

# An Assessment of Patient Safety in Acupuncture Process Under EMR Support

Yi-Chang Li · Ming-Chien Hung · Shih-Jung Hsiao ·  
Kuen-Daw Tsai · Mei-Man Chang

Received: 6 October 2009 / Accepted: 13 December 2009 / Published online: 4 February 2010  
© Springer Science+Business Media, LLC 2010

**Abstract** With the facilitating roles of IT, this study is to investigate the safety issues of the acupuncture process in the current practices under EMR support. A self-administered questionnaire survey was conducted in 80 Chinese medicine practice hospitals and clinics in Taiwan. Concerns over patient safety during the acupuncture process were raised, such as an inconsistency between the

practice and prescription and a lack of monitoring patient's condition during the treatment. Confirming the physicians' prescription and documenting patients' reaction for patient record management are needed to add to the EMR system for patient safety while performing acupuncture. The results of this study can be used by the government or medical institutes to assess the work flow and set up standards of EMRs design for their acupuncture treatment to ensure patient safety and to enhance healthcare quality.

---

Y.-C. Li  
Dept. of Health Services Administration,  
Chung Shan Medical University,  
No.110, Sec 1, Jianguo N. Rd.,  
Taichung, Taiwan  
e-mail: ycli1970@csmu.edu.tw

M.-C. Hung  
Dept. of Information Management, Nanhua University,  
No.55, Sec 1.Nanhua Rd.,  
Dalin, Chia-Yi, Taiwan  
e-mail: chemyhmc@gmail.com

S.-J. Hsiao  
Dept. of Information Management,  
National Chung Cheng University,  
No.168, University Rd.,  
Min-Hsiung, Chia-Yi, Taiwan  
e-mail: benjamin@mis.ccu.edu.tw

K.-D. Tsai  
Dept. of Internal Medicine,  
China Medical University Beigang Hospital,  
No.123, Shin-De Rd.,  
Beigang, Yunlin, Taiwan  
e-mail: kdtsai2009@gmail.com

M.-M. Chang (✉)  
Dept. of Nursing, China Medical University Beigang Hospital,  
No.123, Shin-De Rd.,  
Beigang, Yunlin, Taiwan  
e-mail: changmm1970@gmail.com

**Keywords** Acupuncture · Electronic medical records (EMR) · Patient safety

## Introduction

Acupuncture is a common treatment used both in Chinese Medicine (CM) and Western Medicine (WM). The locations, duration, and number of needles used for acupuncture vary in every case. Any mishandling of the aforementioned may cause a patient to suffer temporary pain, permanent injury, or even death [15]. Patient safety is defined as an attempt “to reduce adverse effects caused by diseases or medical procedures within the healthcare institutes” [5]. Marin [8] indicated that lack of access to information during decision making and ineffective communication among patient care team members are proximal causes of medical errors and other adverse events in patient care, which also applies to the practice of acupuncture.

Ernst et al. concluded that more than a third of acupuncture patients experience adverse effects while being treated with acupuncture, and they suggested that enquiring about the patients' medical history before acupuncture treatment should avoid certain adverse effects [2]. Information technology has great potential for improving quality

and safety in healthcare (e.g. [3, 13]). Electronic medical records (EMR) is at the centre of a health information technology system. Most western countries have already introduced or have plans for the EMR [11]. In the light of the e-government success of being ranked in the top 5 worldwide for 5 years consecutively [14], the Taiwan Department of Health set up the e-health infrastructure that contained Healthcare Certification Authority IC cards with a Public Key for physicians' e-signatures. A total of 8,000 IC cards were issued to medical institutes and more than 30,000 IC cards were issued to medical staff. About 89% of the hospitals in Taiwan have achieved a certain level of computerization of their patients' records [6]. In other words, the hospitals in Taiwan had an excellent infrastructure to develop EMR for both Western Medicine and CM to help physicians in their diagnosis, related administration, and financial tasks within their institutes, and further to exchange EMR with other healthcare institutes.

With most of their medical history saved in the EMR, patients who had bleeding, wounds that fail to heal, immune deficiencies, possible heart disease and possible pregnancy that Ernst et al. [2] mentioned as risky to receive acupuncture treatment can all be identified. In other words, EMR can help reduce the occurrence of adverse events while applying acupuncture. The purpose of this study is to further investigate the safety issues of acupuncture treatment process after applying EMR.

