

Cost Analysis of Psoriasis Treatment Modalities in Malaysian Public Hospitals

AZIZAM NA¹, SAPERI S², ANIZA I², NORAZIRAH MN², ZAFAR A³,
AZURA MA², TAN WC⁵, CHAN LC⁶, TEY KE⁷

¹*Faculty of Business and Management, Universiti Teknologi MARA Selangor, Puncak Alam Campus*

²*Department of Community Health, Universiti Kebangsaan Malaysia Medical Centre, Jalan Yaacob Latif, Bandar Tun Razak, 56000 Cheras, Kuala Lumpur, Malaysia.*

³*Department of Community Medicine and Public Health, Faculty of Medicine and Health Sciences, Universiti Malaysia Sarawak, Jalan Datuk Mohammad Musa, 94300 Kota Samarahan, Sarawak, Malaysia.*

⁴*Department of Dermatology, Hospital Kuala Lumpur, 50586 Jalan Pahang, Kuala Lumpur, Malaysia*

⁵*Department of Dermatology, Hospital Sultanah Bahiyah Alor Setar, Jalan Langgar, Bandar Alor Setar, 05460 Alor Setar, Kedah, Malaysia.*

⁶*Department of Dermatology, Hospital Pulau Pinang, Jalan Residensi, 10990 George Town, Pulau Pinang, Malaysia.*

⁷*Department of Dermatology, Hospital Sultanah Aminah, Jalan Abu Bakar, Masjid Sultan Abu Bakar, 80000 Johor Bahru, Johor, Malaysia*

ABSTRAK

Psoriasis menyebabkan beban ekonomi yang besar akibat perbelanjaan yang tinggi untuk rawatan, prosedur diagnostik, farmaseutikal dan kehilangan produktiviti. Maklumat berkenaan beban ekonomi amatlah terhad. Kajian ini bertujuan untuk mengira kos berkaitan dengan empat jenis rawatan psoriasis. Kajian prospektif kohort telah dijalankan di lima buah hospital melibatkan 91 pesakit psoriasis sederhana dan teruk. Kos dikira daripada perspektif masyarakat menggunakan prinsip "Step Down" dan "Activity Based Costing" dalam tempoh enam bulan rawatan susulan. Komponen kos yang ditanggung oleh pembekal adalah kos pesakit dalam, kos ubat ubatan, kos makmal penyiasatan dan radiologi. Kos pesakit pula adalah perbelanjaan poket untuk pengangkutan dan kehilangan produktiviti. Kos sehari bagi pesakit dalam adalah sebanyak RM1,105.24 (US\$315.94) dan kos pesakit luar bagi setiap lawatan adalah RM298.02 (US\$85.19). Ubat-ubatan menyumbang hampir 90% (RM457,014.00) (US\$130,638.45) daripada jumlah

Address for correspondence and reprint requests: Aniza binti Ismail. Department of Community Health, Faculty of Medicine, Universiti Kebangsaan Malaysia Medical Centre, Jalan Yaacob Latif, Bandar Tun Razak, 56000 Cheras, Kuala Lumpur, Malaysia. Tel: +603-91455913 E-mail: draniza@gmail.com

keseluruhan kos pembekal. Sementara itu, kehilangan produktiviti menyumbang 84% (RM167,439.00) (US\$47,862.80) daripada jumlah keseluruhan kos pesakit. Rawatan biologik menunjukkan kos yang paling tinggi iaitu sebanyak RM342,377.00 (US\$97,869.21), diikuti oleh rawatan sistemik (RM105,607.00) (US\$30,187.99), rawatan topikal (RM38,280.00) (US\$10,942.42) dan rawatan fototerapi (RM21,824.00) (US\$6,238.44). Memahami hubungan antara kos langsung dan tidak langsung dari kedua-dua perspektif adalah penting untuk mengenal pasti dan menilai rawatan yang paling berkesan untuk psoriasis.

