



# Utilization of Rural Primary Care Physicians' Visit Services for Diabetes Management of Public Health in Southwestern China: A Cross-Sectional Study from Patients' View

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## Abstract

**Background:** Primary care physicians' visit services for diabetes management are now widely delivered in China's rural public health care. Current studies mainly focus on supply but risk factors from patients' view have not been previously explored. This study aims to present the utilization of rural primary care physicians' visit services for diabetes management in the last 12 months in southwestern China, and to explore risk factors from patients' view.

**Methods:** This cross sectional study selected six towns at random and all 385 diabetics managed by primary care physicians were potential participants. Basing on the inclusion and exclusion criteria, 374 diabetics were taken as valid subjects and their survey responses formed the data resource of analyses. Descriptive indicators,  $\chi^2$  contingency table analyses and Logistic regression were used.

**Results:** 54.8% respondents reported the utilization of visit services. According to the multivariate analysis, the positive factors mainly associated with utilization of visit services include disease duration (OR=1.654), use of diabetic drugs (OR=1.869), consulting diabetes care knowledge (OR=1.602), recognition of diabetic complications (OR=1.662), needs of visit services (OR=2.338).

**Conclusion:** The utilization of rural primary care physicians' visit services still remains unsatisfactory. Mass rural health policy awareness, support, and emphasis are in urgent need and possible risk factors including disease duration, use of diabetic drugs, consulting diabetes care knowledge, recognition of diabetic complications and needs of visit services should be taken into account when making rural health policy of visit services for diabetes management in China and many other low- and middle-income countries.

**Keywords:** Diabetes management, Rural primary care, Visit services, China

## Introduction

In recent decades, rapid industrialization, increasing urbanization, rising unhealthy lifestyle risk factors and an aging population are contributing to a growing diabetes epidemic with 347 million people worldwide having diabetes (1-6). Diabetes is epidemic among poor and disadvantaged populations, and more than 80% of people with diabetes live in low- and middle-income countries (7). Dia-

betes has become a major public health problem in China with 8.2% of rural residents having diabetes (8, 9). Diabetes are important causes of mortality and morbidity worldwide, through both direct clinical sequelae and increased mortality from cardiovascular and kidney diseases (10). Diabetes management and long-term management mechanisms are thought to be effective measures for the

prevention and control of diabetes (11). However, management of chronic illnesses in low- and middle-income countries is often poor with health systems struggling with an outward flow of human resources and insufficient funds (12).

In terms of rural diabetics in southwestern China, rural populations tend to be older, are more likely to be exposed to health risk factors and experience greater socioeconomic disadvantage; these factors impact on access to health services (13, 14). Patient cost-free rural public health services undoubtedly come to be a main route of diabetes management in southwestern China. Rural primary care physicians' visit services are now widely delivered in China's rural public health services. Researches on physicians' visit services in China and other countries have shown that physicians can obtain complete information of diabetes treatment, observe diabetic complications, put forward individualized treatment measures for patient, improve doctor-patient relationship and collect the first-hand information needed in clinical research on diabetes (15-19).

However these studies also have limitations. On one hand, the definition of physicians' visit services in current studies emphasis on medical visit services, and the scope of most studies are confined to urban communities, systematic studies on visit services of rural public health services are rarely seen. On the other hand, these studies are mainly carried out from the view of the visit services providers, assuming or implying conditions that the supply of follow-up services is the same as the utilization of visit services, namely, however many follow-up services the providers supply, the diabetes patients will make best of these services; whatever kinds of follow-up services the providers supply, the diabetes patients will make full use of these services. In fact, visit services or public health services, as quasi-public goods, their utilization is not entirely consistent with supply, influenced by various factors of both supply and demand. So it is necessary to make study on visit services from the demanding view, namely patients' view to explore risk factors.

