

Hangan L.T.¹, Capatana D.², Nicola Gh.¹, Chirila S.¹, Gurgas L.¹, Cambrea Simona Claudia¹

Medical Informatics applied in psoriasis diagnosis and management

¹Faculty of Medicine, University “Ovidius” of Constanta

²Emergency County Hospital of Constanta

ABSTRACT

Psoriasis represents a chronic disease, with a prevalence of 0.91% to 8.5% worldwide. The clinical manifestations of the disease vary a lot from patient to patient and the response to treatment also varies a lot.

Today, in spite of the drawbacks it has, PASI (Psoriasis Area Severity Index) represents one of the best tools used to evaluate the extent of the disease and the response to medication.

One of the drawbacks of using this scoring system is considered to be the way a doctor has to calculate the result. In this study we offer, step by step, a possible solution to create an informatics tool that can offer the result of the score based on the inputs made by the doctor.

Keywords: psoriasis, PASI, informatics

Chirila Sergiu

Faculty of Medicine, University “Ovidius” of Constanta
University Street, No. 1, Campus B
Constanta, Romania
email: sergiu.chirila@univ-ovidius.ro
phone: +40 721332068

Introduction

Psoriasis represents a chronic immune-mediated, inflammatory, non-contagious disease. The main characteristic is the inflamed lesions covered by scales. The incidence and prevalence of psoriasis was estimated in 2013 by Rosa Parisi in a systematic review of published population-based studies[1]. In adults, the results on prevalence varied from 0.91% in United States to 8.5% in Norway and the incidence estimates ranged from 78.9/100,000 person-years (United States) to 230/100,000 person-years (Italy). Thus the results of the study suggest a high variability in occurrence of psoriasis based on age and geographic region.

The clinical manifestations vary a lot depending on the part of the body that is affected, affected area, severity of the symptoms and patterns. [2] Therefore different methods of assessing a patients are developed and being used. In a systematic review of clinical psoriasis measures used in randomized-controlled trials between 1977 and 2000[3] the

authors identified 44 different scoring systems. One practical method of assessing the severity of the disease and among the first ones was described in 1978 by Fredriksson and Pettersson and named PASI (Psoriasis Area and Severity Index)[4]. Even though there are reports which state the fact that this method is based on approximation made using subjective observation - thus with a high inter-rater and intra-rater variability of the results[5], or that the method is not sensitive enough. Another major objection for using PASI in clinical assessment is the fact that is too time consuming due to the relatively complex way of calculation[6]. In this paper we propose a way to build a PASI calculation tool based on software specialized on cell-based calculations.

Material and Method

To create the application that dermatologists, family doctors and other specialists can use in order to monitor the evolution of the disease, we use Microsoft Excel 2016. The final product will be saved in a format compatible with most of the applications used for creating spreadsheets.

The formula used for calculation is the one described by Harari[7] in 2000:

$$0.1(Eh + Th + Sh)Ah + 0.3(Et + Tt + St)At + 0.2(Eu + Tu + Su)Au + 0.4(El + Tl + Sl)Al$$

(E= erythema; T = thickness; S=scaling; A= area; h = head; t = trunk; u = upper extremities; and l = lower extremities).

To create this we will use the formula described above, cut points for PASI score according to NICE guidelines[8].

4	Body Region	Erythema	Thickness	Scaling	Area
5	Head				
6	Upper Limbs				
7	Trunk				
8	Lower Limbs				
9					

Figure 2 Table with values to calculate PASI score

Process of creating the spreadsheet

The way to calculate the PASI score was described by Fredriksson and Pettersson in 1978[4].

A formula is an equation that is written and gives specific indications about the steps used to obtain the desired result. In our application we are going to use a formula to calculate the PASI score and functions that will allow us to present the result in a suggestive graphical way. To achieve this we decided to use conditional formatting for the cell that contains the final result of the test.

