

Effectiveness of Medication Review in Improving Medication Knowledge and Adherence in Primary Care Patients

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ABSTRACT

Introduction: Medication review by pharmacists can be an important educational intervention to improve adherence rates as it can potentially address many of its barriers. Medication review may also directly improve the patient's knowledge and understanding of his or her drug regimen. This study aims to assess the effectiveness of medication review as an intervention to improve a patient's knowledge and adherence to their chronic medications.

Methods: Two hundred and forty patients from four polyclinics, who were referred by their prescribers for pharmacist-conducted medication review, were recruited for this prospective study. The effectiveness of medication review in improving their knowledge of and adherence to chronic medications was evaluated using a two-part questionnaire, which was applied before intervention and upon follow-up. The data collated was then analysed using Student's paired t-test, Chi-square and Pearson's correlation test.

Results: Of the 195 patients who completed follow-up, 93.8% demonstrated medication knowledge deficits. Medication review conducted by the polyclinic pharmacists had improved the patients' overall understanding of their medications' dosage, frequency, indication, storage and administration method ($p < 0.01$). Seventy point three percent of study patients had issues with medication adherence. Of these, half reported an improvement after medication review. There was significant correlation between the patients' knowledge and adherence scores ($p < 0.001$).

Conclusion: Medication review was found to be an effective intervention for improving patient's medication knowledge and reported adherence to chronic medications in this preliminary study. Further study demonstrating the effectiveness of medication review in cultivating knowledge retention and sustained adherence in the longer term is warranted.

Keywords: Adherence, Knowledge, Medication review, Pharmacists

INTRODUCTION

Medication review is a structured, critical examination by a pharmacist of a patient's medications in relation to his or her health condition. It involves a tripartite partnership between the doctor, pharmacist and patient or caregiver with the aim of optimising the patient's medication therapy, identifying and resolving medication-related issues, and reducing waste¹. Medication review provides a platform for the pharmacist to educate patients on the knowledge of their medicines through individualised counselling, to assess patients' adherence, and

to address any concerns that they may have with regard to their medications, medical conditions and other issues related to their health.

Medication non-adherence can be a problem in the primary care setting due to the demographic development of increasing numbers of patients with chronic diseases requiring continuous polypharmacy^{2,3}. Patients with chronic diseases, who are non-adherence to their long-term pharmacotherapy, may not derive full benefit from their treatment and achieve the desired therapeutic outcomes⁴⁻⁶. Medication review

can be an important educational intervention to improve adherence rates as it can potentially address many of its barriers. Medication review may also directly improve upon the patient's knowledge and understanding of his or her drug regimen, which can potentially lead to better medication adherence. However, there is no local data and limited international studies⁷⁻¹⁴ currently to provide these evidences even as medication review services are widely available in pharmacy centres worldwide.

This research study was conducted with the aim to determine the effectiveness of medication review as an intervention to improve on patients' medication knowledge (defined as dosage, frequency, indication, storage condition and administration of medicine) and their adherence to their chronic medication in the primary care setting.

METHODS

Study design

This pilot study was conducted across four polyclinics providing primary care in the north-eastern and central regions of Singapore from June to December 2012. The duration of study was determined based on the usual follow-up period (of within six months) required to resolve medication-related issues identified for patients who have been enrolled to receive medication review services. Approval was obtained from the SingHealth Central Institutional Review Board Ethics Committee before commencement of the study, and patient informed consent was obtained for participation in the study

Study sample

All polyclinic patients, who were referred for pharmacist-conducted medication review by prescribers due to issues with medication knowledge or adherence, were invited to participate in the study (i.e. consecutive sampling was employed) if they met the following eligibility criteria: they were at least 21 years of age, and were on polypharmacy with chronic medications (defined as having five or more medications being prescribed)^{15,16}. They were excluded from this study if they were perceived by the investigators to have cognitive impairment or language barriers, or if they had received prior medication review. The prescribers referring the patients were blinded to the study. Based on pre-test data, a minimum

sample size of 130 patients was determined for the study, based on a probability level of 5% and desired power level of 80%.

Study instrument

A two-part questionnaire instrument was developed for the purpose of this study by the principal investigator, and all investigators were trained to administer the questionnaire in a standardised manner. The questionnaire solicited information on demographic characteristics, education level, employment and living status, medical and medication history, level of independence with regards to medication administration and use of medication aids.