According to China's "National Basic Public Health Services Specifications" ([http://www.gov.](http://www.gov.cn/)

[cn/zwggk/2011-05/24/content\\_1870181.htm](http://www.gov.cn/zwggk/2011-05/24/content_1870181.htm)), primary care physicians' visit services for diabetes management contain the following items: 1) To measure the fasting blood glucose and blood pressure, and to assess whether critical circumstances exist, such as blood sugar, high blood pressure, or critical symptoms, or the existence of other diseases that cannot be treated and in need of urgent referral; 2) For diabetics who don't need urgent referral, to ask about symptoms, disease status, lifestyle and medication compliance; 3) To check the dorsalis pedis artery pulse, and to measure the weight and determine whether overweight and obesity exist; 4) Appropriate treatment according to the patient's condition; 5) To conduct targeted health education, to set lifestyle improvement goals with diabetics, and to tell patients what physical abnormality should seek medical attention immediately. So rural primary care physicians' visit services in this study refers to preventive rural public health services containing fasting blood glucose and blood pressure monitoring, medication guide, dorsalis pedis artery pulse check, weight measurement and targeted health education and so on.

This study aims to present current situation of the utilization of rural primary care physicians' visit services for diabetes management of public health in southwestern China, to explore influencing factors from patients' view and to evaluate their impact. The research approaches and results will provide reference to perfect the public health services.

## Materials and Methods

### *Study design and sample*

This study focused on the utilization of primary care physicians' visit services for diabetes management from patients' view. Frequency of utilization referred to the number of diabetics who had received rural primary care physicians' visit services for diabetes management once or more in the last 12 months. The data reported in this study were collected from July 1 to August 31 in 2012, as part of a research funded by China Medical Board (CMB) exploring integrated health care services, Study on the Efficiency and Effectiveness of the Integrated Health Care Services in Rural China

(Fig. 1-2). This cross sectional selected six towns in southwestern China (Shown in Appendix 1) at random and all 385 diabetics managed by primary care physicians of the towns were potential participants in the first step. Basing on the inclusion and exclusion criteria, 374 diabetics were taken as valid subjects and their survey responses formed the data resource of analyses in the next step. Inclusion criteria: 1) Accord with diabetes diagnostic criteria published by WHO; 2) Having received diabetes management by primary care physicians for more than 3 months(primary care physicians in Sample regions are required to visit a diabetic every three months at least),or less than 3 months but have received primary care physicians' visit services; 3) Being able to complete the questionnaire independently or in assistance of another person; 4) Local rural residents who were 18 years old or older. 385 diabetics in total from the six towns were included as potential respondents. During July to August 2012, a questionnaire consisting of 5 sections ('Demographic information', 'Knowledge of diabetes', 'Physical conditions', 'Lifestyle', 'Use of health services',) was used to conduct the field survey. Exclusion criteria: 1) Having received diabetes management by primary care physicians for less than 3 months and have not received primary care physicians' visit services; 2) not a permanent resident of the sampled towns; 3) refused or unable to provide true information. Overall, 374 valid survey responses in total formed the data resource of analyses. There was no missing data in each case.

### Analysis

Frequency and percent were used to describe the situation of the utilization of primary care physicians' visit services in the last 12 months. In order to explore factors had relation to the utilization of primary care physicians' visit services and evaluate their impact, logistic regression was adopted. In case of the design effect, data hierarchy must be estimated to determine the use of single-level or two-level logistic regression. Therefore this study used 2nd order PQL method to estimate whether data hierarchy existed or not. The 2nd order PQL method took individual and town as level 1 (low-

level) and level 2 (high-level) respectively, and fitted the data without explanatory variables. The fixed scale parameter was 1. The logistic regression model without explanatory variables was:

$$\begin{aligned} Utilization_{ij} &\sim \text{Binomial}(\text{denom}_{ij}, \pi_{ij}) \\ \text{logit}(\pi_{ij}) &= \beta_{0j} + \text{constant} \\ \beta_{0j} &= \beta_0 + u_{0j} \\ [u_{0j}] &\sim N(0, \Omega_u) : \Omega_u = [\sigma_{u0}^2] \\ \text{Var}(Utilization_{ij} | \pi_{ij}) &= \alpha \pi_{ij}(1 - \pi_{ij}) / \text{denom}_{ij} \end{aligned}$$

Residual variance  $\sigma_{u0}^2$  was the random part of level 2 and the meaning was the degree of variance in individuals' utilization of primary care physicians' visit services, namely individual/town difference. The logistic regression model without explanatory variables ignored the individual and town features of each response of the study when fitting the data.