The first step is to set the cells that contain the labels and decide on the format of the spreadsheet. As the purpose of the application is to offer a quick and reliable way of evaluating patients with psoriasis using the PASI score, we decided to use only the name of the patient and the date of visit as identification data (figure 1). Another purpose of the application is to offer the possibility to print out the results and add it to the medical records of the patients.

Next step is to merge cells B1 and C1 respectively B2 and C2, and use a different fill color for each field (figure 1).

	A	B	C	D
1	Patient Name			
2	Date of visit			
3				

Figure 1 Patient identification data

The next step represents the creation of the labels that will describe the cells that contain the information needed to calculate the PASI score (figure 2).

We decided to use the format above as it offers a good workflow. The doctor will assess each area and describe the values for each characteristic.

To make things easier to use and offer a better visual guidance, we decided to use control objects to input information. Thus the next step we did was to activate the „Developer” tab for File>Options>Customize Ribbon. After activation, from the tab Developer, group Controls we inserted a Combo Box control object (figure 3).

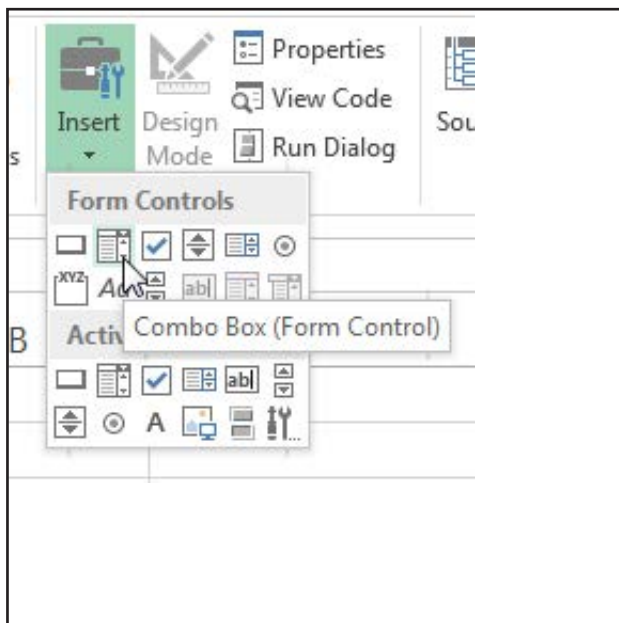


Figure 3 Combo Box control object selection

This object allows for inputting values that are predefined. We wrote the predefined values in a second worksheet called “Grade”. We need here two sets of data. One related to the severity of erythema, thickness and scaling and one group of information for the Area.

The severity of the three indicators is evaluated as:

- None – 0 points
- Slight – 1 point
- Moderate – 2 points
- Severe – 3 points
- Very Severe – 4 points.

For the area, the score used is given in percentage of affected area for each territory:

- 0% - 0 points
- 1% - 9% - 1 point
- 10% - 29% - 2 points
- 30% - 49% - 3 points
- 50% - 69% - 4 points
- 70% - 89% - 5 points
- 90% - 100% - 6 points.

In figure 4 we show the way in which a control object can be formatted, by using right click and choosing the option Format Control.

