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**Research Article****KNOWLEDGE OF THE RISKS ASSOCIATED WITH MISUSE OF ACETAMINOPHEN AMONG SELF-MEDICATION USERS VISITING PHARMACIES DURING THE COVID-19 PANDEMIC IN ABIDJAN**

<sup>1, 2, \*</sup> Aïssata DIAKITE, <sup>1</sup> Djedji Mériadec Jacquelyn OBIKOI, <sup>3, 4</sup> Kadio Jean-Jacques Olivier KADIO, <sup>1, 2</sup> César Pacôme BEKEGNAN and <sup>1</sup> Grace BAH-OTTANGBA

<sup>1</sup>Drugs Sciences, Analytical Sciences and Public Health Sciences Laboratory (3SMAP), School of Pharmacy and Biology, University Felix Houphouët-Boigny, Abidjan, Côte d'Ivoire

<sup>2</sup>Toxicology Laboratory (TL), National Public Health Laboratory (NPHL), Abidjan, Côte d'Ivoire

<sup>3</sup>Department of Pharmacy, Faculty of Health Sciences and Technology, Gamal Abdel Nasser University of Conakry (UGANC), Conakry, Guinea

<sup>4</sup>Guinea Infectious Diseases Research Centre, Gamal Abdel Nasser University of Conakry (UGANC), Conakry, Guinea

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**Abstract**

Due to the SARS-CoV-2 Covid-19 pandemic, acetaminophen has been widely recommended by health authorities and has led the majority of patients seeking treatment in private pharmacies. However, if misused, severe hepatotoxicity with a very poor prognosis may occur. The aim of our study was to assess the level of knowledge about the risks associated with acetaminophen misuse among peoples visiting pharmacies in Abidjan to purchase acetaminophen without a prescription during the COVID-19 pandemic. A multicentre cross-sectional survey was conducted from February 2021 to September 2021 among patients visiting 10 private pharmacies in Abidjan to purchase a paracetamol-containing medicine without a prescription. A questionnaire was administered by a student using the Kobocollect application. An overall score for knowledge of the proper use of acetaminophen was determined (score > 6 points/9) and specific knowledge of the risks associated with misuse was assessed. A total of 300 participants with mean age of 35.3 years 15.8 years old participated in the survey, of whom only 16% had sufficient knowledge about acetaminophen and its proper use. Only 26% of respondents were aware of the risk of hepatotoxicity in the event of an overdose, and 34% believed that there was no risk when consuming alcohol simultaneously with acetaminophen. Our findings during the COVID-19 pandemic demonstrate the need to adjust health policies and improve communication with the public in order to prevent the risk of unintentional acetaminophen poisoning.

**Keywords:** Paracetamol; Misuse; Knowledge; Toxicity; Covid-19.

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**INTRODUCTION**

Paracetamol or acetaminophen (N-acetyl-para-aminophenol) is the most widely sold and prescribed medicine in the world [1]. It is commonly sold alone or in combination, as an analgesic and antipyretic, but also as a first-line treatment for symptoms associated with COVID-19 [2]. Due to the SARS-CoV-2 Covid-19 pandemic, paracetamol has been widely recommended by health authorities because of the risk of serious complications from non-steroidal anti-inflammatory drugs (NSAIDs) in cases of viral infections [3]. In March 2020, the World Health Organisation (WHO) formally recommended that people with symptoms of COVID-19 use paracetamol and avoid the use of ibuprofen [4]. This announcement led to a disproportionate increase in sales volumes of medicines containing paracetamol [5,6]. However, it is well established that irrational use of paracetamol exposes patients to a significant risk of hepatotoxicity, which is often fatal. Currently, paracetamol overdose is considered to be the leading cause of poisoning worldwide. In the United States and the United Kingdom, it is the leading cause of acute liver failure requiring transplantation, far ahead of other drug-related and viral causes [7-9]. As paracetamol is a non-prescription medicine, it is widely self-medicated among the population. However, several studies warn that users do not have sufficient knowledge to guarantee its safe use.

In France (2016), four out of five patients consulting a general practitioner had insufficient knowledge of paracetamol and 20.3% were at risk of overdose [10]. Côte d'Ivoire is one of the regions of the world where malaria is endemic, and the use of paracetamol to combat the fever associated with this disease is common. In the context of the COVID-19 pandemic, symptoms such as fever, headache, joint pain and fatigue could lead the population to use paracetamol without a prescription to prevent or treat the perceived symptoms of the disease. We therefore thought it would be interesting to conduct a survey of paracetamol users during this pandemic period, when they were exposed to a flood of information, some of it contradictory, about the safety of paracetamol use. The objective of our study was to assess the level of knowledge about the risks associated with paracetamol misuse among individuals visiting pharmacies in Abidjan to purchase paracetamol without a prescription during the COVID-19 pandemic.