We observed many cases not only in the medical industry that organizations bought expensive information system and found it unmatched or useless to the organizations. WM practices have been transformed by IT and communication technologies. However, patient safety issues were also brought into broad discussion in WM literature. We believe that IT and communication technologies are also bringing new transformation in workflows and practices in CM. Many CM healthcare providers have EMR in their practices, but some unnoticed patient safety problems may be introduced. This study intended to provide some issues for adopters/potential adopters of acupuncture related computer systems to evaluate their consideration without blindly investing in IS.

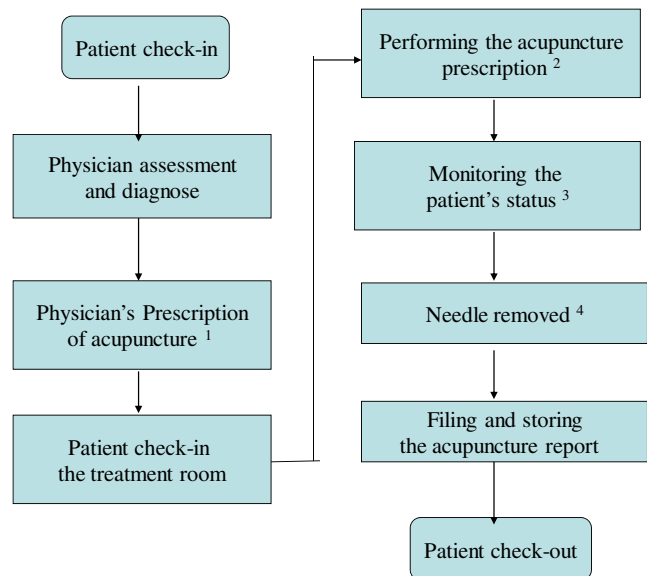
## Material

The WHO recommended that each country should include their Chinese medical practices in the existing medical system and use technical guidelines as a reference to ensure safe and effective practice of each treatment [16]. The Taiwan Committee on Chinese Medicine and Pharmacy consulted the western Hospital Accreditation Standards and developed a similar set of standards for CM institutes, the Accreditation Standard for Chinese Medicine. The concept

of accreditation prioritises patient safety, patient rights, medical ethics, and healthcare quality. The regulations regarding acupuncture can be found in Chapters Five and Six of the accreditation standards [4].

Based on the Accreditation Standard for Chinese Medicine, three CM administrators were interviewed to profile the process of acupuncture treatment. Each of their institutes represents one type of healthcare institute (a hospital, a hospital department, and a clinic) and was chosen due to its long history of medical practice and wide coverage of patients. Their acupuncture process was summarized and presented in Fig. 1.

Generally, the physicians will first give diagnose to five to eight patients using patients' EMR or paper-based records in the clinic room and then perform the required acupuncture treatment for those patients in a separate area called treatment room. Acupuncture is an "invasive treatment" and the key information includes who (patient), what (the number and location (also known as acupoints) of inserted needles), and how (e.g. treatment sequence confirmation of acupoints, needle numbers, monitoring patients' reactions to the treatment etc.). With EMR, the information of "who" and "what" of a acupuncture



**Fig. 1** The process of acupuncture. Possible incidents in the acupuncture process: 1 61.6% respondents key in the name of the acupoints for the acupuncture treatment. Acupoints may be recorded by mistake. 2 70% of the respondents memorized the prescription and performed the acupuncture treatment. Only 9.2% respondents used a bedside computer as a reminder of acupuncture treatment. Most respondents used computer to record diagnoses and prescription without ascertaining how the prescription is confirmed and delivered. 3 19% reported they did not monitor patient's status at all. 80% monitored by nurses. Adverse event may be ignored because of lack of monitoring. 4 47.5% respondents reported that needles were removed by the nurses alone. 47.7% respondents relied on their memory to remove needles. Needles may be left on patient's skin because of lack of remind

treatment can be easily generated and recorded without causing adverse events. Meanwhile, the disposable needles prevented another source of adverse events, the infection problem caused by reusing acupuncture needles. Whether the physician complied with his/her diagnosis for the patients is yet to be studied or reported in detail. It is the objective of our research to explore the current status.

The study could make both academic and practical contributions by exploring patient safety issues in the context of CM. The study can be the cornerstone for subsequent research, e.g. how to integrated EMRS and modality and equipments of acupuncture to enhance patient safety, or how the impacts of this kind of integration on medical quality, and so on.

