IDENTIFYING GREEN LOGISTICS BEST PRACTICES LEADING TO THE EFFECTIVE USAGE OF PHARMACEUTICALS: A CASE STUDY OF THAILAND'S PUBLIC HOSPITALS

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Abstract

Purpose

Pharmaceuticals are a key input into healthcare operations and so their effective management is vital. This issue is of key importance in Thailand and is aligned with the Thailand's 2nd National Logistics and Supply Chain Research Strategies (2012-2016) focusing on healthcare green logistics. Pharmaceuticals in hospitals account for more than 50% of the total hospital purchasing budget. Moreover, the overuse of medicine was generally found to be prevalent in Thai hospitals despite serious financial concerns. The aim of this study was twofold: Phase (i) to investigate the movement and lifecycle of pharmaceuticals within Thai hospital sites and Phase (ii) identify the GL practices that effectively control/minimize the use of pharmaceuticals.

Research Approach

Using a case research method six hospitals were examined, to give coverage of the different types/sizes, locations and a range of environmental performance issues. Hospital visits were undertaken during January to July 2014, to obtain data by using a multi-method approach: interviews, documentation reviews and in situ observation. Purposive respondent sampling was undertaken to ensure that data was collected from staff with experience of pharmaceutical management and a bespoke form of content analysis used for the data review before further cross-case analysis.

Findings and Originality

The result of Phase (i) revealed that pharmaceutical flows appeared to be sophisticated and problematic, caused by issues such as limited budget allocation, ineffective governmental processes, and the over-prescribing of medicine for chronic patients. The findings also identified effective GL practices such as: (i) prescribing medicines for only 1-2 months for some patient conditions/drug types and increasing the frequency of follow-up reviews, (ii) conducting a medicines return programme and (iii) having a clearly defined system of pharmaceutical product review. The outcomes of the study proposed key practices to support a Sustainable Health System at both policy and hospital levels. Within this were: (i) a representation of stakeholder views, (ii) the provision of healthcare education and communication, (iii) addressing self-health management issues and (iv) planned system review and improvement. The design and execution of such a system should be grounded in Thailand's Sufficiency Economy Philosophy (SEP) concept.

Research Impacts

In the GL research paradigm public healthcare, developing nations, human elements and life-cycle products have received limited attention; this study therefore contributes to the reduction of these gaps. The SEP concept was highly recommended by the United Nations, instead of Sustainable Development, in addressing GL practices in Thai culture to promote sustainable health standards and this underpins the focus and the originality/impact of this study.

Practical Impacts

This study recommends that staff in Thai hospitals focus on effective pharmaceutical management to contribute to the sustainability of good GL practices (as identified) and to the design and delivery of a Sustainable Health System in Thailand. The study presents guidance and support to do this.

Introduction

Pharmaceuticals are a key hospital resources in terms of medication and budget spent. In Thailand there are two key national policies which support the increased rationalisation of medicines use (Sumpradit et al. 2012), and to address green logistics (GL), but how this is actually achieved operationally is unknown at present. As reported in various studies, improving logistics efficiency in Thai hospitals is often obstructed particularly by the government systems/policies (e.g. the use of a paper-based system and several approval processes), poor supervision, financial crises, and overuse/irrational use of medicines (NaRanong and NaRanong 2011; Singkarin 2011; Kaplan et al. 2012; Rattanaumpawan 2015). Such barriers need to be addressed and overcome which requires a need for restructure the approach to and execution of medicines management (focusing on both human and physical elements that impact directly on this) at both national and hospital levels to meet this national agenda. One approach that can be considered to effectively manage medicines, is to focus on four main streams of logistics including people, resource, information and finance were observed (Bisson et al. 1993; Tseng et al. 2005). This study will to investigate the movement and lifecycle of pharmaceuticals within Thai hospital sites and identify the GL practices that effectively control/minimize use of pharmaceuticals. In doing so it will also reflect on management culture, policy and regulation and stakeholder influence on this supply chain.

