANC category, the number ranges from 5 cases to 8.3%. Patients with fewer than six screenings for preeclampsia account for 7 cases or 11.7%, while those with six or more screenings all have 0 cases (0.0%). Patients with fewer than six screenings with screening for preeclampsia make up 43 cases or 71.7%, and those with six or more screenings with screening account for 5 cases or 8.3%. In terms of maternal complications,

**Table 2 Comparison of Maternal Complications Based on ANC Visit**

| Variable                       | No ANC<br>N=5 | <6 times<br>without<br>preeclampsia<br>screening<br>N=7 | <6 times with<br>preeclampsia<br>screening<br>N=43 | >=6 kali with<br>preeclampsia<br>screening<br>N=5 | p value |
|--------------------------------|---------------|---------------------------------------------------------|----------------------------------------------------|---------------------------------------------------|---------|
| Maternal Complications         |               |                                                         |                                                    |                                                   |         |
| Placental Abruption            | 1 (20.0%)     | 0 (0.0%)                                                | 3 (7.0%)                                           | 0 (0.0%)                                          | 1.000   |
| Pulmonary Edema                | 0 (0.0%)      | 0 (0.0%)                                                | 3 (7.0%)                                           | 0 (0.0%)                                          | 1.000   |
| Acute Renal Failure            | 1 (20.0%)     | 0 (0.0%)                                                | 0 (0.0%)                                           | 0 (0.0%)                                          | 0.011*  |
| HELLP Syndrome                 | 2 (40.0%)     | 3 (42.9%)                                               | 2 (4.7%)                                           | 1 (2.0%)                                          | 0.071   |
| DIC                            | 0 (0.0%)      | 0 (0.0%)                                                | 0 (0.0%)                                           | 0 (0.0%)                                          | 1.000   |
| Eclampsia                      | 1 (20.0%)     | 0 (0.0%)                                                | 0 (0.0%)                                           | 0 (0.0%)                                          | 0.011*  |
| Without maternal complications | 2 (40.0%)     | 4 (57.1%)                                               | 35 (81.4%)                                         | 4 (80.0%)                                         | 0.400   |
| Maternal death                 | 0 (0.0%)      | 0 (0.0%)                                                | 0 (0.0%)                                           | 0 (0.0%)                                          | 1.000   |

Description: For categorical data, the p-value is calculated using the Chi-Square test, with the alternative of Kolmogorov-Smirnov and Exact Fisher tests if the Chi-Square assumptions are not satisfied. The significance level is determined by a p-value < 0.05.

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For analysis of categorical data in the table above, the Chi-Square statistical test was used for variables such as acute renal failure, DIC, Eclampsia, and maternal death. Additionally, the Kolmogorov-Smirnov test was applied to measure variables such as placental abruption, pulmonary edema, HELLP Syndrome, and cases without complications. The results of the statistical tests in the research group show that the P value for variables like placental abruption, pulmonary edema, HELLP syndrome, DIC, cases without complications, and maternal death are all greater than 0.05 (indicated as  $P > 0.05$ ). This indicates that the differences are not statistically significant. Therefore, it can be concluded that there is no statistically significant difference in proportions between the variables, such as placental abruption, pulmonary edema, HELLP syndrome, DIC, cases without complications, and maternal death, within the ANC visit group.

According to the basic theory of reproductive and obstetric epidemiology, adequate and high-quality ANC visits can significantly lower the risk of severe maternal complications, especially eclampsia and organ dysfunction such as acute renal failure.<sup>2,3,10</sup> This is because ANC provides early detection of signs of pre-eclampsia and hypertension in pregnancy, along with early treatment to prevent deterioration. In contrast, complications like DIC, placental abruption, or HELLP syndrome often occur suddenly and acutely, and cannot always be prevented by simply increasing the number of ANC visits, particularly if risk factors are undetected or occur beyond medical control.

