

Development of the PraziCalc mobile device-app to calculate praziquantel dosage in the treatment of schistosomiasis

Dear Editor

Schistosomiasis is an infectious disease caused by trematode parasites of the genus *Schistosoma*. According to the World Health Organization (WHO), at least 206.5 million people required preventive treatment, of which more than 88 million people were reported to have been treated¹. Currently, three drugs are used for the treatment of schistosomiasis: praziquantel, metrifonate, and oxamniquine. All three have a history of success at the individual clinical level and in population or community-based chemotherapy². However, praziquantel remains the drug of choice in humans because of its high efficacy, low toxicity, and affordability. Currently, large-scale administration of praziquantel (PZQ) is the main measure for controlling schistosomiasis, as recommended by WHO focusing on morbidity control³.

According to WHO, praziquantel is available in 600 mg tablets and must be administered orally in a single dose of 40 mg/kg of body weight after a meal³. In some countries like Brazil, the Ministry of Health has its own guidelines. In this country, the praziquantel dose is given according to the age group: children up to 15 years old (60 mg/kg) and adults (50 mg/kg) of body weight⁴. Determining the treatment dosage by body weight using scales in a global preventive program is considered problematic due to a substantial risk of technical and systematic measurement errors⁵. In endemic areas, mainly in Africa, in order to facilitate treatment delivery, WHO recommends to administer praziquantel using a dose-pole, calculating the appropriate dosage by height instead of weight⁶. Studies have shown that height assessment rather than weighing scale in the treatment of schistosomiasis using the dose pole is promising^{6,7}. However, praziquantel must be administered between an acceptable dosage (30-60 mg/kg) and an ideal dosage (40-60 mg/kg). The under dosing of the drug could result in a partial or inadequate treatment, as much as an over dosage could result in side-effects such as abdominal pain, nausea and headache^{6,7}. The dose-pole use is based on the individual height and does not take into account individuals of the same height with different body weight. Baan *et al.*⁸ has shown, in African girls, that the use of the WHO pole dose is inaccurate in dosing the appropriate amount of praziquantel in overweight/obese girls. Thus, despite the dose-pole benefits particularly in a poor resource scenario, following a regimen of exposures to increasing amounts of PZQ, the development of a more accurate and straightforward method for calculating the optimal dose to reduce the error of weight-based treatment is urgently needed. Treatment performed in a large number of patients in areas where the drug is still administered based on weight, such as in Brazil, there is a grueling job of calculating adequate praziquantel dosing based on the individual's weight. Thus, we present a mobile device-app called PraziCalc which facilitates and automatically calculates the optimal dosage of praziquantel based on the patient's body weight, ensuring the effectiveness of treatment and the recommended dosage.

The app system

We have developed a mobile-device app to simplify the calculation of praziquantel dosage. The system is easy to use by any health worker, teacher,

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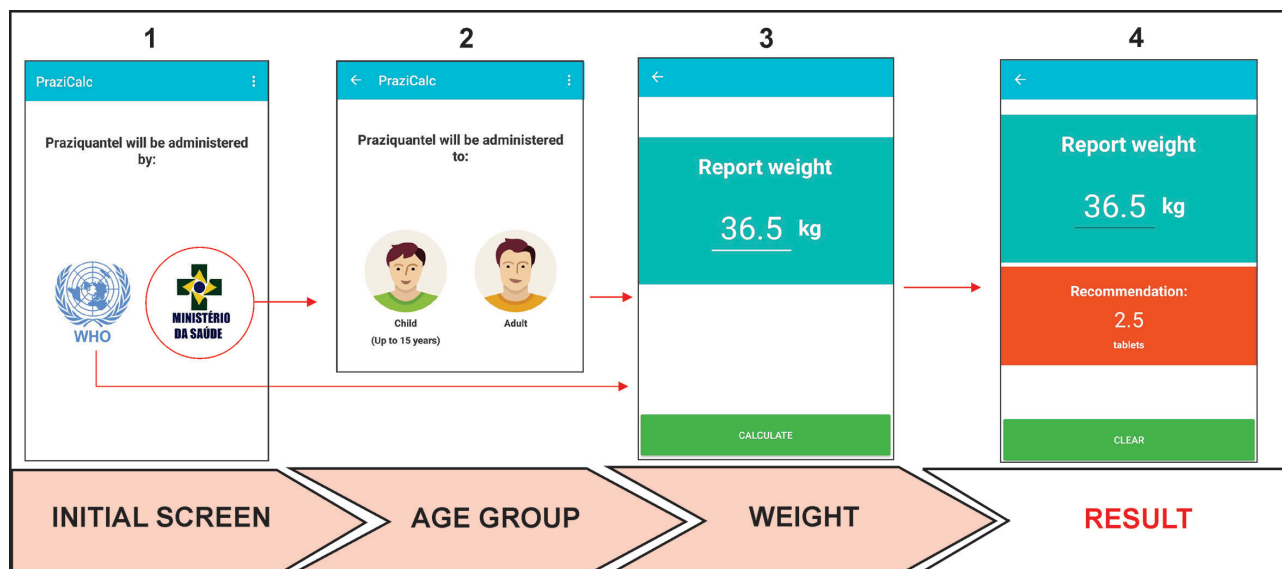


