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## RESEARCH ARTICLE

### AVAILABILITY AND COST OF HYDROXYUREA USED IN THE MANAGEMENT OF SICKLE CELL DISEASE IN LUBUMBASHI, DEMOCRATIC REPUBLIC OF CONGO

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#### ABSTRACT

The lack of availability, accessibility and cost of hydroxyurea, a drug used in the treatment of sickle cell anemia in Lubumbashi, is a major obstacle to improving the health status of sickle cell disease and also decreases the quality of care provided. This research aims, the study on the availability and cost of hydroxyurea used in the treatment of sickle cell anemia in Lubumbashi. **Methods:** This is a descriptive cross-sectional study conducted from 1 October to 30 November 2016. The data were collected through a questionnaire developed for this purpose and subject to 160 officials pharmacies and wholesale establishments (EVG) of the city of Lubumbashi. These data were analyzed from the Microsoft Excel 2013 for the calculation of the mean and standard deviation. **Results:** Our study showed that over 140 pharmacies surveyed, hydroxyurea was available in 14 pharmacies 10% in capsule form dosed at 500 mg, manufactured by Bristol-Myers Squibb Canada lab named "Hydrea®" which is the trademark of that laboratory and an average cost of  $14535 \pm 3371.05$  Congolese Francs (FC) equivalent to  $14.83 \pm 3.44$  US dollars (US \$) for the box of 20 capsules 500mg. Regarding frequented EVG 20, 10 or 50% disponilisaient product at an average cost of  $11063 \pm 3190.60$  FC representing  $11.29 \pm 3.26$  US \$ for the same box. **Conclusion:** Ignorance of hydroxyurea by the majority of managers (not pharmacists) pharmacies makes it virtually unavailable and the cost seems high for lack of financial means of the parents of affected children.

**Key words:** Availability, Cost, Hydroxyurea, Sickle Cell, Lubumbashi.

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#### INTRODUCTION

Pharmaceuticals are a key component of health systems in all countries of the world. They can not afford the protection or recovery of people's health if these products are available, accessible, affordable to these people, but especially if used rationally (Tshakala *et al.*, 2005).

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In Africa, particularly the Democratic Republic of Congo (DR. Congo), the lack of availability and accessibility of drugs is a major obstacle to improving the health status of populations and also decreases the quality of care (Tshakala *et al.*, 2005).. These include hydroxyurea is an anticancer drug belonging to the anti-metabolites group, in the form of capsules of 500mg and manufactured by company Bristol-Myers Squibb Canada under the brand name "Hydrea®". This drug is also used in the treatment of sickle cell disease in children older than 3 years, having at least three vaso-occlusive crisis (VOC) per year or acute chest syndrome (ATS) or anemia severe.

The effectiveness of this treatment will be assessed after a minimum of six months of treatment (Montalembert *et al.*, 1997; 2006). Sickle cell disease is a genetic blood disorder, affecting red blood cells, hereditary and transmitted by both parents who are each carriers of a disease gene. This is a serious chronic or life-threatening (median life 50 to 55 years in France, where there are suitable care services), which manifests itself in early childhood (from six months) (Njiengwé, 2005; Faure, 2006; Nacoulma *et al.*, 2006). Sickle cell disease is a major public health problem with a high prevalence of the major forms homozygous SS. DR. Congo, subjects homozygous Congolese (SS) are mostly holders of the Bantu haplotype which is a more severe disease expression. 20 to 30% of the population carries the sickle cell trait (AS) and about 2% of newborns have the homozygous (SS) of the disease (Tshilolo and Labie, 2003; Faure, 2006; Tshilolo *et al.*, 2007).