Kata kunci: analisis kos, psoriasis, Malaysia

ABSTRACT

Psoriasis imposes a great economic burden as a result of higher expenditures for different interventions, diagnostic procedures, pharmaceuticals and loss of productivity. Less is known about the economic impact of psoriasis treatment in Asean region. The aim of this research was to calculate the costs associated with four psoriasis treatment modalities. A prospective cohort study was conducted in five hospitals involving 91 moderate to severe psoriasis patients. Costs were calculated from the societal perspective using the principle of Step Down and Activity Based Costing (ABC) within a six (6) months follow-up duration. The components of the costs borne by the provider were inpatient cost, cost of medication, laboratory investigation and radiology. Patient's cost included out of pocket expenses, travelling cost and loss of productivity. Cost per patient per day was RM1,105.24 (inpatient) (US\$315.94) and RM298.02 (outpatient) (US\$85.19). Medication accounted for almost 90% (RM457,014.00) (US\$130 638.45) of the total provider cost. Meanwhile, loss of productivity represented 84% (RM167,439.00) (US\$47,862.80) of the total patient's cost. Biologic treatment exhibited the highest cost which was RM342,377.00 (US\$97,869.21), followed by systemic treatment (RM105,607.00) (US\$30,187.99), topical treatment (RM38,280.00) (US\$10,942.42) and topical phototherapy treatment (RM21,824.00) (US\$6,238.44). Understanding the relationship between direct and indirect costs from both perspectives is important to accurately identify and evaluate effective treatment for psoriasis.

Keywords: cost analysis, psoriasis, Malaysia

INTRODUCTION

Psoriasis is a chronic dermatology disease that affects 1-3% of the world's population (Colombo et al. 2008; Stern et al. 2004). The majority of the

patients reported that the disease had a moderate to great negative impact on their quality of life and poses great economy burden (Augustin et al. 2008; Tang et al. 2013). Treatment available for psoriasis patients include topical,

phototherapy, systemic and biologic. Treatment is based on the severity of the illness (mild, moderate, or severe). Topical treatment is given to patients with mild severity while phototherapy treatment is administered to moderate to severe cases of psoriasis (who have failed the topical treatments) before starting them on systemic and biologics (Ministry of Health 2013; Morrow 2006; Schmitt & Ford 2006). Therapy options have a substantial effects on the overall costs related to psoriasis (Pearce et al. 2006; Steinke et al. 2013). Annual costs associated with psoriasis treatment modalities was up to RM42 billion (€7 billion) in Germany and up to RM58 billion (US\$11 billion) in the United States (Morrow 2006; Schmitt & Ford, 2006). As the management for psoriasis evolve from inpatient to outpatient care, many patients would need lifelong care and expensive treatments such as systemic and biologic (Pearce et al. 2006). At a tertiary care level, the cost could increase up to 20 times more due to the different interventions used (Ferrándiz et al. 2010; Raho et al. 2012). Comorbidities such as cardiovascular disease and depression, that are associated with psoriasis patients, may escalate the treatment costs (Mustonen et al. 2014).

Biologics have revolutionised the management of psoriasis. However, greater cost associated with biologic medication might hinder its use in clinical settings (Chen et al. 2014; Mantovani et al. 2016; Vañó-Galván et al. 2012). In the light of shrinking health and care budget combined with limited health care resources, treatment

regimens should be evaluated in relative to their cost and effectiveness (Ellis & Barker 2000). There is not much research on the cost of treatment for psoriasis in this region. Therefore, this study aimed at estimating the costs associated with four different psoriasis treatment in Malaysian public hospitals.

MATERIALS AND METHODS

This was a prospective cohort study to evaluate the cost of four psoriasis treatments i.e. topical; topical and phototherapy; topical and systemic; topical and biologic, at four public hospitals, namely Hospital Kuala Lumpur (HKL), Hospital Sultanah Aminah Johor Bahru (HSAJB), Hospital Sultanah Bahiyah (HSB), Hospital Pulau Pinang (HPP) and the Universiti Kebangsaan Malaysia Medical Centre. Respondents were moderate to severe psoriasis patients attending the Dermatology Clinic at these hospitals from November 2015 until March 2017. The selection of the respondents in this study was based on the criteria as illustrated in Sulong et al. (2016).

