

# Comparative analysis of blood cell counters and free mobile applications in differential leukocyte count

## *Análise comparativa entre contadores de células sanguíneas e aplicativos móveis gratuitos na contagem diferencial de leucócitos*

Isabelle V. M. Siqueira; Catharina A. B. Ramos; Gabriella S. Barboza; Luísa V. C. Marques; Emily F. N. Silva; Hye C. Kang

Universidade Federal Fluminense (UFF), Niterói, Rio de Janeiro, Brazil.

### LETTER TO THE EDITORS

In volume 6, issue 50, of *Jornal Brasileiro de Patologia e Medicina Laboratorial* (JBPMML), Santos *et al.* (2014) highlighted the importance of manual cell counting within clinical laboratories<sup>(1)</sup>. However, differential counters, both manual and digital, are known to have always been needy of improvement. The insufficiency of practical methods that ease differential blood cell count stresses the availability of mobile applications (apps) that play the role of leukocyte differential counters<sup>(2,3)</sup>.

In this context, the high cost-benefit of counters and the need of units in sufficient quantity to accommodate each microscope used for counting are compensated for the wide availability of apps. The lack of counter updates often results in absence or excess of buttons for a certain task<sup>(3)</sup>. On the other hand, apps encompass the possibility of personalization, allowing the setting of a count with the quantity and the type of cell selected by the user. Some of them also have images of the different cell types that are confirmed by the emission of sound or vibration; in such cases, that sound is exclusive for each cell type, what enables a higher degree of reliability.

Typically, in the manual leukocyte count, a total of 100 cells are counted and categorized according to their type<sup>(4)</sup>.

At counters, button setting is generally spaced, what demands visual confirmation by the operator and can contribute to operational error. Similarly, inadequacy of some apps to the different sizes of smartphone screens resulted in key layouts unfavorable to counting, making their use difficult. It is important to emphasize that counters do also not have editing features, what makes error correction time-consuming and subject to recounting<sup>(3)</sup>. The *undo* option appears as a resource for correcting counts in apps, letting users delete the latest errors with no need to restart.

The usual counters do not present a system capable of directly transferring these results to laboratory information systems. They increase the time necessary to generate reports, and thus the possibility of wrong results, with high potential of patient safety impairment. Many apps comprise options for storage and sharing of results in their interface, enabling data transfer and minimizing possible errors.

The flexibility and the facility of the use of apps that can be employed in clinical laboratories extend to the area of education in hematology, which routinely relies on laboratory practices<sup>(5)</sup>. Although they have not been widely adopted by clinical laboratories, leukocyte counters found in apps work similarly as manual and digital differential counters, and can be considered a practical and economic resource in laboratory routine.

### REFERENCES

1. Santos FJ, Figueira DO, Souza JEO. Prevalência de alterações microscópicas discordantes com análise automatizada do hemograma. *J Bras Patol Med Lab.* 2014; 50(6): 398-401.

2. Geum Y, Jeon H, Lee H. Developing new smart services using integrated morphological analysis: integration of the market-pull and technology-push approach. *Service Business.* 2015; 10(3): 531-55. Available at: <https://link.springer.com/article/10.1007/s11628-015-0281-2>.

3. Thurman AC, Davis JL, Buelow BD, Jan M, McCulloch CE. Development and validation of an app-based cell counter for use in the clinical laboratory setting. *J Pathol Inform.* 2015; 6(1): 2. PubMed PMID: 25722942.
4. Jacob EA. Complete blood cell count and peripheral blood film, its significant in laboratory medicine: a review study. *Am J Lab Med.* 2016; 1(3): 34-57. Available at: <http://article.sciencepublishinggroup.com/html/10.11648.j.ajlm.20160103.12.htm>.
5. Dorsey ER, Yvonne Chan YF, McConnell MV, Shaw SY, Trister AD, Friend SH. The use of smartphones for health research. *Acad Med.* 2017; 92(2): 157-160. PubMed PMID: 27119325.

---

**CORRESPONDING AUTHOR**

Isabelle Vasconcelos Menegoy Siqueira  0000-0001-9561-1610  
e-mail: [isabellemenegoy@gmail.com](mailto:isabellemenegoy@gmail.com)



This is an open-access article distributed under the terms of the Creative Commons Attribution License.