Basing on previous studies carried out in China and the related articles (20, 21), this study took 'Using primary care physicians' visit services' as dependent variable ('no'='0', 'yes'='1'), 'Sex', 'Age', 'Highest level of education', 'Income', 'Disease duration', 'Use of diabetic drugs', 'Consulting diabetes care knowledge', 'Re-cognition of diabetic complications', 'Needs of visit services' as independent variables, to conduct a logistic regression to explore possible risk factors influencing utilization of rural primary care physicians' visit services from patients' view. The logistic regression variable assignments and results were shown in Table 1.  $\chi^2$  contingency table analyses were used to compare the difference between diabetic groups divided by demographic information. Statistical significance was at the 0.05 level. Questionnaire data entry was conducted by Epidata version 3.0 (EpiData Software, Atlanta, USA; <http://www.epidata.dk/>) and SPSS version 19.0 (SPSS Inc., Chicago, USA; <http://www.spss.com>) was used in statistical analysis.

## Results

### Demographic characteristics

Rural diabetics in the six towns had poor education, 25.9% of the respondents were illiteracy, and only 1.1% had received college education. The average annual income was merely 6480 yuan;

what's more, 77.8% respondents' annual income was lower than the average. 92.8% of them were farmers engaged in heavy agricultural labor. Since to the above factors, they were commonly faced with problems like lacking awareness and care knowledge of diabetes, economic incapacity in

diabetes treatment and overworked. The above problems may result in rising prevalence of diabetes or impact on access to health services. Therefore it was necessary to focus on their utilization of primary care physicians' visit services for diabetes management.

**Table 1:** Demographic characteristics of the 374 valid subjects

Variables		Frequency	Percent (%)	Mean( $\bar{X} \pm s$ )
Age (yr)	< 60	140	37.4	64.5±8.5
	≥60	234	62.6	
Sex	Male	195	52.1	---
	Female	179	47.9	
Highest level of education	illiteracy	97	25.9	---
	primary school or middle school	192	51.3	
	high school	81	21.7	
	college or higher	4	1.1	
Annual income (yuan)	below the average	291	77.8	6480.0±331.7
	average or above	83	22.2	
Occupation	Farmer	347	92.8	---
	Non-farmer	27	7.2	

Note: "yuan" in the table is the monetary unit of China

### ***Diabetics' utilization of rural primary care physicians' visit services in the last 12 months***

Overall, 205(54.8%) diabetics reported the utilization of primary care physicians' visit services in the last 12 months. The result was far from satisfactory because almost half of the diabetics never received primary care physicians' visit services. Considering their rare access to medical services for diabetes, these respondents were in status of no preventive measures. From this perspective, the burden of diabetes management work in southwestern China was still heavy.

Results of the 2nd order PQL method and logistic regression were shown in Table 2, 3 and Table 4. The result showed that there was no statistical significance of residual variance  $\sigma_{\epsilon}^2$  ( $P=0.1127$ ). Data hierarchy did not exist in level 2 (high-level), thus single-level logistic regression was proper.

The result of logistic regression showed that under the condition of controlling other variables, 'Disease duration', 'Use of diabetic drugs', 'Con-

sulting diabetes care knowledge' and 'Recognition of diabetic complications' 'Needs of visit services' were possible risk factors, and the odds ratios were 1.654, 1.869, 1.602, 1.662 and 2.338 respectively.

### ***Contents of rural primary care physicians' visit services utilization***

Comprehensive interventions for diabetes management include five aspects, health education, proper diets, exercise therapy, oral glucose-lowering drugs and blood sugar monitoring (22). Current rural primary care physicians' visit services for diabetes management in public health in southwestern China were accord with these principles. The detailed 10 items and diabetics' utilization of rural primary care physicians' visit services were shown in Table 5. All 10 items were designed basing on Chinese Type2 diabetes Prevention Guide (<http://cdschina.org/guideline-1.jsp>).