Several studies support these findings. Say et al. (2014), in a systematic review on causes of maternal death, stated that eclampsia and acute renal failure are complications that can be prevented through close monitoring of blood pressure and renal function during pregnancy.<sup>11,12</sup> They highlighted the importance of quality

antenatal care (ANC), not just quantity. Duley (2009), in *BMJ*, emphasized that eclampsia is one of the leading causes of maternal death in developing countries and can be prevented with regular, high-quality ANC through hypertension screening and magnesium sulfate prophylaxis, which can only be administered if ANC is conducted consistently and adequately.

WHO (2016) in *Recommendations on Antenatal Care for a Positive Pregnancy Experience* stated that a minimum of 8 ANC visits with screening for complications, including blood pressure, proteinuria, and danger signs, is associated with a decrease in the incidence of severe preeclampsia and systemic complications such as kidney failure. Research in Indonesia by Titaley et al. (2010) found that women with inadequate ANC visits had a higher risk of complications from hypertension and acute kidney failure than those who received complete ANC according to standards.<sup>4,5</sup>

Hypertension in pregnancy is one of the three leading causes of maternal death, accounting for 25%, alongside bleeding (30%) and infection (12%).<sup>1,2</sup> The prevalence of preeclampsia in developed countries ranges from 1.3% to 6%, while in developing countries it varies from 1.8% to 18%. Generally, hypertension in pregnancy occurs in 5% to 10% of all pregnancies. The global incidence of hypertension in pregnancy from 2002 to 2012 was 4.6%, with regional variation ranging from 2.7% to 8.2%. The worldwide incidence of preeclampsia was 2.16%. These statistics differ across regions due to variations in population characteristics, criteria, and definitions.<sup>3</sup>

The long-term effects on mothers who experience severe preeclampsia must not be overlooked.<sup>2,6</sup> Research indicates that mothers with a history of preeclampsia have an increased risk of developing chronic hypertension and cardiovascular disease later. Metabolic disorders, like metabolic

syndrome, are also more prevalent in women with such a history, raising their risk for type 2 diabetes and obesity. Consequently, ongoing health monitoring is essential to prevent further complications.<sup>10,13</sup>

Theoretically, adequate ANC can facilitate early detection of preeclampsia, enabling quicker intervention. However, research at Dr. Moewardi Regional Hospital in Surakarta showed that the number of ANC visits was not significantly linked to maternal mortality or morbidity in severe preeclampsia.<sup>7,14</sup> The average number of ANC visits for patients in this study was 7.5 (range 0-16), but this did not directly relate to preventing complications.<sup>7</sup> Approximately eight visits reduced poor neonatal outcomes but had no effect on maternal complications. He emphasizes that the quality, not just the quantity, of antenatal care is essential.<sup>8</sup> A normal antenatal care visit for pregnant women is usually abbreviated with the letter "K" in the pink book or KIA book given to them at the first visit. During the antenatal visit, the mother will undergo a series of examinations to confirm the pregnancy and monitor for any possible complications or health issues that might affect the pregnancy itself.<sup>15</sup>

## Conclusion

Inadequate Antenatal Care (ANC) visits are significantly associated with a higher risk of eclampsia and acute kidney failure.<sup>5,8,11,12</sup> This demonstrates that the quality and regularity of ANC are crucial for detecting and preventing severe pregnancy complications that could threaten the mother's life.<sup>4,9,11</sup> These findings support the idea that consistent monitoring of blood pressure and kidney function during pregnancy can help reduce the risk of serious obstetric issues.<sup>2,11,12</sup> However, there was no statistically significant link between the level of ANC compliance and the occurrence of

complications such as placental abruption, pulmonary edema, HELLP Syndrome, DIC, and maternal death.<sup>7</sup> Similarly, neonatal outcomes like low birth weight (LBW), prematurity, low APGAR scores, NICU admission, IUFD, and early neonatal death showed no significant differences between the adequate and inadequate ANC groups.<sup>7,14</sup> This suggests that while ANC is vital, its effectiveness depends heavily on the quality of examinations, early screening capabilities, and the availability of referral facilities, not just the frequency of visits.<sup>4,5,8</sup>

### Conflict of Interest

The authors state that they have no competing interests.