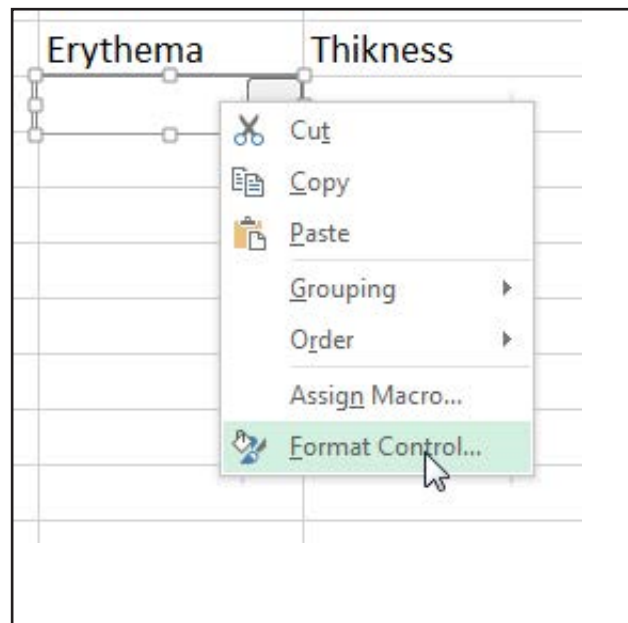


Figure 4 Format control

From the windows that appears, we had to go to Control tab and modify the Input Range, Cell link and Drop down lines according to figure 5. The input range is the range of cells that contain the scoring for the evaluated indicators. Because the data has two columns (one with names and one with values), the control object will only show the column with the names and the values in the second column will be added to the linked cell (in this case B5).

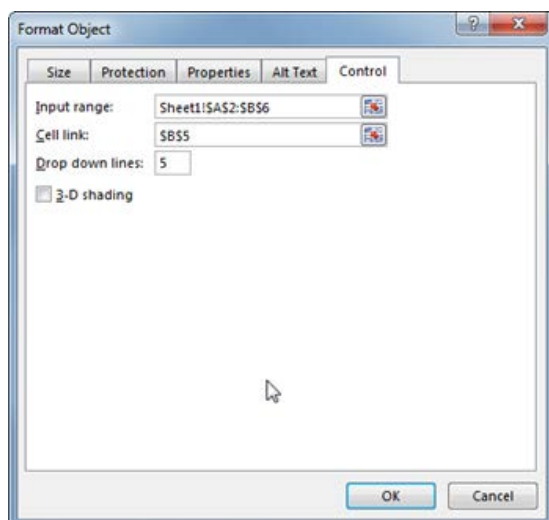


Figure 5 Properties for control object

For the result we decided to use the cut-off points recommended by NICE in 2014, values lower than 10 being considered mild, between 10 and 20 moderate and a score higher than 20 is considered sign of severe disease.

The formula used for calculating the PASI score is written as follows (figure 6).

For the cell that contains the result of the PASI score we decided to use Conditional Formatting in order to offer a quick visual perspective over the result of the test (figure 7).

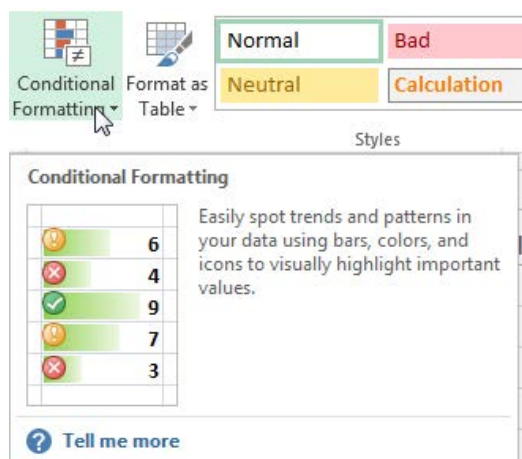


Figure 7 Conditional Formatting



Figure 6 PASI written formula in Excel

As more customization is needed, we edited the rule so that the lowest values will be green while the highest values red (Figure 8).