A Medication Knowledge Index scoring system was used in the questionnaire to report the test results of the patient's knowledge on the dosage, frequency, indication, storage and administration method of their prescribed medication regimens. The patient's knowledge was quantified using the following formula:

$$\text{Medication Knowledge Index Score} = \frac{\text{Number of medications correctly verbalised for each Knowledge Index}}{\text{Total number of medications patient is prescribed}}$$

For example, four medications with indications correctly verbalised/ a total of five medications = 0.8

Total score = \sum (patient's individual medication knowledge index score)

Medication adherence was measured using the Morisky Medication Adherence Scale (MMAS-4), which was applied in accordance with the study patient's language proficiency (in English or Mandarin). The MMAS-4 scale was selected based on published evidence of the theoretical correlation between the constructs it measures and medication adherence, as well as its ease of use¹⁷⁻¹⁹. The MMAS-4 consists of four questions with a scoring scheme of "Yes"=1 and "No"=0. The items are summed to give a range of scores from 0 to 4:

MMAS-4 score= 0 (High adherence)

MMAS-4 score= 1 to 2 (Intermediate adherence)

MMAS-4 score= 3 to 4 (Low adherence)

Table 1. Patient demographics and characteristics.

Total number of patients	195
Gender	
Female	96
Male	99
Age (years)	
Mean±SD	70±8
Race	
Chinese	152
Malay	10
Indian	31
Others	2
Education level	
No education	97
Primary	67
Secondary	24
Tertiary	7
Working status	
Not working	102
Working	40
Retired	53
Administration of medicine	
Caregiver	23
Self	172
Living status	
Alone	15
Family	177
Friends	3
Medication aids	
Using	41
Not using	154

The study investigators administered the questionnaire twice on the same patient; on the day of medication review before it was conducted, and on the patient's subsequent follow up visit.

Study intervention

The medication review intervention conducted by the polyclinic's attending pharmacist comprised a half-an-hour interview and counselling session with the study patient (with or without their caregivers) to identify and address medication-related issues. These were pharmacists who had received prior training on medication review based on a standard course programme. On the day of medication review, the attending pharmacist would document the patient's issues and care plan in the form of

electronic medical records for communication with the referring physician. At the follow-up visit, the investigator would ensure that there were no other similar interventions being received by the study patients prior to administration of the questionnaire instrument.

Statistical methods

Statistical analysis was carried out using SPSS 21.0. Student's paired t-test and Chi-square test were used to determine the significance in relation to the change in patient's scores for medication knowledge and adherence respectively after medication review. Pearson's correlation was used to determine the relationship between medication knowledge and adherence scores.