Literature Review

The definition of Medicine as used in this study refers to a substance, especially in the form of a liquid or a pill that is a treatment for illness or injury (Cambridge Dictionary 2017). The words "medicine" and "drug" are used interchangeably (WHO 2016: p. 8). In Thailand, all public hospitals are governed by the Ministry of Public Health (MOPH), and in the main receive pharmaceutical products from the Government Pharmaceutical Organization (GPO). The hospital pharmacy has the following responsibilities: (i) interacting with the prescriber (doctor) to promote the rational prescribing and use of drugs, (ii) selecting drugs and dosage regimens, and (iii) monitoring patient compliance and therapeutic response to drugs (WHO 1994). Below is the summarised medicines management in Thailand, as the analysis report of WHO (2016: pp. 8-14):

> *Thailand has a remarkable health delivery system which over 90% of essential medicines has been provided in public hospitals with very small levels of stock out. Each hospital can submit the order the required medicines to suppliers by itself. However, no national standardized*

formulas for stocking/purchasing medicines (both types and volumes) has been addressed yet. Thus the compliance with the national Essential Medicines List can be questioned. Currently, the medicine management system is totally electronic, controlled by the hospital. Sharing information between hospitals and GPO/MOPH/NHSO[1] is still limited.

In promoting rational, safe and cost effective use of medicines, it should be introduced in both undergraduate and postgraduate curricula, as well as more monitoring on e.g. existing patient records. All hospitals providing an annual report on drug consumption for MOPH, to identifying high cost medicines and % budget spent on non-essential medicine listed drugs. Moreover, the national standard treatment guidelines (STGs) should be developed, and able to access online.

From the analysis of WHO, the over/irrational use of medicines occurs because of using medicines for reasons other than those indicated in the prescribing literature (Lessenger and Feinberg 2008). There are four causes of this event: (i) lack of knowledge, (ii) patient-physician relationship in terms of monetary cost, (iii) poor availability of proper alternative medicines and (iv) weak supervision of regulatory bodies (Yousefi et al. 2012). Such irrational prescribing has led to healthcare challenges such as rapidly increasing antimicrobial resistance (due to over-use of antibiotics) (Holloway and Dijk 2011), the scale of which has received international recognition (Carlet et al. 2012) and (iv) costing the hospital more than the use of expensive drugs (Price et al. 1986).

In 2012 the MOPH therefore introduced the policy, "Reduce cost of medicine and medical supply by 10%" (Ministry of Public Health 2013). This is supported by such goals as: (i) establishing joint procurement to increase purchasing negotiation; and (ii) implementing the standard cost accounting system to effectively monitor cost. To increase efficiency of medicine stock management and improve the rational use of medicine, the MOPH (2012) has set several policies: such as reduce stock reservation (turnover rate) to be less than 3 months, and select uses 'unit dose' or 'daily dose' systems. Reducing medicine usage is recommended in the case of overuse or irrational use as mentioned. Clearly, there is neither clear guideline/measurement indicators for reducing use of medicine, nor green practice for medicine (Punpeng 2011). Some alternative therapies/practices, like practising mindfulness that reduces stress, pain and blood pressure, appeared to be effectively reducing medicine, healthcare cost and improving health (Schneider et al. 2012). Hospitals can also focus on more physical and tangible factors such as increasing medicines vigilance and recycling (Xie and Breen 2012) to rotate stock to reduce waste and obsolescence and instigate savings via improved inventory management. Lastly, nearly-expired and deteriorated medicines that have a shelf life longer than 6-7 months can be exchanged with suppliers (Visuttikhun 2012). Visuttikhun also suggested that to reduce expired items and shortage, the hospital should provide more frequent checking on shelf-life and distribution, reduce the volume reserved (e.g. on wards), focus on first-expired first-out (FIFO), and periodically record nearly-expired items to remind staff to use them in order.

Methodology

This research aims to (i) investigate the movement and lifecycle of pharmaceuticals within Thai hospital sites and (ii) identify the GL practices that effectively control/minimize the use of

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[1] National Health Security Office

pharmaceuticals. To answer this main question, four sub-questions were formulated and delivered to:

1. How should we measure the best Green Logistics practices of pharmaceutical management?
2. How do hospitals manage this resource, from purchase planning through to waste disposal?
3. What practices support/facilitate excellence in GL performance in Thai public hospitals?
4. What barriers are identified which undermine effective GL practices and performance in Thai public hospitals?