## Method

The research process followed a three-step procedure: (1) to figure out the acupuncture process in current CM practices; (2) to develop a questionnaire identifying the safety issues in current acupuncture process; (3) to survey and to explore the practical concern on these safety issues and to propose how to solve these concern under the EMR support.

Based on the aforementioned acupuncture process, a questionnaire was designed to access the detail information of how physicians conducted an acupuncture treatment. The questionnaire items were conducted and refined by an expert panel meeting. The expert panel was constituted for questionnaire design and consisted of five experts, three of them were professors in the CM field and the other two were senior administrators of domestic EMRS. In panel discussion, a brain storming session was first held to stimulate a list of what problems would happen in the steps of acupuncture process. Then experts ranked and determined the importance and appropriateness of the items in a Delphi session. After two rounds of ranking, the percentage of agreement among experts is 0.7, which means the content validity of the questionnaire is acceptable [1].

There are two parts to the questionnaire. The first part focuses on the entire operation process and related methods of conducting an acupuncture treatment with the following questions. First, how does a physician prescribe an acupuncture treatment? How is the prescription put into practice? How is the process of receiving treatment monitored? Who removes the needles and how he/she does it? Is there any documentation to record the treatment process and patients' reaction? If so, how are these records saved and what is their content? Finally, is there any protection of patient privacy during an acupuncture treatment? The second part of the questionnaire is to collect the basic information of the institute. The questionnaire was pretested among two senior physicians and three senior

nurses from prestigious CM hospitals. Minor revisions were made on question wording in order to ensure the face validity of the questionnaire.

The sensitivity of reporting pitfalls of their acupuncture process may hold hospitals and clinics to participate the survey. Therefore, a convenient sample was used in this study. One hundred and ten institutes were invited by telephone calls and asked for agreement of participation. After their agreement, questionnaires were distributed to the heads of CM departments of the hospitals or clinics. A gift was delivered to responder to encourage their early response. Others were reminded by telephone calls and e-mails. E-mail responses were also accepted for their conveniences. After two rounds of remind, 80 valid respondents were returned which yielded a response rate of 72.7%.

## Results

63% of the respondents were private institutes, 15% were corporation hospitals, and 11% were public hospitals. The earliest institute was established 40 years ago and the latest one was founded only a year ago. The average history of the samples institutes is about 10 years. The number of clinics provided per week ranged from 4 to 92, with an average number of 34, median and mode of 18. There is a significant positive relation between the institute history and number of clinics it provides per week, with a correlation coefficient ( $R$ ) of 0.65. This is coincident to the preference of Taiwanese patients in seeking medical service for they believe that older brand institutes have better quality.

Most of the respondents employ EMR to assist their physician's diagnosis and record tracking. Except for medical centers, most institutes outsourced their EMR development to software suppliers. On average, 74.4% of the respondents outsourced their information systems to external providers, which include all of the clinics, two third of the local hospitals, and one third of the regional hospitals of our samples. This is coincident to smaller institutes have relative less resources to afford their own information system department and therefore outsource their system to supplier.

The survey results showed that there are four ways to prescribe an acupuncture treatment. From the most commonly used to the least popular, they are: keying in the name of the acupoints for the acupuncture treatment (61.6%); selecting acupoints directly from a list shown on the computer screen (32.3%); pointing to the acupuncture point of a human-shaped diagram on the computer screen (3%); and writing out a paper prescription by hand (3%). 79% of the respondents used only one way to generate an

acupuncture prescription, while others combined more than one method.

While performing the prescribed acupuncture treatment in a separate room, physicians used more than one method to remind them the prescription they ordered earlier. The detail of reminding methods to deliver an acupuncture treatment is shown in Table 1. 70% of the respondents memorized the prescription and performed the acupuncture treatment. Next to this, 30% reported to use paper-based patient records or similar supporting aids, and only 13.75% used a bedside computer as a reminder. In other words, most respondents used their information systems (IS) to generate diagnoses and prescription without ascertaining how the prescription is confirmed and delivered. These institutes adopted the IS design of western medicine and developed their Chinese medical IS which left a great gap for adverse events to occur.