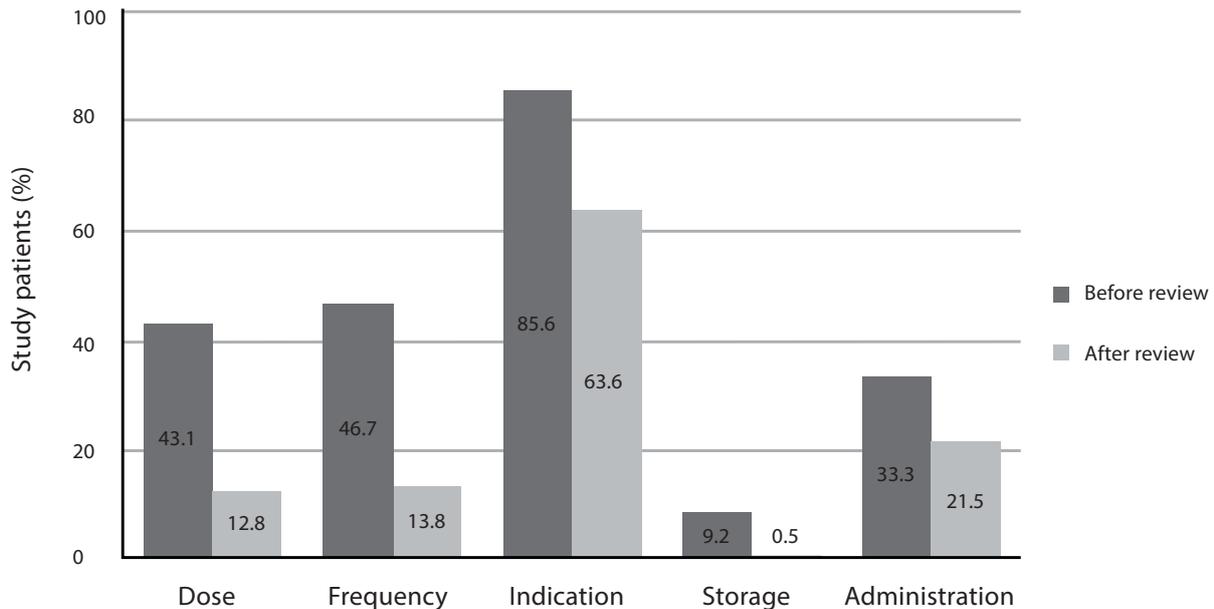


Fig. 1. Knowledge deficiencies before and after medication review.

Table 2. Medication adherence before and after medication review.

		Before review	After review
Total number of adherent patients	Score=0	58 (29.7%)	123 (63.1%)
Total number of non-adherent patients		137 (70.3%)	72 (29.7%)
Patients with intermediate adherence			
	Score=1	40 (20.5%)	37 (19.0%)
	Score=2	59 (30.3%)	27 (13.8%)
Patients with low adherence			
	Score=3	13 (6.7%)	3 (1.5%)
	Score=4	25 (12.8%)	5 (2.6%)

RESULTS

Sample characteristics

A total of 240 polyclinic patients were recruited for this study, with 195 completing the follow-up. Eighteen point eight percent of patients were lost to follow up due to reasons of patient being hospitalised or choosing to seek treatment in other healthcare institutions. The resultant participants were mostly elderly with a mean age of 70 ± 8 years, with half having no formal education (Table 1). The mean number of chronic medications prescribed per participant was 7.5 ± 2.0 .

Medication knowledge

Of the 195 patients who completed the follow-up, 93.8% (183 patients) demonstrated medication knowledge deficits. Amongst these patients, 43.1%

of the patients had issues with medication dosage; 46.7% had issues with medication frequency; 85.6% did not know the indication of at least one medication; 9.2% did not know the proper storage conditions of their medication; and 33.3% had issues with medication administration.

At the follow-up visit, the percentage of patients who were able to verbalise the correct dose, frequency, indication, storage condition and administration of their medications improved by 30.3%, 32.9%, 22%, 8.7% and 11.8% respectively after medication review (Fig. 1).

Medication review, conducted by the polyclinic pharmacists, had improved the patients' medication knowledge on the indices of dosage,

Table 3. Multivariate analysis of patients' educational level versus medication adherence.

Education level-adherence to medication cross-tabulation

		Adherence		Total
		Not adherent	Adherent	
Education level	No formal education	49	48	97
	Primary	36	31	67
	Secondary	13	11	24
	Tertiary	4	3	7
	Total	102	93	195

Chi-square tests

	Value	df	Asymp. sig. (2-sided)
Pearson chi-square	0.278 ^a	3	0.964
Likelihood ratio	0.278	3	0.964
McNemar-Bowker test			^b
N of valid cases	195		

a. Two cells (25.0%) have expected count less than 5. The minimum expected count is 3.34.

b. Computed only for a P×P table, where P must be greater than 1.

Table 4. Multivariate analysis of patients' educational level versus medication knowledge.

Education level-improvement in knowledge cross-tabulation

		Improvement in knowledge		Total
		No improvement	Improvement	
Education level	No formal education	16	81	97
	Primary	12	55	67
	Secondary	9	15	24
	Tertiary	0	7	7
	Total	37	158	195

Chi-square tests

	Value	df	Asymp. sig. (2-sided)
Pearson chi-square	7.434 ^a	3	0.059
Likelihood ratio	7.872	3	0.049
McNemar-Bowker test			^b
N of valid cases	195		

a. Two cells (25.0%) have expected count less than 5. The minimum expected count is 1.33.

b. Computed only for a P×P table, where P must be greater than 1.

frequency, indication, storage and administration method ($p < 0.01$).

Medication adherence

Out of the 195 patients who completed the study, 29.7% (58 patients) attained a high adherence score (MMAS-4=0) before medication review was conducted and these patients continued to be adherent even after the intervention was applied.