In a complex organization like healthcare facilities, Bisson et al. (1993) recommends using various tools for data collection which include documentation, interviewing and observation. Thus, these tools were used to record and understand the medicines management from purchasing through waste disposal. Six case hospitals agreed to participate in this study (called "A", "B", "C", "D", "E" and "F"). These sites were different types/sizes, locations and had a range of environmental performance issues. All names of case hospitals and their locations (provinces) remain anonymous. The site visits tool place in January to July 2014 to obtain data. Purposive respondent sampling was undertaken to ensure that data was collected from staff with experience of pharmaceutical management. A large volume of data obtained was managed by 'content analysis' method which helped to examine and select key information (UTEXAS 2011). The selected data can then be analysed and compared with the criterion, and identified the performance – using 'cross case analysis' method (Miles and Huberman 1994: p. 190).

Findings

1. How should we measure the best Green Logistics practices of pharmaceutical management?

The concept of best practice refers a technique or method or process delivers a more effective outcome than any others (Frontex RDU 2012: p.19). Therefore, good practices must be able to (i) reduce the amount of resource used/waste generated/other environmental impacts, and/or (ii) increase cost reduction/improved revenue, and/or (iii) offer well-beings, and/or (iv) provide fast logistical movement (McKinnon 2010; Singkarin 2011). More detail on this is presented in the literature above.

2. How do hospitals manage this resource, from purchase planning through to waste disposal?

To answer the second research question, this section examines the close-loop pharmaceutical logistics within the hospitals. The findings indicated that case hospitals mostly use a centralized administration system in which the Director has the highest authority followed by the board of committee. An overview of this closed-loop system is presented in Figure 1.

It was found that most public hospitals often purchase resources twice a year or quarterly. However, this led the large amount of financial investment and over-stock, generated financial crisis and wastage medicines. Therefore, the MOPH requires a more frequent purchasing, every 1-2 months. However, larger-sized hospitals, like "E" Hospital conducts purchasing every week, with the "E" pharmacy issuing 50 purchasing order (POs) a week or 2,000 POs a year. From purchasing to making payment, the electronic system such as e-purchasing and e-payment is not allowed in the government system as mentioned by all interviewees.
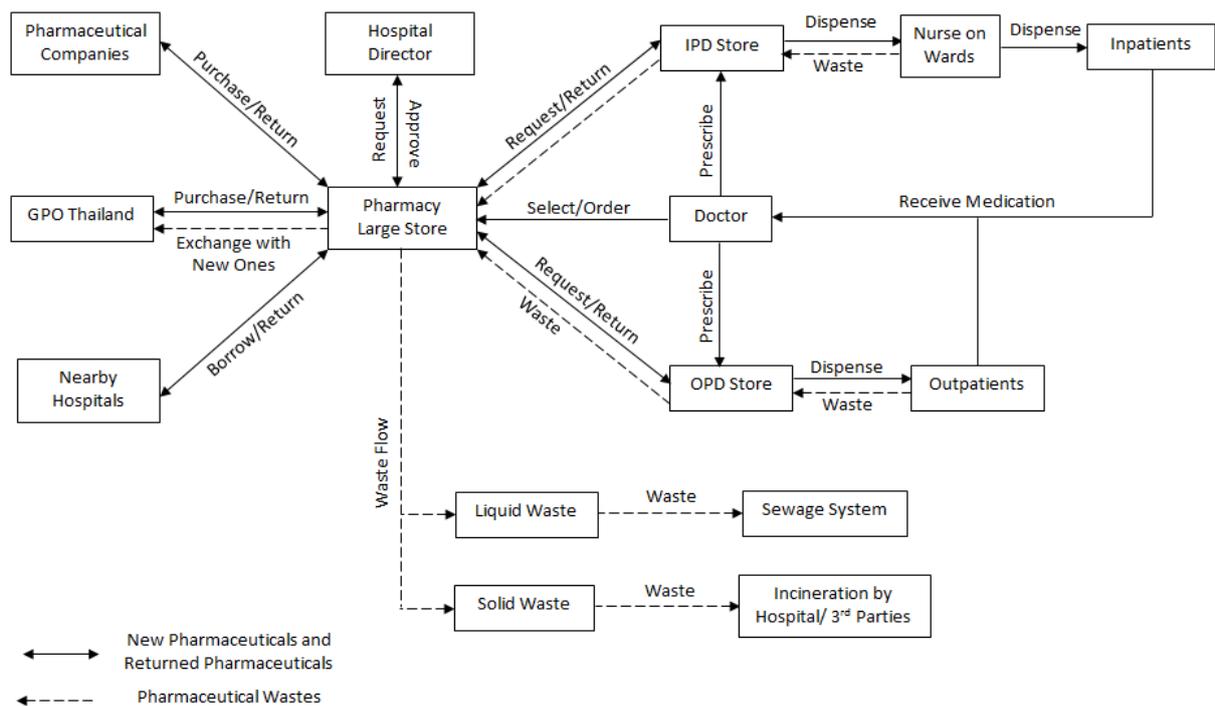
Figure 1: Diagram of Medicines Management of Thailand's Public Hospitals.
Source: Adapted from Ninsananda (2013).