A cost analysis was conducted from a societal perspective. Components of the costs borne by the provider include capital cost (building cost), recurrent cost (emolument, consumables, utilities and maintenance) and direct costs (medication, laboratory investigation and radiological examination). Costing methods in this study was as per description by Sulong et al. (2016). Various components of the provider's cost were shared with other services provided by the hospitals. Hence, the

Table 1: Calculation model

Approach	Component of cost	Measure	Formula
STEP DOWN	Inpatient cost	Cost per patient per day	<ul style="list-style-type: none"> · 60% of the annual operational cost (a) · Ratio inpatient days medical to inpatient days all department (b) · Operational cost medical department (c) = a x b · Ratio inpatient days psoriasis to inpatient days medical (d) · Operational inpatient cost psoriasis (e) = c x d · Average inpatient days of psoriasis (f) · Average cost of inpatient psoriasis per patient per day (g) · = e / f
	Outpatient cost	Cost patient per visit	<ul style="list-style-type: none"> · 40% of the annual operational cost (1) · Ratio outpatient visit medical to outpatient visit all department (2) · Operational cost medical department (3) = 1 x 2 · Ratio outpatient visit psoriasis to outpatient visit medical (4) · Operational outpatient cost psoriasis (5) = 3 x 4 · Average outpatient visit psoriasis (6) · Average cost of outpatient psoriasis per patient per visit (7) · = 5 / 6

allocation method was used based on the ratio of psoriasis patients as inpatients (number of days) and ratio of psoriasis patients as outpatients to the clinic per year (Sharifa Ezat et al. 2009) (Table 1).

RESULTS

A total of 91 patients were recruited for this study. Demography of the majority of the patients were as follows: males (56[62%]), aged more than 35 years old (58[63%]), Malays (61[67%]), higher education (33[35%]), married (62[68%]) and employed (85[93%]) with income between RM0-3000.00 (49[54%]). Majority of the patients received topical and systemic treatment (40[44%]), followed by topical (32[35%]), topical and biologic (10[11%]) and topical and

phototherapy (9[10%]) (Table 2).

Table 3 shows the estimated cost of treatment of psoriasis for six months duration. Cost of treating psoriasis in this cohort was RM706,416.00 with cost per patient at RM7,762.81. Medication exhibited the highest cost which was almost 90% of the total provider cost (RM457,014.00; cost per patient was RM5,022.13) followed by laboratory tests (RM49,329.00; cost per patient was RM542.08) and radiology (RM1,744.00; cost per patient was RM19.16). From the patient’s perspective, loss of productivity was the greatest cost (RM167,448.00; cost per patient was RM1,840.09), followed by out of pocket payments (RM20,610.00; cost per patient was RM226.48) and travelling cost (RM10,271.00; cost per patient was RM112.87). Table 4 shows

Table 2: Demographic profile of the respondents

Characteristics		n	%
Age	19-25	10	11
	26-35	23	25
	36-55	32	35
	56-80	26	28
Gender	Male	56	62
	Female	35	38
Ethnicity	Malays	61	67
	Chinese	20	22
	Indians	10	11
Education	No schooling	1	1
	Secondary + primary	57	64
	Diploma	16	18
	Degree	15	16
	Others	2	1
Marital Status	Single + divorced	29	32
	Married	62	68
Occupation	Unemployed	6	7
	Employed	85	93
Income (RM)	No income	21	23
	<1000	7	8
	1001-3000	42	46
	3001-5000	17	19
	>5000	4	4
Treatment	Topical	32	35
	Topical and phototherapy	9	10
	Topical and systemic	40	44
	Topical and biologic	10	11

Table 3: Overall cost for treating psoriasis in Malaysia

Perspective	Cost (RM)	Cost per patient (n=91)	Annual cost (2015)
Provider			
· Medication	RM 457,014.00	RM 5,022.13	
· Lab tests	RM 49,329.00	RM 542.08	
· Radiology	RM 1,744.00	RM 19.16	
Overall provider cost	RM 508,087.00	RM 5,583.37	
Patient			
· Out of pocket payments	RM 20,610.00	RM 221.54	RM1,290,869.46
· Traveling cost	RM 10,271.00	RM 112.87	
· Loss of productivity	RM 167,448.00	RM 1,840.09	
Overall patient cost	RM 198,329.00	RM 2,179.44	
Societal (patient + provider cost)	RM 706,416.00	RM 7,762.81	