Seventy point three percent (137 patients) of the participants reported non-adherence (MMAS-4 score of 1 to 4) to their chronic medications before medication review. However, this percentage was almost halved (to 36.9%) after they had received the intervention. There was also a significant decrease in the percentage of patients who had reported low adherence scores (27.7% to 5.8%), and a significant increase in the percentage of patients who reported

high adherence scores (29.7% to 63.1%), after the medication review intervention ($p < 0.01$; Table 2).

Association between medication knowledge and adherence

There was significant correlation between the patients' medication knowledge and adherence scores ($p < 0.001$).

Multivariate analysis of educational level versus knowledge and adherence

A multivariate analysis of study patient's educational level affecting their results on medication knowledge and adherence was conducted (Tables 3 and 4). It was found that the younger patients were generally better educated ($p < 0.01$). However, no correlation was found between the patients' educational level and their adherence to their medication regimens ($p = 0.964$), or knowledge of their medications ($p = 0.059$).

DISCUSSION

This study demonstrated the effectiveness of pharmacist-led medication review in improving the knowledge and adherence of primary care patients, especially the elderly, towards their chronic medications.

This is important because adherence rates are typically lower among patients with chronic conditions, often dropping dramatically after the first six months of therapy^{20,21}. Medication non-adherence is also likely to grow as the population ages, and as patients take more medications to treat chronic conditions²²⁻²⁴. This study has shown that about 70% of the study population reported non-adherence to chronic medications at some point in time. This figure is higher than the rates (ranging from 30–60%) reported by the World Health Organisation⁶ for developed countries, and it serves as an alert on the scale of the problem and the need for interventions to be put in place.

Medication review may be one way to establish a 'medication adherence contract' between healthcare providers and their patients at the onset of therapy as it sets out the medication plan and instructions to adhere to a long-term medication regimen in accordance to the physician's prescription²⁵. It also serves to overcome adherence barriers by providing an avenue to resolve drug-related issues, simplify complex medication regimens, recommend medication aids, provide

individualised counselling, provide monitoring and feedback, and educate patients and caregivers^{10,26-32}. These factors could have contributed to the improvements in medication adherence scores as shown in this pilot study.

Poor adherence to chronic medication is detrimental to patient health outcomes and presents a big challenge to primary healthcare providers who are to treat many of such patients in a high volume environment⁴⁻⁶. It is imperative for primary care institutions to view medication non-adherence as a serious impediment to achieving better patient outcomes, and actively institute measures (such as medication review services) to detect and manage this issue in patients with chronic diseases. Research to quantify the impact to primary care patients' clinical outcomes as a result of poor medication adherence, or medication review intervention, will be conducted by our investigators in a study further to this.

This study found that medication review improved the medication knowledge indices of dose, frequency, indication, storage conditions and administration. This, in turn, may have led to the improved adherence scores ($p < 0.001$). It is important to reinforce such information to patients who are on multiple chronic medications as old age, slower response time and decreased cognitive function may worsen retention of the necessary instructions for medication-taking²⁰. This is especially so in settings which do not have the luxury to allow for longer patient contact time³³.

There are many methods to assess and measure medication adherence^{18,34} and knowledge^{7,35}. The medication knowledge index and MMAS-4 scoring scales were utilised as surrogate markers for indirect measurement of the patient's knowledge and adherence for this study, due to their ease of administration in our fast-paced primary care setting. However, we would like to highlight that the MMAS-4 scale and its translated Mandarin versions are not validated tools in our local setting, although it has been used in many adherence studies worldwide. Moving forward, we will need to assess its effectiveness in measuring a patient's adherence state across time. Similarly, future studies can explore the development of a validated knowledge assessment tool to assess patient's medication knowledge or literacy, which can be incorporated into medication review services.

Study limitations

This research study did not set out to include a control group as we could not ethically reject patients who were referred by their physicians for medication review services. In addition, we could not include patients who were unable to converse in the spoken languages of the investigators, or who were cognitively impaired. It is uncertain if medication review intervention is effective in improving medication knowledge and adherence in such patient groups. The point measurements of knowledge indices and medication adherence scores were taken across two medication review visits, which were on average 12 weeks apart. A longer term study to determine the sustainability of improvements in knowledge and adherence scores is required.