**MATERIALS AND METHODS****Research setting**

The study was conducted in private pharmacies in the District of Abidjan, which has 580 pharmacies spread across the District's ten municipalities.

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\*Corresponding Author: Aïssata DIAKITE,

## Type of study and duration

This was a descriptive cross-sectional study including subjects visiting a private pharmacy to purchase paracetamol without a prescription. The study period ran from February 2021 to September 2021, during the height of the first wave of the COVID-19 pandemic in Côte d'Ivoire.

## Study participants

The target population consisted of customers of private pharmacies in the District of Abidjan who spontaneously came to purchase, without a prescription, for themselves or a relative, medicines containing paracetamol alone or in combination. The study included adults of either sex who had signed the informed consent form. The study had previously been approved by the National Council of the Order of Pharmacists in Côte d'Ivoire under number 50/CNOP/P/DA/PE/20 of 16 December 2020.

## Type of sampling

The pharmacies were selected from the official list of private pharmacies in the District of Abidjan provided by the National Union of Private Pharmacies of Côte d'Ivoire (NUPPCI). From this list, an initial selection of 10 municipalities was made. Then, three pharmacies were randomly selected in each municipality. Thus, 30 pharmacies were included in our study and served as the basis for our survey. The survey of patients in these 30 pharmacies yielded approximately 10 questionnaires per pharmacy, for a total of 300 questionnaires, without disrupting the pharmacies' activities. If the owner of a selected pharmacy did not wish to participate, another pharmacy was randomly selected from the same municipality to replace it.

## Data collection tool

A questionnaire was adapted from studies conducted on knowledge of paracetamol after a review of the relevant literature on the subject [10,11]. The questionnaire was pre-tested with 50 pharmacists from private pharmacies in the study area and a few minor changes were made to improve comprehension. The average time taken to complete the questionnaire was 10 minutes. The questionnaire was administered with the assistance of the investigator (PharmB student). At the end of the survey, participants were given an information sheet on the proper use of paracetamol.

The final version consisted of 21 items organised around three themes in order to meet the objectives of our study: 1) the socio-demographic characteristics of respondents, 2) knowledge of paracetamol and its proper use, and 3) knowledge of the risks associated with paracetamol misuse.

## Data management, analysis and interpretation

The collected data was entered into the Kobocollect application, version 2022.3.6. Statistical analyses were performed using RStudio software, version 4.1.3. A list of the six best-selling painkillers in Côte d'Ivoire was given to participants so that they could identify those containing paracetamol. The proportion of correct answers for each medicine was expressed as a percentage. In addition, participants were asked questions about their knowledge of the

correct use and recommended dosage according to the summary of product characteristics (SPC). A knowledge score was calculated based on similar studies conducted in France by Séverin and Cipolat [10,11]. Depending on the scoring method used, the answers to questions 7 to 11 and 14 to 17 were used to calculate the knowledge score out of 9 points. The criteria for calculating and interpreting the knowledge score are detailed in the supplementary material [Appendix 1]. Participants who scored above 6 out of 9 (66%) had a good level of knowledge about paracetamol [11]. At the same time, participants' self-reported level of knowledge was reported in two ways: good knowledge and poor knowledge. Knowledge of the risks associated with overdose was assessed through three questions relating to the clinical consequences of overdose (severity and impact) and the combination of paracetamol with alcohol consumption.

## RÉSULTS

Overall, 300 subjects residing in the District of Abidjan participated in the survey during the Covid-19 pandemic.

### Characteristics of participants

The mean age of participants was 35.3 years old 15.8 years, ranging from 18 to 66 years. The most represented age group was 25 to 40 years (61%). The sample consisted mainly of men (60%). Twenty-two per cent suffered from chronic painful conditions (osteoarthritis, arthritis, rheumatoid arthritis), and 63% reported taking paracetamol more than once a month. In addition, 32% of respondents reported occasionally purchasing paracetamol outside of pharmacies, on the street market [Tableau 1].

**Table 1. Profile of patients purchasing paracetamol without a medical prescription in private pharmacies in Abidjan during the COVID-19 pandemic (2021)**

Characteristics	Number	Percentage (%)
Sex		
Women	119	40
Men	181	60
Age (year)		
[18 – 25[	33	11
[25 – 40[	184	61
+ 40	83	28
Median (IQR)	34 years (28 – 41) years	
Min - Max	(18 – 66) years	
History of chronic painful illness		
Yes	65	22
No	235	78
Reported frequency of consumption prior to the survey		
Less than once a month	111	37
More than once a month	189	63
Habit of purchasing paracetamol outside of pharmacies		
Yes	98	32
No	202	68
Source of information before taking paracetamol*		
Physician	119	39,6
Pharmacist	122	40,6
Medicine leaflet	75	25
Internet	30	10
Entourage / neighbours	54	18
I am not requesting any information.	105	35

\* Several answers were possible, for example: General practitioner + Internet, or Neighbours + Notice.