A chi-squared test was performed to test the dependence between the reminding methods physicians used and their types of institutes. It was proved that different type of institutes used different reminding methods with an observe significant level of  $p < 0.011$ . Multiple reminding methods were used by the physicians. 57%, 73%, and 93% of the physicians in medical centers, clinics, and local hospitals respectively relied on their memory when performing the acupuncture treatment. Half of the physicians in medical centers and regional hospitals use paper-based patient records. About one third of the physicians in local hospitals used hand-written notes and one third of physicians in medical center used human-shape diagram to remind them the prescription during the treatment. Most of the physicians in any hospital type would ask patients about their symptoms of this visit or the acupoints for last treatment to remind them the prescription they ordered for this visit.

In terms of monitoring patients' reaction during an acupuncture treatment routine, 80% of the respondents would have nurses walk around the bedsides to access patients' reaction to the treatment, and about 19% did not monitor at all. There was only one hospital that used Closed

Circuit Television equipment for long-distance monitoring by nurses.

When the treatment was over, in our sample the acupuncture needles were removed by the nurses alone (47.5%), by the joint practice of physicians and nurses (42.5%), or by the physicians solely (10%). The detail information regarding needles removal is shown in Table 2. A Chi-square Test was performed and proved that different type of hospitals had different types of staff to remove the acupuncture needles with an observed significant level of  $p < 0.01$ . All the medical centers in our sample had their nurses to remove the needles. The joint practice of the physicians and nurses to remove needles is more popular in the regional hospitals (80%), followed by the clinics (50%). This is coincident to the preference of Taiwanese patients in seeking medical service for they believe that bigger institutes have better quality. The Taiwan universal insurance also allows patients to walk in medical center and receive any needed medical service without referral which keeps those physicians rather busy.

Most of the staffs (47.7%) relied on their memory to remove needles, while 19.8% of staffs followed a hand-written note. A human-shape diagram or recording board to indicate numbers or acupoints of needles was the least common method to use, accounting for only 8.1% of the total respondents. Regarding type of institutes, 73% physicians of the clinics tended to depended on their memory to complete such procedures and 40% of the staff in regional hospitals referred to a hand-drawn diagram.

In terms of recording the information occurred during an acupuncture treatment, such as numbers and acupoints of needles removal, most of the respondents (63%) did not record such information and, therefore, had no mechanism for storing these records. 13% of them recorded the information but did not save them. In other words, 75% of the surveyed respondents had no way to trace or monitor the process of acupuncture treatment. Among them, most of the clinics (81%), followed by the local hospitals (60%) had no records. Half of the regional hospitals recorded the

**Table 1** The reminding methods of performing acupuncture prescription in each hospital types

	Medical centers, <i>n</i> (%)	Regional hospitals, <i>n</i> (%)	Local hospitals, <i>n</i> (%)	Clinics, <i>n</i> (%)	Summary, <i>n</i> (%)	Chi-squared test
Memorization	4 (57)	3 (30)	14 (93)	35 (73)	56 (70)	0.007**
Paper-based patient record	4 (57)	5 (50)	7 (47)	8 (17)	24 (30)	0.015*
Hand-written note	1 (14)	0 (0)	5 (33)	3 (6)	9 (11.25)	0.020*
Human-shaped diagram	2 (29)	0 (0)	0 (0)	1 (2)	3 (3.75)	0.004**
Bed-side computer	0 (0)	3 (30)	1 (7)	7 (15)	11 (13.75)	0.261
Ask patient how they were treated last time	2 (29)	3 (30)	6 (60)	5 (10)	16 (20)	0.059

\* $p \leq 0.05$ , \*\* $p \leq 0.001$

**Table 2** Remover of acupuncture needles and hospital types

Hospital types	By nurses alone	By physicians alone	Joint practice of physicians and nurses	Sum	Chi-squared test
Medical centers	7 (100)	0 (0)	0 (0)	7 (100)	0.001*
Regional hospitals	1 (10)	1 (10)	8 (80)	10 (100)	
Local hospitals	12 (80)	1 (7)	2 (13)	15 (100)	
Clinics	18 (38)	6 (13)	24 (50)	48 (100)	

\* $p \leq 0.01$ 

process using a human-shape diagram (50%) and about half of the medical centers did not save such records (57%).

A further examination of the contents of those records showed that the number of needles removed (46%), followed by the acupoints where needles removed (27%), and the duration of needling connecting with electricity (12.9%) were the most frequently shown items. In terms of protecting the patients' privacy, all of the respondents used curtains as a space divider between beds to provide some degree of privacy. Only two hospitals (2.5%) offered blankets for the patients to cover during an acupuncture treatment.