CONCLUSION

Pharmacist-led medication review can be an effective intervention in the primary care setting to improve on medication knowledge and adherence in elderly patients on chronic medications. However, further study demonstrating the effectiveness of medication review in cultivating knowledge retention and sustained adherence in the longer-term is warranted.

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REFERENCES

1. Clyne W, Blenkinsopp A, Seal, R. A guide to medication review 2008. Liverpool: National Prescribing Centre Plus, Medicines Partnership Programme. 38 p.
2. Fischer MA, Stedman MR, Lii J, Vogeli C, Shrank WH, Brookhart MA, et al. Primary medication non-adherence: analysis of 195,930 electronic prescriptions. *J Gen Intern Med* 2010;25(4):284–90 doi: 10.1007/s11606-010-1253-9.
3. Brunton SA. Improving medication adherence in chronic disease management. *J Fam Pract* 2011;60(4 Suppl Improving):S1–8.

4. DiMatteo MR, Giordani PJ, Lepper HS, Croghan TW. Patient adherence and medical treatment outcomes: a meta-analysis. *Med Care* 2002;40(9):794–811 doi: 10.1097/00005650-200209000-00009.
5. Mahoney JJ, Ansell BJ, Fleming WK, Butterworth SW. The unhidden cost of noncompliance. *J Manag Care Pharm* 2008;14(6b):S1–29.
6. World Health Organization. Adherence to long term therapies: evidence for action. Geneva: World Health Organization; 2003. 195 p.
7. Burge S, White D, Bajorek E, Bazaldua O, Trevino J, Albright T, et al. Correlates of medication knowledge and adherence: findings from the residency research network of South Texas. *Fam Med* 2005;37(10):712–8.
8. Okuyan B, Sancar M, Izzettin FV. Assessment of medication knowledge and adherence among patients under oral chronic medication treatment in community pharmacy settings. *Pharmacoepidemiology Drug Saf* 2013;22(2):209–14 doi: 10.1002/pds.3275.
9. SL Pinto, JL Howe, G Partha. Improving patient knowledge and clinical outcomes through a medication therapy management (MTM) program. *Value Health* 2010;13(7):A284 doi: 10.1016/S1098-3015(11)72063-0.
10. Lewis NJ, Bugdalski-Stutrud C, Abate MA, Blommel M, Wu CH, Gaither CA. The Medication Assessment Program: comprehensive medication assessments for persons taking multiple medications for chronic diseases. *J Am Pharm Assoc* 2008;48(2):171–80 doi: 10.1331/JAPhA.2008.07141.
11. Stuart B, Loh E, Miller L, Roberto P. Should eligibility for medication therapy management be based on drug adherence? *J Manag Care Pharm* 2014;19(1):66–75.
12. Moczygemba LR, Barner JC, Lawson KA, Brown CM, Gabrillo ER, Godley P, et al. Impact of telephone medication therapy management on medication and health-related problems, medication adherence, and Medicare Part D drug costs: a 6-month follow up. *Am J Geriatr Pharmacother* 2011;9(5):328–38 doi: 10.1016/j.amjopharm.2011.08.001.
13. Bunting BA, Smith BH, Sutherland SE. The Asheville project: clinical and economic outcomes of a community-based long-term medication therapy management program for hypertension and dyslipidemia. *J Am Pharm Assoc* 2008;48(1):23–31 doi: 10.1331/JAPhA.2008.07140.
14. Planas LG, Crosby KM, Mitchell KD, Farmer KC. Evaluation of a hypertension medication therapy management program in patients with diabetes. *J Am Pharm Assoc* 2009;49(2):164–70 doi: 10.1331/JAPhA.2009.08164.
15. Hajjar ER, Cafiero AC, Hanlon JT. Polypharmacy in elderly patients. *Am J Geriatr Pharmacother* 2007;5(4):345–51 doi: 10.1016/j.amjopharm.2007.12.002.
16. Bushardt RL, Massey EB, Simpson TW, Ariail JC, Simpson KN. Polypharmacy: misleading, but manageable. *Clin Interv Aging* 2008;3(2):383–9 doi: 10.2147/CIA.S2468.
17. Morisky DE, Green LW, Levine DM. Concurrent and predictive validity of a self-reported measure of medication adherence. *Med Care* 1986;24(1):67–74 doi: 10.1097/00005650-198601000-00007.
18. Lavsa SM, Holzworth A, Ansani NT. Selection of a validated scale for measuring medication adherence. *J Am Pharm Assoc* 2011;51(1):90–4 doi: 10.1331/JAPhA.2011.09154.
19. Morisky DE, DiMatteo MR. Improving the measurement of self-reported medication nonadherence: final response. *J Clin Epidemiol* 2011;64(3):262–3 doi: 10.1016/j.jclinepi.2010.09.002.
20. Insel K, Morrow D, Brewer B, Figueredo A. Executive function, working memory, and medication adherence among older adults. *J Gerontol B Psychol Sci Soc Sci* 2006;61(2):102–7.
21. Bovet P, Burnier M, Madeleine G, Waeber B, Paccaud F. Monitoring one-year compliance to antihypertension medication in the Seychelles. *Bull World Health Organ* 2002;80(1):33–9 doi: 10.1590/S0042-96862002000100007.
22. Wood B. Medication adherence: the real problem when treating chronic conditions. *US Pharm* 2012;37(4) (Compliance suppl):3–6.