Therefore, this contrasts with the report of WHO (2016: pp. 8-14). Paper-based system is highly time-consuming. Regularly, the required items are moved from mentioning stock to (i) inpatient store (IPD store) to distribute to all wards, clinic, etc. as their requisitions, and to (ii) outpatient store (OPD store) to dispense to outpatients.

Medicine waste is hazardous and consists of four categories: medicines left over; nearly expired medicines; deteriorated medicines; and expired medicines. Pills and capsules have to be disposed via thermal processes or safe landfill, while liquids need to be diluted before being discharged into hospital sewage systems. While the GPO receives expired medicines in exchanging with new ones, private vendors require products with at least 4-6 months lifetime. Before the formal disposal of pharmaceutical waste, it must be approved by the Regional Revenue Department and Provincial Health Office. This is because this resource has high value, which the approval can be taken several months.

3.   What practices support/facilitate excellence in GL performance in Thai public hospitals?

There are general practices adopted for effective stock management, including adopting FIFO (first-expired first-out), information systems, and unit dose systems. FIFO means items with a shorter lifetime will be used or removed first from stock. Unit dose systems dispense medicines for inpatients according to the meal rather than on a daily basis, which gives better control through having fewer medicines left from wards. "A", "D", "E" and "F" hospitals can meet 1-2 months with more frequent monitoring of stock. Also, the doctors are advised not to over-prescribe medicines and have asked for more cooperation.

To meet necessary cost reduction (10%), several practices were adopted: (i) conducting a joint procurement; (ii) adopting antibiotic smart use (ASU program); (iii) adopting a returned medicine

programme and (iv) holding only one item for each generic drug name. Adopting an ASU programme can reduce drug resistance and cost of expensive antibiotics. Sites "B", "C", "D" and "F" undertook a returned medicines programmes of patients with chronic conditions.

The evidence collated from the study shows that only site "D" was successful in minimizing medicines usage (by 5.67% which converts to 29,588 Baht (see Figure 2).

Environmental Practice	"A" Hosp (60 Bed)	"B" Hosp (90 Bed)	"C" Hosp (150 Bed)	"D" Hosp (30 Bed)	"E" Hosp (528 Bed)	"F" Hosp (40 Bed)
1st Outcome: Turnover rate is 1-2 month	1.5 Month	3-3.5 Months	3 Months	1 Month	1.5 Month	1.2 Month
Summary	Success	Failure	(Discuss)	Success	Success	Success
2nd Outcome: A volume use of medicines	Increased (15.78%), per bed (174,731 B)	Increased (44.38%), per bed (213,793 B)	Increased (58.36%), per bed (208,154 B)	Decreased (5.67%), per bed (29,588 B)	Increased (from interview)	Increased (8.89%), per bed (215,661 B)
Summary	Failure	Failure	Failure	Success	Failure	Failure
3rd Outcome: A volume of returned medicine per year	No Practice	2011: 133,488 B, 2012: No Data, 2013: 123,668 B	More than 100,000 Baht a year (from interview)	About 200,000 Baht a year (from interview)	No Practice	Year 2011: 33,210 B Year 2012: 34,919 B Year 2013: 73,622 B
Summary	No Practice	(Discuss)	Success	Success	(Discuss)	Success

Figure 2: Outcomes of Adopting Medicine Practices (All site analysis). Source: by Author.

4. What barriers are identified which undermine effective GL practices and performance in Thai public hospitals?

The most important barrier was found to be hospital personnel. The findings indicated a reluctance to reduce ordering and stockpiling as this could adversely impact on medical treatment. Presently, there are neither strong guidelines nor evidence to confirm the benefit of reducing medicines, or suggestions of how to affect it. On top of that, physicians do not want to change their habits in prescribing medicines ("A", "B" and "F" Hospitals). Some of them had never been informed about the financial situation, and were rarely asked for cooperation.