Figure 1 - Steps to use the PraziCalc mobile device-app: 1) choose if the drug will be administered according to the guidelines of the World Health Organization or the Health Ministry of Brazil; 2) in Brazil, praziquantel dosage is given according to the age group (children or adult); 3) entry with the individual weight; 4) recommendation on the amount of tablets that should be administered to the patient. Note: The calculation example in the figure was according to WHO guidelines

community volunteer or drug distributor and it only requires a mobile device (e.g. smartphone, tablet etc.). The app was created in 2017, it is free to all users, bilingual (English/Portuguese) and available for iOS and android operational systems. The app works as it follows: firstly, there is an initial screen where it is possible to choose if the drug will be administered according to the guidelines of the World Health Organization (WHO) or the Health Ministry of Brazil (step 1). According to WHO, praziquantel, which is available in 600 mg tablets, should be administered orally in a single dose of 40 mg/kg of body weight³. In Brazil, the Ministry of Health has its own guideline. Praziquantel dosage is prescribed according to the age group (children up to 15 years old or adult - step 2) and body weight of the individual and administered orally in a single dose of 50 mg/kg for adults and 60 mg/kg for children after a meal⁴. Subsequently, it is possible to enter the individual weight (step 3) and, through a calculation ($P \times D / 600$, where P is the weight and D is the dosage in mg of the drug), the recommended amount of tablets that should be administered to each patient (step 4) is informed. **Figure 1** summarizes the steps to use the PraziCalc app.

CONCLUSIONS

Through the use of this innovative mobile device-app, many benefits may occur for research in this area and for the infected population. Our purpose is to publicize and

make the PraziCalc app accessible to any health center that treats the disease with praziquantel, facilitating the incorporation of this treatment process directed to patients with schistosomiasis in endemic areas, who need preventive chemotherapy, in medical clinics and in health centers. We believe this tool will assist the medical and fieldwork teams in presenting a more dynamic, faster and safe method to deliver praziquantel in the recommended dosage where the drug is still administered based on body weight.

CONFLICT OF INTERESTS

The authors have declared that no competing interests exist.

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REFERENCES

1. World Health Organization. Schistosomiasis: number of people treated worldwide in 2014. *Wkly Epidemiol Rec.* 2016;91:53-60.
2. World Health Organization. The control of schistosomiasis: report of a WHO expert committee. Geneva: WHO; 1985.
3. World Health Organization. Preventive chemotherapy in human helminthiasis: coordinated use of anthelmintic drugs in control interventions: a manual for health professionals and programme managers. Geneva: WHO; 2006.
4. Brasil. Ministério da Saúde. Secretaria de Vigilância em Saúde. Departamento de Vigilância das Doenças Transmissíveis. Vigilância da esquistossomose mansoni: diretrizes técnicas. 4ª ed. Brasília: Ministério da Saúde; 2014.
5. Mutapi F, Maizels R, Fenwick A, Woolhouse M. Human schistosomiasis in the post mass drug administration era. *Lancet Infect Dis.* 2016;17:e42-8.
6. Palha De Sousa CA, Brigham T, Chasekwa B, Mbuya MN, Tielsch JM, Humphrey JH, et al. Dosing of praziquantel by height in sub-Saharan African adults. *Am J Trop Med Hyg.* 2014;90:634-7.
7. Nordin P, Poggensee G, Mtweve S, Krantz I. From a weighing scale to a pole: a comparison of two different dosage strategies in mass treatment of *Schistosomiasis haematobium*. *Glob Health Action.* 2014;7:25351.
8. Baan M, Galappaththi-Arachchige HN, Gagai S, Aurlund CG, Vennervald BJ, Taylor M, et al. The accuracy of praziquantel dose poles for mass treatment of schistosomiasis in school girls in KwaZulu-Natal, South Africa. *PLoS Negl Trop Dis.* 2016;10:e0004623.