**Table 2:** Logistic regression variable assignment

Variables	Definition& assignment			
<b>Dependent variable</b>				
Using primary care physicians' visit services	0 no	1 yes		
<b>Independent variables</b>				
Sex	0 female	1 male		
Age	0 under 60 years old	1 60 years old or older		
Highest level of education	0 illiteracy	1 primary school or middle school	2 high school	3 college or higher
Income	0 below the average	1 average or above		
Disease duration	0 less than 1 year	1 1 year or more		
Use of diabetic drugs	0 no	1 yes		
Consulting diabetes care knowledge	0 no	1 yes		
Recognition of diabetic complications	0 no	1 yes		
Needs of visit services	0 no	1 yes		
Individual level	Level 1			
Town level	Level 2			

**Table 3:** The 2nd order PQL method fitting two-level logistic regression without explanatory variables

Parameters (Residual)		Estimates	S.E,	$\chi^2$	P
Fixed parameters		0.545	0.090	571.357	< 0.0001
Random parameters					
Level2(town-level)	$\sigma_{u0}^2$	0.046	0.028	2.516	0.11270
Level1(individual-level)	$\sigma_{e0}^2$	0.196	0.014	10.231	< 0.0001

**Table 4:** Result of Logistic regression about diabetics' utilization of primary care physicians' visit services

Variables in the equations	B	S.E,	P	OR	95%C.I.
Disease duration	0.503	0.238	0.035	1.654	1.037-2.637
Use of diabetic drugs	0.625	0.245	0.011	1.869	1.155-3.023
Consulting diabetes care knowledge	0.472	0.291	0.105	1.602	0.905-2.836
Recognition of diabetic complications	0.508	0.245	0.038	1.662	1.029-2.684
Needs of visit services	0.849	0.26	0.001	2.338	1.404-3.892
Constant	-1.741	0.293	0.000	0.175	

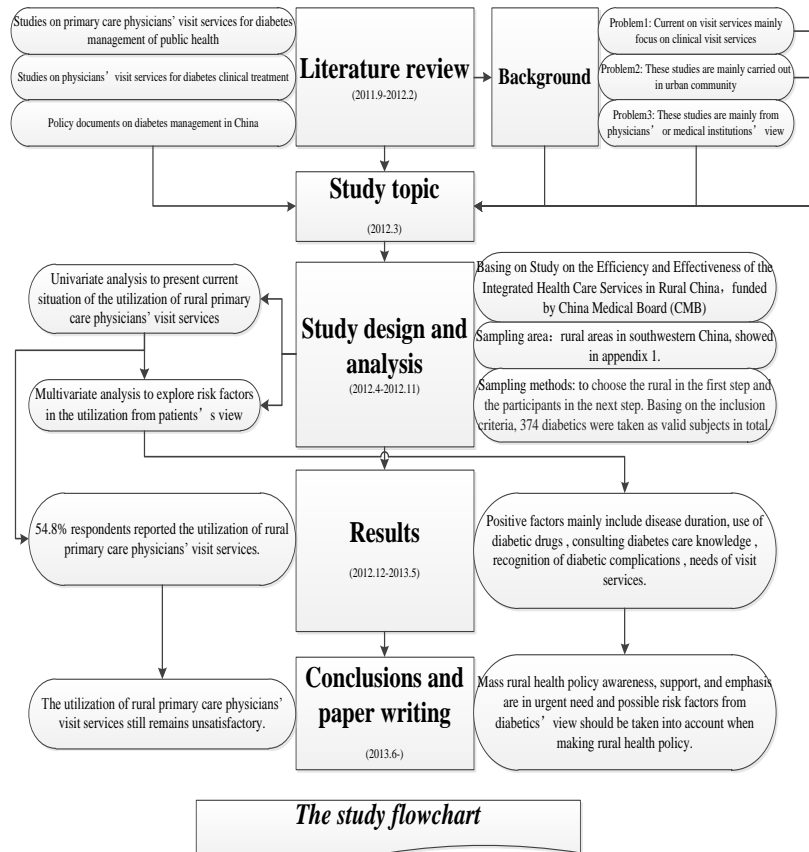
**Table 5:** Contents of primary care physicians' visit services utilization (n=205)