The projections in the country indicate that each year are born in the DR. Congo over 52,000 children homozygous SS, a quarter of new cases recorded in Africa. The main clinical manifestations in childhood include mainly hand-foot syndrome, severe acute anemia, splenic sequestration, painful crises and severe infections (meningitis, pneumonia, osteomyelitis, etc. (Tshilolo *et al.*, 2007). At this risk of serious complications pathology may occur, these include many CVO above 3 per year for at least two years, the STA and anemia severe with lower hemoglobin 7g, requiring the use of hydroxyurea and that under supervision of a specialist (Charache *et al.*, 1995; Bernaudin, 2008; Ngasia *et al.*, 2011). The study conducted at Texas Childrens Center for Global Health, Baylor College of Medicine, in the United States of America (USA) has shown that hydroxyurea is currently the only product approved for the treatment of sickle cell disease because it increases successively total hemoglobin, fetal hemoglobin and mean corpuscular volume and at the same time a decrease in transfusion, painful crises, chest seizures, hospitalizations and pneumococcal infections (Fishbein, 1963; Dover *et al.*, 1986; Charache *et al.*, 1992; Arnaud *et al.*, 2005; Bernaudin *et al.*, 2005; Ngasia *et al.*, 2011). Therefore, the objective of this research is to study the availability and cost of hydroxyurea used in the treatment of sickle cell anemia in Lubumbashi.

## MATERIALS AND METHODS

This cross-sectional descriptive study was conducted in 7 towns of Lubumbashi, Haut-Katanga Province in DR. Congo, specifically in 140 pharmacies and 20 wholesale facilities (EVG) for the period from 1 October to 30 November 2016, starting from the research sheet given by the Faculty of Pharmaceutical Sciences of the University of Lubumbashi. The managers of these entities were asked to answer questions about the knowledge of hydroxyurea, availability and cost. Among the information that concerned them, we noted the name, gender and education level. The collected parameters were noted in a research registry and entered on computer and analyzed using Microsoft Excel 2013 for the calculation of the mean and standard deviation.

## RESULTS

**Distribution of officials and pharmacies EVG sex:** Female gender was dominant with a staff of 90 cases or 56.25%, of

which the sex ratio is 1.28. This study showed no female presence in EVG (Table I).

**Distribution of officials and pharmacies according EVG Public and level of education:** It is clear from this research that over 160 heads of EVG and pharmacies, 62 cases or 38.75% were pharmacists, including 40 located in the town of Lubumbashi, in precisely 20 EVG and 20 pharmacies. As for non-pharmacists, they represent 98 cases or 61.25%, including nurses (21.87%), unskilled tenants (19.37%), graduates of state (18.75%) and doctors (1, 25%), divided into the remaining common (Table II).

**Distribution of officials and pharmacies according EVG Public and knowledge of hydroxyurea:** It appears from these results that 93 or 58.12% of managers and pharmacies EVG ignored the drug hydroxyurea and all left in the six communes except that of Lubumbashi. (Table III).

**Distribution of hydroxyurea as municipalities, the availability and cost in pharmacies:** Of the 140 surveyed pharmacies, 14 or 10% disponibilisaient hydroxyurea at an average cost of  $14535 \pm 3371.05$  Congolese Francs (FC) equal to  $14.83 \pm 3.44$  US dollars (US \$) for the box of 20 capsules dosed at 500mg and these pharmacies were located only in the town of Lubumbashi (Table IV).

**Distribution of hydroxyurea as municipalities, the availability and cost in the EVG:** The data showed that the EVG existed only in the common Lubumbashi and 20 EVG surveyed, 10 or 50% disponibilisaient hydroxyurea at an average cost of  $11063 \pm 3190.60 \pm 11.29$  FC equal to 3, US \$ 26 for 20 capsules box dosed at 500mg (Table V).