inpatient and outpatient costs. It was estimated that cost per patient per day for inpatients was RM1,105.24 and cost per patient per visit for outpatients was RM298.02. There was a significant difference across the group in all modalities for provider’s and patient’s costs ($p < 0.05$). From provider’s perspective, topical and biologic exhibited greatest medication cost, with RM333,295.00, meanwhile, topical and systemic yielded highest lab test and radiology test with RM26,565.00 and RM850.00 respectively. From patient’s perspective, topical and phototherapy produced highest productivity cost with RM73,170.00, while topical and systemic produced greatest traveling cost with RM3960.00. On the other hand, topical incurred highest out of pocket payments with RM8,430.00 (Table 5).

DISCUSSION

In this study, the cost estimation for treating psoriasis in this cohort (6 months follow-up) was RM706,416.00 with cost per patient at RM7,762.81. A previous study conducted by Tang et al. (2013) showed that the estimated cost of the treatment of psoriasis was RM1,307.47/person/year (year 2007). The number of participants, severity of the illness, component of costs, and the principle of costing might explain the difference in costs. All respondents in this study had moderate to severe psoriasis, which has been proven to impose greater economic burden than mild psoriasis (Balogh et al. 2014; Gospodarevskaya et al. 2009; Sohn et al. 2006; Steinke et al. 2013). In addition, inflation could be another cause for the greater costs estimated in this study. This study utilised micro costing, ABC which provides the most

Table 4: Inpatient and outpatient cost

Recurrent and capital cost (RM) (2015)	Apportion	r ¹	Annual cost of medical	r ²	Annual cost of psoriasis	Patient days/visits	Cost per patient per day/visit
524,498,225.41	314,698,935.25 (a) (60%)	0.18 (b)	56,645,808.34 (c)	0.0017 (d)	98,587.49 (e)	89.2 (f)	1,105.24 (g)
	209,799,290.11 (1)(40%)	0.31 (2)	65,419,250.44 (3)	0.0021 (4)	138,698.98 (5)	465.4 (6)	298.02 (7)

*r¹= ratio inpatient days/outpatient visit medical to hospital, r²= ratio inpatient day/outpatient visits psoriasis to medical

precise cost estimation than macro costing (Drummond et al. 2015).

The cost of the treatment of psoriasis is well studied (Colombo et al. 2008; Crown et al. 2004; Mustonen et al. 2014; Balogh et al. 2014). However, the evidence concerning the economic impact of the treatment of psoriasis is limited in this region. In the USA, the cost of treating psoriasis was RM28,628.00 (US\$6,422.00) patient/year (Vanderpuye-Orgle et al. 2015). A study conducted by Levy et al. (2012) showed that the annual cost for treating psoriasis in Canada was RM5.9 billion (US\$1.7 billion) with cost per patient reported to be RM28,070.00 (US\$7999.00). In Germany, Steinke et al. (2013) revealed that yearly costs per patient added up to RM38,844.34 (€7,092.00). In a systematic review, Obradors et al. (2014) discovered that the annual total cost of the treatment of psoriasis in Europe (from the social perspective) was between RM6,349.00 (€1,340.00) and RM39,104.00 (€8,253.00). Because our health care system is heavily subsidised, the estimated costs of the treatment of psoriasis are far

lower than other countries. In addition, the use of expensive drugs such as biologics is still limited in this country which explains the lower cost of the treatment to psoriasis in this cohort compared to other countries (Tang et al. 2013).

Our findings showed that medication appeared to be most significant aspects (90%) and this is in line with previous analysis conducted in European countries (Beyer & Wolverton 2010; Obradors et al. 2014). Productivity loss is not uncommon among psoriasis patients. In fact, it surpasses the aspect of direct costs among patients with psoriasis (Raho et al. 2012; Schmitt & Ford 2006), approved the greatest cost. Generally, about 15% to 60% of workers with psoriasis are absent from work with an average of 26 days/year (De Arruda & De Moraes 2001; Mattila et al. 2013). In Taiwan, the cost due to reduced productivity accounted for 30-50% of the total expenses (Chen et al., 2014).