Contents	Frequency of diabetics utilize visit services (n)	Percent (%)
Fasting blood glucose & blood pressure monitor	146	71.2
Dorsalis pedis artery pulse check	0	0.0
Diabetic symptoms observation	143	69.8
Diabetic complications observation	106	51.7
Medication guide	113	55.1
Urgent referral guide	52	25.4
Proper diet guide	89	43.4
Quit smoking guide	71	34.6
Alcohol temperance guide	64	31.2
Regular exercises	72	35.1

$\chi^2$  contingency table analyses showed that the ratios of respondents taking advantage of fasting blood glucose & blood pressure monitor were significantly different, with 41.09% and 25.33% of diabetics under 60 years old group and diabetics 60 years or older group respectively ( $\chi^2=7.032$ ,  $P=0.008$ ). More diabetics (42.17%) with income above the average income of rural residents in southwestern China reported the utilization of medication guide than diabetics with income below the average income (26.80%;  $\chi^2=7.230$ ,  $P=0.007$ ). Utilization of urgent referral guide was different between diabetics with different needs of visit services. The percent of diabetics who needed visit services (27.41%) was significantly higher than diabetics who didn't need visit services (20.82%;  $\chi^2=5.426$ ,  $P=0.020$ ). No respondent responded dorsalis pedis artery pulse check. The most likely reason is that primary care physicians had not realized the significance of this work.



**Fig. 1:** The location of the program study on the Efficiency and effectiveness of the integrated health care services in Rural China



**Fig. 2:** The study flowchart

## Discussion

The inclusion/exclusion criteria excluded potential participants did not meet research objectives, thus some potential sources of bias and confounders were reduced. This study took all 385 diabetics managed by primary care physicians of the six random sampled towns as potential participants ensured the external validity of the study results.

Primary care physicians were the most common providers of chronic disease management services (23). Considering rural populations' difficulty in accessing to health services, the utilization of rural primary care physicians' visit services to a large extent determined the diabetes management. Since to the positive effects of physicians' visit services for diabetes management, primary care physicians' visit services therefore should be in theory an important means of diabetes management. In reality health policy-makers must take into account the fact that for rural diabetics in southwestern China, considering the low income, it is almost impossible to seek clinical treatment of diabetes. Therefore in the current stage health policies of diabetes management must focus on improving the quality of patient cost-free health care and primary care physicians' visit services are obviously wise choices.

The present results found that only 54.8% diabetics reported the utilization of visit services delivered by primary care physicians, which is too low for these underserved rural diabetics. Diabetes Complications may explain a portion of the result. With the diabetes duration prolongs, diabetics are at high risks of developing micro-vascular and macro-vascular complications (24), while the effects of these interventions on complications of diabetes remain unknown (25). Another reason maybe that since to different perceptions of health and disease (26), interpersonal issues between patients (27) and rural primary care physicians, and a great trust in traditional Chinese medicine (28), rural diabetics in southwestern China use primary care less frequently than they are recommended by physicians.

The logistic regression analysis showed possible risk factors from patients' view. The results indicated that, diabetics' needs of primary care physicians' visit services was the primary factor influencing the utilization, with an odds ratio 2.338. This result provided insight into improving the utilization: primary care physicians increase rural diabetics' needs of primary care physicians' visit services via making them recognize the importance of visit services for diabetes management in rural public health. Because of the huge number of diabetics in rural China, it is unrealistic to put forward individualized care plan for each. Therefore group visit services for rural diabetics should play an important role at present, and the five found in the logistic regression analysis can be the basis for grouping. Further studies may focus on exploring possible risk factors for group management from the views of government, public health policy and so on.

It must be pointed out in this study that 10 items included in current primary care physicians' visit services for diabetes management was not comprehensive. Except for measures mentioned above, International Diabetes Federation (IDF) recommends stress and depression control, and sleeping patterns improvement as core measurement for preventing diabetes (29).