23. Blandford L, Dans PE, Ober JD, Wheelock C. Analyzing variations in medication compliance related to individual drug, drug class, and prescribing physician. *J Managed Care Pharm* 1999;5(1):47–51.
24. Gadkari AS, McHorney CA. Unintentional non-adherence to chronic prescription medications: how unintentional is it really? *BMC Health Serv Res* 2012;12:98 doi: 10.1186/1472-6963-12-98.
25. Gottlieb H. Medication nonadherence: finding solutions to a costly medical problem. *Drug Benefit Trends* 2000;12(6):57–62.
26. Stuart B, Loh FE, Roberto P, Miller, LM. Increasing Medicare part D enrollment in medication therapy management could improve health and lower costs. *Health Aff* 2013;32(7):1212–20 doi: 10.1377/hlthaff.2012.0848.
27. Haynes RB, McDonald HP, Gary AX. Helping patients follow prescribed treatment. *JAMA* 2002;288(2):2880–3 doi: 10.1001/jama.288.22.2880.
28. Santschi V, Chiolero A, Burnand B, Colosimo AL, Paradis G. Impact of pharmacist care in the management of cardiovascular disease risk factors: a systematic review and meta-analysis of randomized trials. *Arch Intern Med* 2011; 171(16): 1441–53 doi: 10.1001/archinternmed.2011.399.
29. Barnett MJ, Frank J, Wehring H, VonMuenster S, Kumbera P, Halterman T, et al. Analysis of pharmacist-provided medication therapy management (MTM) services in community pharmacies over 7 years. *J Manag Care Pharm* 2009;15(1):18–31.
30. American Pharmacists Association and National Association of Chain Drug Stores Foundation. Medication therapy management in community pharmacy practice: core elements of an MTM service (version 1.0). *J Am Pharm Assoc* 2005;45(5):573–9 doi: 10.1331/1544345055001256.
31. Taitel M, Jiang J, Rudkin K, Ewing S, Duncan I. The impact of pharmacist face-to-face counselling to improve medication adherence among patients initiating statin therapy. *Patient Prefer Adherence* 2012;6: 323–9 doi: 10.2147/PPA.S29353.
32. Haynes RB, Ackloo E, Sahota N, McDonald HP, Yao X. Interventions for enhancing medication adherence. *Cochrane Database Syst Rev* 2008;(2):CD000011 doi: 10.1002/14651858.CD000011.pub3.
33. Simpson RJ Jr. Challenges for improving medication adherence. *JAMA*. 2006; 296: 2614–6 doi: 10.1001/jama.296.21.jed60074.
34. Osterberg L, Blaschke T. Adherence to medication. *N Engl J Med*. 2005;353(5): 487–97 doi: 10.1056/NEJMr050100.
35. Cordasco KM, Asch SM, Bell DS, Guterma JJ, Gross-Schulman S, Ramer L, et al. A low-literacy medication education tool for safety-net hospital patients. *Am J Prev Med*. Dec 2009; 37(6 Suppl 1): S209–16 doi: 10.1016/j.amepre.2009.08.018.