Biologics and systemic treatments have higher cost due to medication and monitoring costs. This is especially relevant as systemic agents

Table 5: Costs according to modalities

Component of cost	Modalities				P value
	Topical (n=32)	Topical and phototherapy (n=9)	Topical and systemic (n=40)	Topical and biologic (n=10)	
Provider (RM)					
Medication	27,920.00	17,608.00	17,191.00	333,295.00	P<0.005
Lab tests	9,810.00	4,116.00	26,565.00	8,838.00	
Radiology	550.00	100.00	850.00	244.00	
Cost per patient (RM)	1,196.25	2,424.89	2,640.15	34,237.70	
Patient (RM)					
Out of pocket payments	8,430.00	5,650.00	4,250.00	2,280.00	P<0.005
Traveling cost	2,841.00	1,645.00	3,960.00	1,825.00	
Loss of productivity	26,778.00	73,170.00	59,412.00	8,088.00	
Cost per patient (RM)	1,189.03	8,960.56	1,690.55	1,219.30	
Overall cost	76,329.00	102,289.00	173,228.00	354,570.00	

*All costs were calculated for six months duration, ANOVA, significant, p<0.005

such as methotrexate, acitretin and cyclosporine have significant side-effects and cumulative toxicity. Therefore, laboratory tests need to be conducted to identify those who are at risk at developing toxicity (Ministry of Health, 2013). The price for systemic and biologic drugs are more costly compared to traditional therapies (Beyer & Wolverton, 2010). The estimated annual cost of biologic treatment varied from RM160,654.00 (\$36,038.00) (adalimumab) to RM200,267.00 (US\$44,924) (ustekinumab) in the year 2013 (Cheng & Feldman, 2014).

Phototherapy is indicated for patients with moderate psoriasis where topical treatment has failed (Ministry

of Health 2013). In this analysis, there is a smaller number of patients receiving this treatment. The possible explanation for this is because patients find it challenging to attend the clinic for phototherapy sessions for two (2) or three (3) days a week as they have to miss work which subsequently affects their income. It also requires many resources from the provider (Mustonen et al. 2014). In terms of cost, phototherapy has the least cost and the possible explanation for this is because of the lower number of patients receiving this modality in our analysis. Phototherapy may result in economic burden to patients and the provider. In a study conducted by Langan et al. (2004), it was found

that the yearly cost of narrowband UVB was RM306,906.00 (€53,555.00) in Ireland with a mean cost per patient at RM1,862.00 (€325). Staffing was the most significant aspect, accounting for 70% of the cost. Recent evidence suggested that annual cost of narrowband UVB phototherapy at RM8,218.00 (US\$1,734.00) was lesser than other treatment modalities: RM20,073.00 (US\$4,235.00) for PUVA, RM36,818.00 (US\$7,768.00) for cyclosporin, RM43,430.00 (\$9,163.00) for acitretin, RM111,565.00 (US\$23,538.00) for adalimumab, RM112,043.00 (US\$23,639.00) for infliximab, RM115,835.00 (US\$24,439.00) for eanercept except for methotrexate, at RM5,673.00 (US\$1197.00) (Beyer & Wolverton 2010).

A major strength of our study was that this was the first study conducted in Malaysia to estimate the cost of treatment for psoriasis and hence, it was able to provide important input to policy makers in the allocation of resources. This is a comprehensive economic evaluation which includes all available treatment modalities and costs that were evaluated from both perspectives (provider and patient). A Clinical Pathway (CP) for moderate to severe psoriasis patients was specifically developed for the data collection in this study. Due to the detailed care plan (illustrated in the CP), true estimation of cost in each activity of treatment (Ismail et al. 2016) was provided. The main limitation of this study was short time horizon. Psoriasis is a long-term disease and its treatment lasts for lifetime, therefore, it would

be ideal for an economic evaluation to measure costs associated with the changes and interruptions during treatment for many years. In addition, cost of side effects and comorbidities were excluded in the analysis. These factors could influence overall cost of the treatments.

CONCLUSION

Our study showed that patients receiving the topical along with biologic treatment incur an overall highest cost compared to other classic interventions when prescribed in an outpatient setting. Understanding the relationship between direct and indirect costs from both perspectives is necessary to accurately identify and evaluate effective treatments for psoriasis.