The policy of the MOPH that requires purchasing every 1-2 months to improve finance liquidity was obstructed by physicians who often prescribe long-term medicine for 4-5 months. In consequence, an imbalance between stocking and using rates emerged; and led a resource shortage and internal conflicts among physicians and pharmacists. "C" maintained a 3-month turnover rate because of the need to distribute this resource to nearby hospitals rarely faces shortage and conflict issues.

Discussions

The study of integrating Green Logistics (GL) in Healthcare settings, including medicine, was suggested by the Thailand's 2nd National Logistics and Supply Chain Research Strategies (2012-2016). Previously, the MOPH (Punpeng 2011) had developed the best green practices for hospitals, but this work had its limitations: an incomplete view of the close-loop system, unclear measurement indicators and no specific practices for medicines. Poor understanding of the above areas can highly affect the effective addressing GL practices. The authors chose to deliberately focus on these gaps within this study. As reported above, authors such as Ninsananda (2013) have presented a picture of medicines flow/logistics within hospitals, but the close-loop view was absent from this study. The outputs of this study presented an adapted and more comprehensive overview of this process (identifying system design and participants), as shown in Figure 1. Previous studies focusing on the effective use of medicine (e.g. Ministry of Public Health 2012; Schneider et al. 2012) tended to

examine a single area such as rational prescribing and practicing mindfulness. Clearly an integrated view of a sustainable health system was lacking. By adopting a holistic approach to GL practice identification in supporting medicines management is a more effective lens within which to examine this important area of Thai healthcare. Such an approach encompasses the hospital as a business, hospital staff, patients and community, body and soul development, and reduces potential negative impact on the environment (reduction of chemicals in circulation).

Conclusions

This study demonstrates that Public hospitals in Thailand still face the problem of irrational use/overuse of medicines. To improve this situation, the life cycle of medicines should be understood by hospital personnel and every effort made to demonstrate good green logistics practice within this supply chain. The findings within this study clearly outline deficiencies within public hospital sites such as ineffective communication between key users of this system (physicians, pharmacists, and patients) which undermines collegiality and cooperation, and (ii) ineffective systems/policies (no clear guidance and control) leading to poor medicines management. Whilst a gloomy picture it is not damning as there was evidence of effective GL practice in place also such as prescribing medicines for only 1-2 months for some patient conditions/drug types and increasing the frequency of patient follow-ups. Such practices aim to contribute to the sustainability of good GL practices and to the design and delivery of a Sustainable Health System in Thailand at both policy and hospital levels. Further enhancements of this study would include greater collaboration with the Thai Pharmacy Council to extend this study to a wider audience, with the aim of presenting generalizable outcomes.

References

- Bisson, C. L., McRae, G. and Shanner, H. G. (1993) *An Ounce Of Prevention: Waste Reduction Strategies For Healthcare Facilities.* Chicago, Illinois: American Society for Healthcare Environmental Services of the American Hospital Association.
- Cambridge Dictionary (2017) *Definition of medicine. http://dictionary.cambridge.org/dictionary/english/medicine* Accessed 29/04/2017.
- Carlet, J., Jarlier, V., Harbarth, S., Voss, A., Goossens, H. and Pittet, D. (2012) Ready for a world without antibiotics? The pensières antibiotic resistance call to action. *Antimicrobial resistance and infection control* 1 (1), 11.
- Frontex RDU (2012) *Best Practice Operational Guidelines for Automated Border Control (ABC) Systems.* European Agency for the Management of Operational Cooperation, Research and Development Unit,. *http://btn.frontex.europa.eu/resources/library/best-practice-operational-guidelines-automated-border-control-abc-systems* Accessed 9/05/2013.
- Holloway, K. and Dijk, L. v. (2011) *Rational use of medicines.* Nivel - the Netherlands Institute for Health Services Research. World Health Organization. *https://www.nivel.nl/node/2430?database=ChoicePublicat&amp;priref=3693* Accessed 19/06/2017.
- Kaplan, W. A., Ritz, L. S., Vitello, M. and Wirtz, V. J. (2012) Policies to promote use of generic medicines in low and middle income countries: a review of published literature, 2000–2010. *Health Policy* 106 (3), 211-224.
- Lessenger, J. E. and Feinberg, S. D. (2008) Abuse of prescription and over-the-counter medications. *The Journal of the American Board of Family Medicine* 21 (1), 45-54.
- McKinnon, A. C. (2010) *Green logistics : improving the environmental sustainability of logistics.* London: Kogan Page.