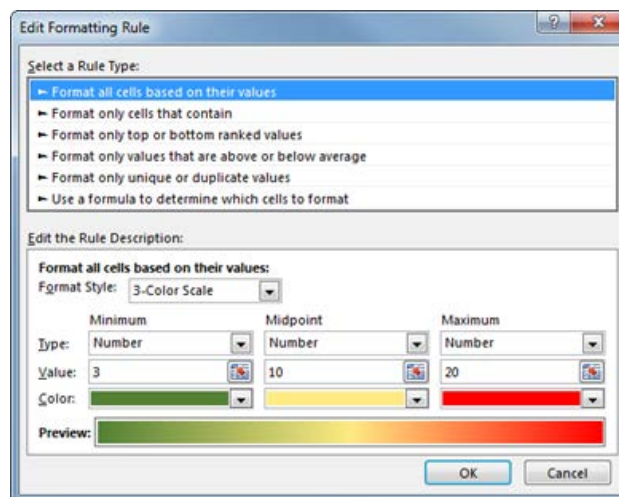


Figure 8 PASI Score result graphics

For reference we did a print screen and added, just below the result the figure with the reference colors. Over it we added a text Box with words to describe the categories in order to have a legend for the customized colors. After superposing the text box we had to choose No Fill from the shape options. The background becomes transparent and, as visible in figure 9 the score is easy to read.

10				
11	PASI SCORE		9	
12		MILD	MODERATE	SEVERE
13				

Figure 9 Result representation for PASI score

The last steps include a protection of the workbook. For this we decided to allow the editing only for the necessary fields (identification data of patients). For cosmetics reasons we selected all the cells and choose to use a fill color white. The next step is represented by a new selection and after that we applied a thick border. We selected the printing area so that the final result can be an easy to print file that can be archived in the personal health record of the patients.

Patient Name							
Date of visit							
Body Region	Erythema		Thikness		Scaling		Area
Head	None	▼	None	▼	None	▼	0%
Upper Limbs	None	▼	None	▼	None	▼	0%
Trunk	None	▼	None	▼	None	▼	0%
Lower Limbs	None	▼	None	▼	None	▼	0%
<div style="display: flex; justify-content: space-between; align-items: center;"> <div>PASI SCORE</div> <div style="text-align: center;"> <div style="background-color: #4F81BD; color: white; padding: 5px 20px; font-weight: bold;">3</div> <div style="display: flex; justify-content: space-around; margin-top: 5px;"> MILD MODERATE SEVERE </div> </div> </div>							

Figure 10 Representation of the final result

Discussion

One of the major complains related to the use of PASI score in real life is the fact that is very time-consuming and hard to manage. With the information provided here any doctor can build a simple application in very few steps.

Another disadvantage of using PASI score is related to its high variability in results which is was documented in previous studies [9]. This problem can be overcome, with good results if methods of better training are used. The use of photos, tablet, phone or PC applications also offer good practice possibilities in order to reduce the extent of the variability of PASI assessment[5].

Other studies compare PASI score with other proposed scoring systems. Most of these studies agree that the score offers good results. There were studies to compare the PASI assessment with computer generated scores [9, 10] or with other scoring systems [11, 12].

The current guidelines recognize PASI as an established parameter to measure the severity of skin symptoms in psoriasis [13] and is considered a gold standard score for the assessment of extensive psoriasis[14].

Conclusions

PASI score is a tool that found its place in psoriasis management in the last 40 years and continues to be one of the most used tools to evaluate the extent of the disease, and by using different variations to assess the efficacy of the treatment. By creating and using simple to use tools, readily available, doctors involved in psoriasis management can rapidly obtain a result that can guide their medical decision.

References

1. Parisi, R., Symmons, D.P.M., Griffiths, C.E.M. & Ashcroft, D.M. (2013). Global Epidemiology of Psoriasis: A Systematic Review of Incidence and Prevalence. *J Invest Dermatol.* 133(2), 377-385. doi: <http://www.nature.com/jid/journal/v133/n2/supplinfo/jid2012339s1.html>
2. Meffert, J. & James, W.D. (2015, December). *Psoriasis Clinical Presentation*. Retrieved December, 2015, from <http://emedicine.medscape.com/article/1943419-clinical#showall>