It is surprising that for the whole 10 items of primary care physicians' visit services for diabetes management, the highest percent of diabetics reported the utilization was merely 71.2% (Fasting blood glucose & blood pressure monitor). What's more, no diabetics reported dorsalis pedis artery pulse check. This result reflected the fact that the utilization of primary care physicians' visit services for diabetes management in public health in rural areas in southwestern China was poor. The results were closely related to lacking a team of rural primary care physicians concentrating on delivering visit services. A national survey carried out in China in the year 2011 indicated that only 74.09% and 8.01% of primary care physicians in town hospital and village clinics respectively are practice physician or assistant practice physician (30). The general lack of professional skills for diabetes management has become a barrier to improve pri-

primary care physicians' visit services (31). Therefore, China's primary care physicians, as the most common providers of diabetes management, need more professional training for better diabetes visit services. Further studies or diabetes prevention program in southwestern China should focus on the formation of primary care physician team and service specification of visit services.

## Conclusion

Results of this cross-sectional study from patients' view suggest that the utilization of primary care physicians' visit services for diabetes management in public health in rural areas in southwestern China is far from perfect, mass health policy awareness and support to improve primary care physicians' visit services are in urgent need. Risk factors from patients' view should be taken into account when making rural health policy of primary care physicians' visit services for diabetes management in China and many other low- and middle-income countries.

## Ethical considerations

Ethical issues (Including plagiarism, Informed Consent, misconduct, data fabrication and/or falsification, double publication and/or submission, redundancy, etc) have been completely observed by the authors.

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## References

1. Melanie Y. Bertram, Aneil VS. Jaswal, Victoria Pillay Van Wyk, et al (2009). The non-fatal dis-

- ease burden caused by type 2 diabetes in South Africa. *GlobHealth Action*, 2013, 6(6): 206-212.
2. Zhenfang Xia, Zhuansuo Wang, Tubao Yang, et al. (2013). Prevalence and Risk Factors of Type 2 Diabetes in the Adults in Haikou City, Hainan Island, China. *Iranian J Publ Health*, 42(3): 222-230.
3. SH Yarahmadi, K Etemad, AR Mahdavi Hazaveh, N Azhan. (2013). Urbanization and Non-Communicable Risk Factors in the Capital City of 6 Big Provinces of Iran. *Iranian J Publ Health*, 42(1): 113-118.
4. Kristina Ahlin, Annika Billhult (2012). Lifestyle changes- a continuous, inner struggle for women with type 2 diabetes: A qualitative study. *Scandinavian Journal of Primary Health Care*, 6(30): 41-47.
5. Azita Noroozi, Fazlollah Ghofranipour, Ali Reza Heydarnia, et al (2011). Validity and Reliability of the Social Support Scale for Exercise Behavior in Diabetic Women. *Asia Pac J Public Health*, 23(5): 730-741.
6. Steven H. Barag, DO (2011). Insulin Therapy for Management of Type 2 Diabetes Mellitus: Strategies for Initiation and Long-term Patient Adherence. *JAOA*, 7(5): S13-S19.
7. Michiyo Higuchi (2010). Access to Diabetes Care and Medicines in the Philippines. *Asia-Pacific J Public Health*, 22(3): 96-102.
8. Shengsheng Liu, Anhua Bi, Dongbo Fu, et al. (2012). Effectiveness of using group visit model to support diabetes patient self-management in rural communities of Shanghai: a randomized controlled trial. *BMC Public Health*, 12(12): 1043.
9. Yang W, Lu J, Weng J, et al (2010). China National Diabetes and Metabolic Disorders Study Group: Prevalence of diabetes among men and women in China. *N Engl J Med*, 362(6): 1090-1101.
10. Goodarz Danaei, Mariel M Finucane, Yuan Lu, et al. (2011). National, regional, and global trends in fasting plasma glucose and diabetes prevalence since 1980: systematic analysis of health examination surveys and epidemiological studies with 370 country-years and 2.7 million participants. *Lancet*, 378(14): 31-40.
11. Stern E (2005). Impact of a two-arm educational program for improving diabetes care in primary care centers[J]. *Int J Clin Pract*, 59 (10): 1126-1130.