ACKNOWLEDGEMENT

This study was funded under Research University Grant (Project ID: GUP-2014-055). Approval was obtained from the Research and Ethic Committee of Universiti Kebangsaan Malaysia Medical Centre (UKMMC) and National Medical Research Registry (NMRR). The authors would like to express appreciation to the Dermatology Consultants for their input during the conception of the study, as well as the patients who participated in this study.

REFERENCES

- Augustin, M., Krüger, K., Radtke, M.A., Schwippel, I., Reich, K. 2008. Disease severity, quality of life and health care in plaque-type psoriasis: a

- multicenter cross-sectional study in Germany. *Dermatology* 216(4): 366-72.
- Balogh, O., Brodsky, V., Gulácsim L., Herédi, E., Herszényi, K., Jókai, H., Kárpáti, S., Baji, P., Remenyik, É., Szegedi, A., Holló, P. 2014. Cost-of-Illness in Patients with Moderate to Severe Psoriasis: A Cross-Sectional Survey in Hungarian Dermatological Centres. *Eur J Health Econ* 15(1): 101-9.
- Beyer, V., Wolverson, S.E. 2010. Recent Trends in Systemic Psoriasis Treatment Costs. *Arch Dermatol* 146(1): 46-54.
- Chen, K.C., Hung, S.T., Yang, C.W., Tsai, T.F., Tang C.H. 2014. The Economic Burden of Psoriatic Diseases in Taiwan. *J Dermatol Sci* 75(3): 183-9.
- Cheng, J., Feldman, S.R. 2014. The Cost of Biologics for Psoriasis Is Increasing. *Drugs in Context* 3: 212266.
- Colombo, G., Altomare, G., Peris, K., Martini, P., Quarta, G., Congedo, M., Costanzo, A., Di Cesare, A., Lapucci, E., Chimenti, S. 2008. Moderate and Severe Plaque Psoriasis: Cost-of-Illness Study in Italy. *Ther Clin Risk Manag* 4(2): 559-68.
- Crown, W. H., Bresnahan, B. W., Orsini, L. S., Kennedy, S. & Leonardi, C. 2004. The burden of illness associated with psoriasis: cost of treatment with systemic therapy and phototherapy in the US. *Curr Med Res Opin* 20(12): 1929-36.
- de Arruda, L.H., De Moraes, A.P. 2001. The Impact of Psoriasis on Quality of Life. *Br J Dermatol* 144(Suppl 58): 33-6.
- Drummond, M.F., Sculpher, M., Claxton, K., Stoddart, G.L., Torrance, G. 2015. Methods for the Economic Evaluation of Health Care Programmes. New York: Oxford University Press.
- Ellis, C., Barker, J. 2000. Psoriasis: A View for the Year 2000. *Curr Probl Dermatol* 12(2): 45-50.
- Ferrándiz, C., Carrascosa, J.M., Boada, A. 2010. A New Era in the Management of Psoriasis? The Biologics: Facts and Controversies. *Clin Dermatol* 28(1): 81-7.
- Gospodarevskaya, E., Picot, J., Cooper, K., Loveman, E., Takeda, A. 2009. Ustekinumab for the Treatment of Moderate to Severe Psoriasis. *Health Technol Assess* 13(3): 61-6.
- Ismail, A., Sulong, S., Zafar, A., Syed Junid, S. M. A-J., Wan Norlida, I., Maskon, O., Che Hassan, H. H. 2016. Implementation of clinical pathways in Malaysia: Can clinical pathways improve the quality of care? *Int Med J* 23(1): 47-50.
- Langan, S.M., Heerey, A., Barry, M., Barnes, L. 2004. Cost analysis of narrowband uvb phototherapy in psoriasis. *J Am Acad Dermatol* 50(4): 623-6.
- Levy, A.R., Davie, A.M., Brazier, N.C., Jivraj, F., Albrecht, L.E., Gratton, D., Lynde, C.W. 2012. Economic burden of moderate to severe plaque psoriasis in Canada. *Int J Dermatol* 51(12): 1432-40.