## DISCUSSION

The discussion of the results of this study focuses on the following: the distribution of EVG makers and pharmacies by sex, level of education, knowledge of hydroxyurea and distribution of the drug according to the Commons, availability and cost to the entities mentioned above. Distribution of officials by gender: Table I shows that of 160 cases is 100% responsible for EVG and pharmacies, 90 cases or 56.25% were female and all were in pharmacies and not in the EVG. This feminine frequency in pharmacies (Dispensaries) was also found in a study conducted in France by gender and type of contract of pharmacists working in pharmacies. 75% of these pharmacists were women and 25% men. The only difference is that all these women are pharmacists, unlike those of Lubumbashi (<https://fr.statista.com/statistiques/514434/repartition-pharmaciens-etablisements-sante-sexe-contrat-france/>). According to the educational level, Table II shows that 98 officials (61.25%) pharmacies were not pharmacists but nurses (21.87%), tenants without any education level (19.37%), status graduates (18.75%) and doctors (1.25%). The frequency of non-pharmacists in pharmacies render certain drugs including hydroxyurea virtually unavailable through ignorance, while the pharmaceutical legislation of DR. Congo and Morocco say that no one can manage a pharmacy he owns the pharmacy diploma or degree required for an equivalent (Schedule to the Ordinance-Law No. 91-018 of 30 May 1991; Van den Brink, 2003; Nhaili, 2014) Regarding the knowledge of hydroxyurea makers EVG and pharmacies as municipalities, the results show that 93 officials is 58.12% did not know the drug.

**Table I. Distribution of officials and pharmacies EVG sex**

| Entity     | Sex         |             |
|------------|-------------|-------------|
|            | Male        | Female      |
| EVG        | 20          | -           |
| pharmacies | 50          | 90          |
| Total      | 70 (43.75%) | 90 (56.25%) |

**Table II. Distribution of officials and pharmacies according EVG Public and level of education**

| Town       | Level of studies |             |                     |                 |           |
|------------|------------------|-------------|---------------------|-----------------|-----------|
|            | Pharmacists      | Nursing     | Unqualified tenants | Graduates state | Doctors   |
| Lubumbashi | 40               | -           | -                   | -               | -         |
| Kampemba   | 7                | 2           | 7                   | 2               | 2         |
| Kamalondo  | 4                | 6           | 5                   | 5               | -         |
| Kenya      | 4                | 5           | 4                   | 7               | -         |
| Ruashi     | 3                | 7           | 6                   | 4               | -         |
| Katuba     | 2                | 8           | 6                   | 4               | -         |
| Annex      | 2                | 7           | 3                   | 8               | -         |
| Total      | 62 (38.75%)      | 35 (21.87%) | 31 (19.37%)         | 30 (18.75%)     | 2 (1.25%) |

**Table III. Distribution of officials and pharmacies according EVG Public and knowledge of hydroxyurea**

| Town       | Knowledge   | Ignoring    |
|------------|-------------|-------------|
| Lubumbashi | 40          | -           |
| Kampemba   | 8           | 12          |
| Kamalondo  | 5           | 15          |
| Kenya      | 6           | 14          |
| Ruashi     | 3           | 17          |
| Katuba     | 3           | 17          |
| Annex      | 2           | 18          |
| Total      | 67 (41.87%) | 93 (58.12%) |

**Table IV. Distribution of hydroxyurea as municipalities, the availability and cost in pharmacies**

| Town       | pharmacies                               |             |  |
|------------|--|-------------|--|
|            | Hydroxyurea: box of 20 capsules of 500mg |             |  |
|            | Available                                | Unavailable | average cost                           |
| Lubumbashi | 14                                       | 6           | 14535 ± 3371,05FC (US \$ 14.83 ± 3.44) |
| Kampemba   | -  | 20          |  |
| Kamalondo  | -  | 20          |  |
| Kenya      | -  | 20          |  |
| Ruashi     | -  | 20          |  |
| Katuba     | -  | 20          |  |
| Annex      | -  | 20          |  |
| Total      | 14 (10%)                                 | 126 (90%)   |  |