## Discussion

Although EMR is adopted and the information systems of CM were developed, there remain many safety-related problems in the current practices of acupuncture treatment. The results of the self-reported questionnaire showed many divergences between the practice and the regulations of the Accreditation Standard for CM in three aspects. Firstly, the acupuncture prescriptions were not confirmed while performing an acupuncture treatment and almost 61% of the respondents relied purely on their memory. Secondly, the nursing members partially fulfilled their responsibility in assisting physicians to carry out the prescription, monitor the patients' reactions, and report to the physicians whenever it is necessary. Lastly but not the least, no records were made to document the entire treatment process for patient safety or the references for later visits of the patients.

In order to further explore the reasons behind the survey results, a follow up interview with the aforementioned expert panel was conducted. Experts' agreed that the survey findings were consistent with their observations. Besides, the interview attributed the results into two aspects: First, the IT adoption of TM is slower than that of the WM, therefore the design of TM information systems mostly followed the concept of the WM. This finding is consistent with MRCVS's finding [10], in which he suggested that a major barrier to adoption of IT in acupuncture is the tendency amongst certain sections of the experts in TCM to be defensive and secretive about their methods, including their acupuncture—and herbal—formulas. Second, the clinic work flow for TM outpatients is different from that

for the WM ones. To get the last mile of outpatient care for acupuncture treatment, a computer at point of care to extend EMR is needed and was overlooked by most of TM information system design.

## Implications

During the paper era, nurses would bring in the patient record and put at bedside to confirm the prescription by accessing the information in the paper records or filled in information relating to the treatment very easily. In the EMR era, only a few nurses would keep notes or mark on a counting board and added this information to their paper-based nursing report to provide some degree of patient safety assurance. Without computer at the point of care, physician had no way to reference the record information about the treatment by and nurses for the next diagnosis of the same patient.

Secondly, the volume of patients plays a large role in the survey results. The referral system was not reinforced in Taiwan. As aforementioned, patients can go to medical center or regional hospitals without family doctors' referral and make the physicians rather busy than those in other institutes. Without computers at the point of care, most of the staffs relied on their memory, used more than one method to remind him/her of the prescription, or even asked their patients which explored more pitfalls of patient safety because patients were not professional enough to remember the exact prescription. Meanwhile, some patients would add other symptoms that they forgot to reveal during diagnosis and made physician to change treatment without changing the prescriptions he/she made earlier.

The survey results implied several research issues emerging in the TM academic community, e.g. the design of bed-side computer systems to better monitor the patient's reaction, the integration of EMR, bed-side computer and modality to provide better and timely information of patient, and the design of Clinical Decision Support Systems (CDSS) for supporting acupuncture assessment and prescription, etc. Because most of medical professional are unfamiliar with informatics, TCM medical professionals could learn more about what the patient safety issues are emerging in the EMR context. Government agencies should



provide a forum to broadly discuss these patient safety issues. This forum should also bring the WM and TCM medical professionals/academicians/healthcare IT vendors together to share the experiences and solve these patient safety problems.

## Conclusion

EMR could be a platform to integrate the complementary and alternative medicine (CAM) therapies such as acupuncture with western medical practice or referrals to CAM therapies from western medicine [12]. Moisil and Jitaru reported that the IT project in Romania such as The Acupuncturist (Software ITC SA Bucuresti) provided better communication between staff members of the health units through automatic monitoring of work flow, standards for documents, automatic filling and delivery of the documents, integrating the cooperation system with data bases from the whole health system [9]. However, without appropriate design, computerization can bring in more risks to the medical practice. Based on the results, suggestions are made to the CM hospitals and clinics to re-examine their work flow of acupuncture treatment process after adopting EMR. The healthcare authorities should set up clearer and more feasible standards and rules to improve the compliance of the TM institutes. More safety-related education and promotion with regard to acupuncture treatment are also needed to solve some problems raised by this study. Chinese medical providers also face the circumstances of patients shopping for doctor similar to Lo et al.'s found [7]. Therefore, a bedside computer to extend the advantages of EMR and computer systems redesign are needed to promote greater continuity of care between doctors, nurses, and patients.