- Mantovani, L., Medaglia, M., Piacentini, P., Tricca, M., Vena, G.A., Voza, A., Castellino, G. 2016. Burden of moderate-to-severe plaque psoriasis and new therapeutic approaches (Secukinumab): an Italian perspective. *Dermatol Ther* 6(2): 151-67.
- Mattila, K., Leino, M., Mustonen, A., Koulu, L., Tuominen, R. 2013. Influence of psoriasis on work. *Eur J Dermatol* 23(2): 208-11.
- Ministry of Health. 2013. Clinical Practice Guidelines: Management of Psoriasis Vulgaris <http://www.moh.gov.my/penerbitan/CPG2017/9004.pdf> [22 September 2014]
- Morrow, T. 2006. Cost-effective psoriasis treatment may demand creative coverage rules. *Manag Care* 15(5): 61-3.
- Mustonen, A., Leino, M., Mattila, K., Koulu, L., Tuominen, R. 2014. Treatment costs of psoriasis in a tertiary-level clinic. *BMC Health Serv Res* 14(1): 344.
- Obradors, M., Figueras, M., Paz, S., Comellas, M., Lizán, L. 2014. Costs of psoriasis in Europe. A systematic review of the literature. *Value Health* 17(7): A606.
- Pearce, D.J., Nelson, A.A., Fleischer, A.B., Balkrishnan, R., Feldman, S.R. 2006. The cost-effectiveness and cost of treatment failures associated with systemic psoriasis therapies. *J Dermatolog Treat* 17(1): 29-37.
- Raho, G., Koleva, D.M., Garattini, L., Naldi, L. 2012. The burden of moderate to severe psoriasis: an overview. *Pharmacoeconomics* 30(11): 1005-13.
- Schmitt, J.M., Ford, D.E. 2006. Work limitations and productivity loss are associated with health-related quality of life but not with clinical severity in patients with psoriasis. *Dermatology* 213(2): 102-10.
- Sharifah Ezat, W.P., Azimatun, N., Amrizal, M., Rohaizan, J., Saperi, S. 2009. Economic burden of diabetic care in government health facilities in Selangor. *Journal of Community Health* 15(2): 17-26.
- Sohn, S., Schoeffski, O., Prinz, J., Reich, K., Schubert, E., Waldorf, K., Augustin, M. 2006. Cost of moderate to severe plaque psoriasis in Germany: a multicenter cost-of-illness study. *Dermatology* 212(2): 137-44.
- Steinke, S.I., Peitsch, W.K., Ludwig, A., Goebeler, M. 2013. Cost-of-illness in psoriasis: comparing inpatient and outpatient therapy. *PLoS One* 8(10): e78152.
- Stern, R.S., Nijsten, T., Feldman, S.R., Margolis, D.J., Rolstad, T. 2004. Psoriasis is common, carries a substantial burden even when not extensive, and is associated with widespread treatment dissatisfaction. *J Invest Dermatol Symp Proc*

9(2): 136-9.

- Sulong, S., Ismail, A., Azizam, N.A., Md Nor, N., Ahmed, Z. 2016. Economic burden and cost effectiveness analysis of psoriasis treatment modalities in Malaysian public hospitals : a study protocol. The European Proceedings of Social and Behavioural Sciences 243-50
- Tang, M.M., Chang, C.C., Chan, L.C., Heng, A. 2013. Quality of life and cost of illness in patients with psoriasis in Malaysia: a multicenter study. *Int J Dermatol* 52(3): 314-22.
- Vanderpuye-Orgle, J., Zhao, Y., Lu, J., Shrestha, A., Sexton, A., Seabury, S., Lebwohl, M. 2015. Evaluating the economic burden of psoriasis in the United States. *J Am Acad Dermatol* 72(6): 961-7.
- Vañó-Galván, S., Gárate, M.T., Fleta-Asín, B., Hidalgo, A., Fernández-Guarino, M., Bermejo, T., Jaén, P. 2012. Analysis of the cost effectiveness of home-based phototherapy with narrow-band uv-b radiation compared with biological drugs for the treatment of moderate to severe psoriasis. *Actas Dermosifiliogr* 103(2): 127-37.

Received: 30 Sept 2017

Accepted: 19 Jul 2018