### References

1. Syairaji M, Nurdiati DS, Wiratama BS, Prüst ZD, Bloemenkamp KWM, Verschueren KJC. Trends and causes of maternal mortality in Indonesia: A systematic review. *BMC Pregnancy Childbirth*. 2024;24(1):515. doi:10.1186/s12884-024-06687-6.
2. McPherson RA, Pincus MR, editors. *Henry's clinical diagnosis and management by laboratory methods*. 22nd ed. Philadelphia: Saunders Elsevier; 2011.
3. Say L, Chou D, Gemmill A, Tunçalp Ö, Moller AB, Daniels J, et al. Global causes of maternal death: A WHO systematic analysis. *Lancet Glob Health*. 2014;2(6):e323–33. doi:10.1016/S2214-109X(14)70227-X.
4. Wibowo N, Irwinda R, Permaiselvi S, Mose JC, Handayani S, Pratama G, et al. *Pedoman nasional pelayanan kedokteran: Diagnosis dan tatalaksana preeklampsia*. Jakarta: Perkumpulan Obstetri dan Ginekologi Indonesia; 2016.
5. Reni NLP, Adhiestiani NM, Widiastini L, Ekajayanthi P. Hubungan kepatuhan ANC dengan kejadian preeklampsia di Ruang Ponek RSUD Sanjiwani. *Jurnal Kebidanan*. 2024;13(1):41–50. Available from: <https://jurnal.stikeswilliambooth.ac.id/index.php/Keb/article/view/572>
6. Beyuo TK, Lawrence ER, Oppong SA, Kobernik EK, Amoakoh-Coleman M, Grobbee DE, et al. Impact of antenatal care on severe maternal and neonatal outcomes in pregnancies complicated by preeclampsia and eclampsia in Ghana. *Pregnancy Hypertens*. 2023; 31:46–51. doi: 10.1016/j.preghy.2022.11.007.
7. Mardiyah N, Ernawati E, Anis W. Antenatal care dan luaran maternal preeklampsia. *Indonesian Midwifery and Health Sciences Journal*. 2022;6(3):298–309.
8. Bundarini B, Fitriahadi E. Gambaran kelengkapan antenatal care terpadu di Puskesmas Tepus II Gunungkidul. *Jurnal Smart Kebidanan*. 2019;6(2):70–79.
9. Cunningham FG, Leveno KJ, Bloom SL, Dashe JS, Hoffman BL, Casey BM, et al. *William's obstetrics*. 25th ed. New York: McGraw-Hill; 2018.
10. Wibowo N, Irwinda R, Permaiselvi S, Mose JC, Handayani S, Pratama G, et al. *Pedoman nasional pelayanan kedokteran: Diagnosis dan tatalaksana preeklampsia*. Jakarta: Perkumpulan Obstetri dan Ginekologi Indonesia; 2016.
11. World Health Organization. *WHO recommendations on antenatal care for a positive pregnancy experience*. Geneva: World Health Organization; 2016. Available from: <https://www.who.int/publications/i/item/9789241549912>
12. Titaley CR, Dibley MJ, Roberts CL. Factors associated with underutilization of antenatal care services in Indonesia: Results of Indonesia Demographic and Health Survey 2002/2003 and 2007. *BMC Public Health*. 2010; 10:485.

doi:10.1186/1471-2458-10-485.

13. Duley L. The global impact of pre-eclampsia and eclampsia. *Semin Perinatol.* 2009;33(3):130–7. doi: 10.1053/j.semperi.2009.02.010.
14. Callahan T, Caughey AB. *Blueprints obstetrics and gynecology.* 6th ed. Philadelphia: Wolters Kluwer; 2013.
15. Zuvarcan DA, Putra DA, Martuti S. Correlation between preeclampsia and infant low birth weight at Dr. Moewardi Hospital, Surakarta, Central Java, Indonesia. *Journal of Maternal and Child Health.* 2024;9(1):28–37. Available from: <https://thejmch.com/index.php/thejmch/article/view/1053>