## Limitation

The limitations of this study might come from the sampling method, the respondent bias, self-reported status of practices, and static cross section approach of collecting data. Convenience sampling brought the bias which should be noted when applying the results of this study to other groups. The respondents might tend to favour the technology and were therefore willing to mail back the questionnaire. Those who did not favour the technology might have been unwilling to take the time to respond. Also, without the official adoption status of EMR in each hospital and clinics, the self-reported status collected in this study may be biased. Besides, this study used a static cross-sectional approach which may not reveal the dynamics of the technology adoption processes. Therefore, more rigorous and face-to-face interview is needed further to explore the

issues uncovered by this study. Also, future research can extend the sample base and focus more on different clinics that offer acupuncture treatment to further unveil the safety problems in the process of treatment.

## Appendix

### Questionnaire items

#### Part 1.

How does a physician prescribe an acupuncture treatment?  
How is the prescription put into practice?  
How is the process of receiving treatment monitored?  
Who removes the needles and how he/she does it?  
Is there any documentation to record the treatment process and patients' reaction?  
If so, how are these records saved and what is their content?  
Is there any protection of patient privacy during an acupuncture treatment?

#### Part 2.

Institution type? (hospital or clinics)  
Hospital level? (medical center/regional hospital/local hospital)  
Number of beds?  
Number of physicians and nurses?  
Is there IT department in your hospital or clinic?

## References

1. Crisp, J., Pelletier, D., Duffield, C., Adams, A., and Nagy, S., The Delphi method. *Nurs. Res.* 46(2):116–118, 1997.
2. Ernst, G., Strzyz, H., and Hagmeister, H., Incidence of adverse effects during acupuncture therapy—A multicentre survey. *Complement. Ther. Med.* 11(2):93–97, 2003.
3. Huang, H. H., and Ku, C. Y., Grouping proof protocol for medication safety of inpatient. *J. Med. Syst.* 33(6):467–474, 2008. doi:10.1007/s10916-008-9207-z.
4. Joint Commission on the Accreditation of Healthcare Organizations, *Hospital accreditation standards: Accreditation policies, standards, elements of performance (HAS)*. JCAHO/Joint Commission Resources, 2009.
5. Kohn, L. T., Corrigan, J. M., and Donaldson, M. S., *To err is human: Building a safer health system*. Washington: National Academies, 2000.
6. Liao, H. C., Wu, T. Y., and Chien, Y. M., The critical factors affecting hospital adoption of electronic medical records in Taiwan: A secondary data analysis. *J. Inf. Manage.* 12(6):45–65, 2005. (in Chinese).
7. Lo, A. Y., Hedley, A. J., Pei, G. K., Ong, S. G., Ho, L. M., Fielding, R., Cheng, K. K., and Daniel, L., Doctor-shopping in Hong Kong: Implications for quality of care. *Int. J. Qual. Health Care.* 6(4):371–381, 1994.
8. Marin, H. F., Improving patient safety with technology. *Int. J. Med. Informat.* 73(7–8):543–546, 2004.

9. Moisil, I., and Jitaru, E., E-health progresses in Romania. *Int. J. Med. Informat.* 75(3–4):315–321, 2006.
10. MRCVS, P. R. M., Information technology in acupuncture and traditional Chinese medicine. Paper to the 24th IVAS Congress, 1998. <http://med-vetacupuncture.org/english/articles/tai98it.html>. 2009/08/01.
11. Øvretveit, J., Scott, T., Rundall, T. G., Shortell, S. M., and Brommels, M., Improving quality through effective implementation of information technology in healthcare. *Int. J. Qual. Health Care.* 19(5):259–266, 2007.
12. Smith, K., and Kalra, D., Electronic health records in complementary and alternative medicine. *Int. J. Med. Informat.* 77(9):576–588, 2008.
13. Sun, P. R., Wang, B. H., and Wu, F., A New Method to Guard Inpatient Medication Safety by the Implementation of RFID. *J. Med. Syst.* 32(4):327–332, 2008.
14. West, D. M., Global e-government report 2007. <http://www.insidepolitics.org/>. 2009/03/14.
15. White, A., Hayhoe, S., Hart, A., and Ernst, E., Adverse events following acupuncture: Prospective survey of 32 000 consultations with doctors and physiotherapists. *Br. Med. J.* 323(1):485–486, 2001.
16. World Health Organization (WHO), WHO Traditional Medicine Strategy 2002–2005, World Health Organization, Geneva. [http://whqlibdoc.who.int/hq/2000/WHO\\_EDM\\_TRM\\_2000.1.pdf](http://whqlibdoc.who.int/hq/2000/WHO_EDM_TRM_2000.1.pdf). 2009/01/1.