12. Tshipfuralo Ndou, Greer van Zyl, Salamina Hlahane, Jane Goudge (2013). A rapid assessment of a community health worker pilot programme to improve the management of hypertension and diabetes in Emfuleni sub-district of Gauteng Province, South Africa. *Glob Health Action*, 6(6): 213-218.
13. CC Unger, N Warren, R Canway, et al (2011). Type 2 diabetes, cardiovascular disease and the utilization of primary care in urban and regional settings. *Rural and Remote Health*, 11(7): 1-7.
14. Wan Q, Harris MF, Powell0Davies G, Jayasinghe UW, Flack J, Georgiou A, et al (2007). Cardiovascular risk levels in general practice patients with type 2 diabetes in rural and urban areas. *Aus J Rural Health*, 15(5): 327-333.
15. Jennifer Nicholas, Judith Charlton, Alex Dregan, et al (2013). Recent HbA1c Values and Mortality Risk in Type 2 Diabetes. Population-Based Case-Control Study. *Plos One*, 8(7): 1-7.
16. Zhang Xiaoyan (2010). Thinking on Carrying out Follow-up Services. *Chin Med Rec*, 11(5): 10-11.
17. Dongjing, Xing Fengmei, Sun Jingling(2012). An investigation on self-management of diabetes patients in rural China. *Chin Nurs Res*, 26(6A): 1478-1479.
18. Michel P. Hermans, Sylvie A. Ahn, Yovan P. Mahadeb, Michel F (2013). Sleep apnoea syndrome and 10-year cardiovascular risk in females with type 2 diabetes: relationship with insulin secretion and insulin resistance. *Diabetes Metab Res Rev*, 29(10): 227-234.
19. Nazrul Islam, Ariful Islam, Syed Jamil Abdal, et al (2012). Eosinophilic Fasciitis: What Matters in Management in a Developing Country-A Case Report with Two and a Half-year Follow-up. *J Health Popul Nutr*, 30(1): 117-120.
20. Haipeng Wang, Qingyue Meng (2013). Study on determinants of medical service utilization and trends for patients with chronic disease. *Chinese Primary Health Care*, 27(8): 83-85.
21. Zuxun Lu, Junan Liu, Tingsong Xia, et al (2005). Utilization of community health services and influencing factors in Shenzhen. *Chin J Hosp Admin*, 7(7): 464-467.
22. Siminerio L.M (2006). Deploying the chronic care model to implement and sustain diabetes self-management training programs. *The Diabetes Educator*, 32(2): 253-260.
23. Stephen A. Tonks, Sohil Makwana, Amanda H. Salanitro, et al (2012). Quality of Diabetes Mellitus Care by Rural Primary Care Physicians. *The Journal of Rural Health*, 28(9): 364-371.
24. Mayur Patel, Ina M. Patel, Suresh K. Rathi (2012). Factors Associated with Consumption of Diabetic Diet among Type 2 Diabetic Subjects from Ahmedabad, Western India. *J Health Popul Nutr*, 30(4): 447-455.
25. Shiro Tanaka, Sachiko Tanaka, Satoshi Iimuro, et al (2013). Cohort Profile: The Japan Diabetes Complications Study: a long-term follow-up of a randomized lifestyle intervention study of type 2 diabetes. *Int J Epidemiol*, 5(18): 1-9.
26. Jessica Madden, Amanda Barnard, Cathy Owen(2013). Utilization of multidisciplinary services for diabetes care in the rural setting. *Aust J Rural Health*, 21(3): 28-34.
27. Allan J, Ball P, Alston M (2008). 'You have to face your mistakes in the street': the contextual keys that shape health service access and health workers' experiences in rural areas. *Rural and Remote Health*, 8(8): 835.
28. Zhao Hailu, Sui Yi, Qiao Chunfeng, et al (2012). Sustained Anti-diabetic Effects of a Berberine-Containing Chinese Herbal Medicine Through Regulation of Hepatic Gene Expression. *Diabetes*, 4(61): 933-943.
29. C.H. Lin, Y.Y. Lee, C.C. Liu, et al(2012). Urbanization and prevalence of depression in diabetes. *Public Health*, 126(4): 104-111.
30. Zhifeng Wang, Jinzhong Jia, Weiyan Jian, et al(2011). The rural primary health care of China: development and consideration. *Chin J Health Policy*, 4(10): 1-6.
31. Michael N. Wiggins, Reid D. Landes, Swetangi D. Bhaleeya, et al(2013). Primary care physicians' knowledge of the ophthalmic effects of diabetes. *Can J Ophthalmol*, 48(11): 265-268.