**Table V. Distribution of hydroxyurea as municipalities, the availability and cost in the EVG**

| Town       | Wholesale Establishment (EVG)            |             |   |
|------------|--|-------------|---|
|            | Hydroxyurea: box of 20 capsules of 500mg |             |   |
|            | Available                                | Unavailable | average cost                            |
| Lubumbashi | 10                                       | 10          | 11063 ± 3190.60 FC (US \$ 11.29 ± 3.26) |
| Kampemba   | -  | -           |   |
| Kamalondo  | -  | -           |   |
| Kenya      | -  | -           |   |
| Ruashi     | -  | -           |   |
| Katuba     | -  | -           |   |
| Annex      | -  | -           |   |
| Total      | 10 (50%)                                 | 10 (50%)    |   |

This frequency of ignorance was represented by non-pharmacists by reference to Table II returned as the Public and level of education. Concerning the availability and cost of Hydroxyurea in Pharmacies, Table IV shows that said the drug was virtually unavailable as 140 pharmacies surveyed, 14 or 10% only disponibilisaient and all these pharmacies were in the town Lubumbashi.

This virtual unavailability is linked to ignorance of this product by non-pharmacists who managed the majority of pharmacies and the location of the latter in the town of Lubumbashi could be justified by the fact that it is the most urbanized and abounds center of the city of Lubumbashi, the second city after the Kinshasa DR. Congo (Yannick *et al.*, 2014; //fr.wikipedia.org/w/index.php? title= Lubumbashi andoldid=145236036).

As for the average cost of the medication amounts to 14535 ± 3371.05 FC equivalent to 14.83 ± US \$ 3.44 for a box of 20 capsules of 500mg, it seems high for parents of affected children by lack of funds, as this treatment is long-term (at least six months), compared to R and D. Congo is today, despite its immense natural wealth, classified among the poorest countries in the world whose population is too déminue to afford medical care or buy medicine. The gross domestic product (GDP) per capita is US \$ 394.25 / year, or 32.8 US \$ / month or US \$ 1 / day. 87.7% of Congolese live below the poverty line (Wembonyama *et al.*, 2007; <https://www.google.com/search>).

The availability and cost of hydroxyurea in EVG as shown in Table V, show that of the 20 EVG respondents, 10 or 50% disponibilisaient this drug at an average cost de 11063 3190.60 ± 11.29 ± equal FC US \$ 3.26 and all these EVG are located in the town of Lubumbashi. Referring to Article 48 talking profit margins of pharmaceutical products set by the Ministry of R and D in the economy. Congo, which are 20% for EVG and 33% for pharmacies, we say that the retailer price or price of hydroxyurea in pharmacies respects the margin, but still seems high to those concerned for the reasons mentioned above (Wembonyama *et al.*, 2007; <https://www.google.com/search>; [http://www.leganet.cd/Législation/Droit%20Economic/Regulatory Products / AM.1250. 008. 28.09. 2015.html](http://www.leganet.cd/Législation/Droit%20Economic/RegulatoryProducts/AM.1250.008.28.09.2015.html)).

## Conclusion

Ignorance of hydroxyurea, a drug used in the treatment of sickle cell anemia in Lubumbashi by most people other than pharmacists who manage the majority of pharmacies, makes it virtually unavailable product and its cost appears high by to the financial resources of parents with sickle cell disease. The initiation of a national program and management of sickle cell disease by the Congolese government, as is the case for malaria, tuberculosis and HIV / AIDS is essential to help sickle cell.

## Author Contributions

**Bushiri Furaha Mathilde:** Contributed to the collection of data and writing of the manuscript.

**Bokanya Impele Alex:** Contributed data processing

**Bushiri Mitamba Jolie:** Contributed to the drafting of Article

**Katende Masanka Philomène:** Contributed to the seizure of the article

**Ali Kaponda Alain:** Contributed to the drafting of Article

**Kakuru Kambale Simon:** Contributed to the drafting of Article

**Kabamba Nzaji Michel:** Contributed to the revision of Article

**Panda Mulefu Jules:** Contributed to the drafting of Article

**Kodondi Kule-koto Fridolin:** contributed to the validation protocol and coordination of the study

**Conflicts of interest:** None

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