- Miles, M. B. and Huberman, A. M. (1994) *Qualitative data analysis: an expanded sourcebook.* Thousand Oaks; London: Sage Publications.
- Ministry of Public Health (2012) *The policy of developing efficiency of medical supply system. http://dmsic.moph.go.th/dmsic/index.php?p=1&type=3&s=3&id=49* Accessed 21 May 2015.
- Ministry of Public Health (2013) *The framework of inspection and supervision: 10% Cost reduction policy. http://203.157.186.16/gauge/index.php* Accessed 19/06/2015.
- NaRanong, A. and NaRanong, V. (2011) The effects of medical tourism: Thailand's experience. *World Health Organization. Bulletin of the World Health Organization* 89 (5), 336-44.
- Ninsananda, T. (2013) *Summary of seminar in medicine management training,.* Thailand,: *http://www.pharmhcu.com/*
- Price, D., Cooke, J., Singleton, S. and Feely, M. (1986) Doctors' unawareness of the drugs their patients are taking: a major cause of overprescribing? *Br Med J (clin res ed)* 292 (6513), 99-100.
- Punpeng, T. (2011) *GREEN and CLEAN Hospitals Project.* Department of Health. Thailand:
- Rattanaumpawan, P. (2015) Perception, attitude and knowledge of antimicrobial resistance, appropriate antimicrobial use, and infection control among the sixth year medical students in three medical schools. *IDWeek,.* San Diego, CA, USA, 2015. The Infectious Diseases Society of America (IDSA).
- Schneider, R. H., Grim, C. E., Rainforth, M. V., Kotchen, T., Nidich, S. I., Gaylord-King, C., Salerno, J. W., Kotchen, J. M. and Alexander, C. N. (2012) Stress Reduction in the Secondary Prevention of Cardiovascular Disease: Randomized, Controlled Trial of Transcendental Meditation and Health Education in Blacks. *Circulation: Cardiovascular Quality and Outcomes*.
- Singkarin, D. (2011) *Enhance logistics and supply chain of Thai hospitals. http://logistics.dpim.go.th/article/detail.php?id=1893* Accessed 27/04/2011.
- Sumpradit, N., Chongtrakul, P., Anuwong, K., Pumtong, S., Kongsomboon, K., Butdeemee, P., Khonglormyati, J., Chomyong, S., Tongyoung, P., Losiriwat, S., Seesuk, P., Suwanwaree, P. and Tangcharoensathien, V. (2012) Antibiotics Smart Use: a workable model for promoting the rational use of medicines in Thailand. *World Health Organization. Bulletin of the World Health Organization* 90 (12), 905-13.
- Tseng, Y.-y., Yue, W. L. and Taylor, M. A. P. (2005) The role of transportation in logistics chain. 2005. Eastern Asia Society for Transportation Studies.
- UTEXAS (2011) *Conduct research: Content analysis. https://www.utexas.edu/academic/ctl/assessment/iar/research/plan/method/content.php* Accessed 23/04/2015.
- Visuttikhun, J. (2012) *The management of nearly-expired and expired medicine. http://competencyrx.com/images/pdf/storage_problem.pdf* Accessed 05/06/2015.
- WHO (1994) *The Role of the Pharmacist in the Health Care System: Hospital Pharmacy. http://apps.who.int/medicinedocs/en/d/Jh2995e/1.6.3.html#Jh2995e.1.6.3* Accessed 29/04/2017.
- WHO (2016) *Medicines in health care delivery: Thailand. http://www.searo.who.int/entity/medicines/thailand_situational_assessment.pdf?ua=1* Accessed 29/04/2017.
- Xie, Y. and Breen, L. (2012) Greening community pharmaceutical supply chain in UK: a cross boundary approach. *Supply Chain Management* 17 (1), 40-53.
- Yousefi, N., Majdzadeh, R., Valadkhani, M. and Nedjat, S. (2012) Reasons for physicians' tendency to irrational prescription of corticosteroids. *Iranian Red Crescent Medical Journal* 14 (11), 713-8.