3. Naldi, L., Svensson, A., Diepgen, T., Elsner, P., Grob, J.J., Coenraads, P.J., Bavinck, J.N., Williams, H. & European Dermato-Epidemiology, N. (2003). Randomized clinical trials for psoriasis 1977-2000: the EDEN survey. *J Invest Dermatol.* 120(5), 738-741. doi: 10.1046/j.1523-1747.2003.12145.x
4. Fredriksson, T. & Pettersson, U. (1978). Severe psoriasis--oral therapy with a new retinoid. *Dermatologica.* 157(4), 238-244.
5. Youn, S.W., Choi, C.W., Kim, B.R. & Chae, J.B. (2015). Reduction of Inter-Rater and Intra-Rater Variability in Psoriasis Area and Severity Index Assessment by Photographic Training. *Annals of Dermatology.* 27(5), 557-562. doi: 10.5021/ad.2015.27.5.557
6. Carlin, C.S., Feldman, S.R., Krueger, J.G., Menter, A. & Krueger, G.G. (2004). A 50% reduction in the Psoriasis Area and Severity Index (PASI 50) is a clinically significant endpoint in the assessment of psoriasis. *J Am Acad Dermatol.* 50(6), 859-866. doi: 10.1016/j.jaad.2003.09.014
7. Harari, M., Shani, J., Hristakieva, E., Stanimirovic, A., Seidl, W. & Burdo, A. (2000). Clinical evaluation of a more rapid and sensitive Psoriasis Assessment Severity Score (PASS), and its comparison with the classic method of Psoriasis Area and Severity Index (PASI), before and after climatotherapy at the Dead-Sea. *Int J Dermatol.* 39(12), 913-918.
8. Evidence Update Advisory Group. (2014). Psoriasis - Evidence Update November 2014 *The assessment and management of psoriasis* (Vol. 68). National Institute for Health and Care Excellence.
9. Ihtatho, D., Fadzil, M.H., Affandi, A.M. & Hussein, S.H. (2007). Area assessment of psoriasis lesion for PASI scoring. *Conf Proc IEEE Eng Med Biol Soc. 2007*, 3446-3449. doi: 10.1109/IEMBS.2007.4353072
10. Ahmad Fadzil, M.H., Ihtatho, D., Mohd Affandi, A. & Hussein, S.H. (2009). Objective assessment of psoriasis erythema for PASI scoring. *J Med Eng Technol.* 33(7), 516-524. doi: 10.1080/07434610902744074
11. Henseler, T. & Schmitt-Rau, K. (2008). A comparison between BSA, PASI, PLASI and SAPASI as measures of disease severity and improvement by therapy in patients with psoriasis. *Int J Dermatol.* 47(10), 1019-1023. doi: 10.1111/j.1365-4632.2008.03753.x
12. Gottlieb, A.B., Chaudhari, U., Baker, D.G., Perate, M. & Dooley, L.T. (2003). The National Psoriasis Foundation Psoriasis Score (NPF-PS) system versus the Psoriasis Area Severity Index (PASI) and Physician's Global Assessment (PGA): a comparison. *J Drugs Dermatol.* 2(3), 260-266.
13. Nast, A., Gisondi, P., Ormerod, A.D., Saiag, P., Smith, C., Spuls, P.I., Arenberger, P., Bachelez, H., Barker, J., Dauden, E., de Jong, E.M., Feist, E., Jacobs, A., Jobling, R., Kemeny, L., Maccarone, M., Mrowietz, U., Papp, K.A., Paul, C., Reich, K., Rosumeck, S., Talme, T., Thio, H.B., van de Kerkhof, P., Werner, R.N. & Yawalkar, N. (2015). European S3-Guidelines on the systemic treatment of psoriasis vulgaris - Update 2015 - Short version - EDF in cooperation with EADV and IPC. *J Eur Acad Dermatol Venereol.* 29(12), 2277-2294. doi: 10.1111/jdv.13354
14. Bhor, U. & Pande, S. (2006). Scoring systems in dermatology. *Indian J Dermatol Venereol Leprol.* 72(4), 315-321.