### Knowledge about the proper use of paracetamol

Data relating to participants' general knowledge of paracetamol and its proper use are summarised in Table 2.

**Table 2 : Knowledge of patients purchasing paracetamol without a medical prescription on its proper use during the COVID-19 pandemic in Abidjan (2021)**

Field of knowledge	Number	Percentage (%)
Identification of medicines containing paracetamol		
Diclofenac® (Diclofenac)	60	20
Doliprane® (Paracetamol) <sup>(a)</sup>	258	86
Fervex® (Paracetamol+pheniramine) <sup>(a)</sup>	165	55
Ibex® (Ibuprofen)	132	44
Litacold® (Paracetamol+chlorpheniramine+phenylephedrine+ caffeine) <sup>(a)</sup>	144	48
Sedaspir® (acetyl salicylic acid +caffeine+codeine)	78	26
Identification of the 3 medicines containing paracetamol	15	5
Therapeutic indications for paracetamol <sup>(b)</sup>		
Relieves pain <sup>(a)</sup>	276	92
Reduce fever <sup>(a)</sup>	159	53
Combats general fatigue	129	43
Treats nervousness and anxiety	7	2,3
Helps prevent Covid-19 infection	54	18
Indications according to Marketing Authorization		
Off-labelled indication of paracetamol	165	55
Indication in accordance with the marketing authorization	135	45
Frequency of dose intakes		
Once a day	60	20
1 to 4 times a day <sup>(a)</sup>	237	79
More than 4 times a day	3	1
Maximum single dose per intake		
500 milligrams	42	14
1 gram <sup>(a)</sup>	243	81
2 grams	13	4,3
There is no maximum single dose.	21	0,7
Maximum Daily Dose		
2 grams	168	56
3 grams	81	27
4 grams <sup>(a)</sup>	36	12
More than 4 grams	4	1,3
There is no maximum daily dose	12	4
Weight below which the paracetamol dose should be adjusted		
Below 40 kg	51	17
Below 50 kg <sup>(a)</sup>	60	20
I don't know	189	63
Comprehensive knowledge about paracetamol		
Good level of knowledge measured by a score > 6 out of 9	48	16
Good level of self-reported knowledge	66	22

<sup>(a)</sup> The answer is correct.

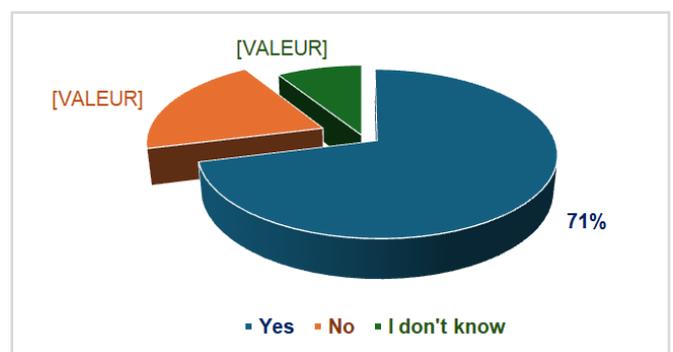
<sup>(b)</sup> Several answers were possible, for example: General practitioner + Internet, or Neighbours + Notice.

The majority of respondents were able to correctly identify Doliprane® as a medicine containing paracetamol (86%). Approximately 55% identified Fervex® as a medicine containing paracetamol and 48% identified Litacold® as such. However, only 5% were able to correctly identify all three medicines containing paracetamol. A large majority of participants (92%) knew that paracetamol was indicated for pain management, while 53% knew that paracetamol was indicated for treating fever. However, 43% of participants believed that paracetamol was indicated for fatigue, and 18% believed that it was indicated for preventing COVID-19 infection. Participants' knowledge of the paracetamol dosage regimen was assessed. The majority (81%) of respondents had a good understanding of the maximum single dose of 1 gram per intake, as stated in the Summary of Product Characteristics (SPC). Only 12% knew the maximum authorised daily dose of 4 grams/day. Of the 300 subjects surveyed, 100 (33%) had accurate knowledge of the dosage interval for adults according to the SPC. As for dose adjustment, 20% of participants knew that the paracetamol dose should be adjusted when the patient's weight was less than 50 kg, while 17% mistakenly believed that the adjustment should be made for weights below 40 kg. A majority admitted that they did not know the weight below which the paracetamol dose should be adjusted. According to the criteria used to calculate the overall knowledge score on paracetamol, only 16% of respondents were classified as having sufficient knowledge of paracetamol and its proper use (score > 6 out of 9).

However, 22% of respondents stated that they had good knowledge of paracetamol [Table 2].

#### Knowledge about the risks associated with overdose

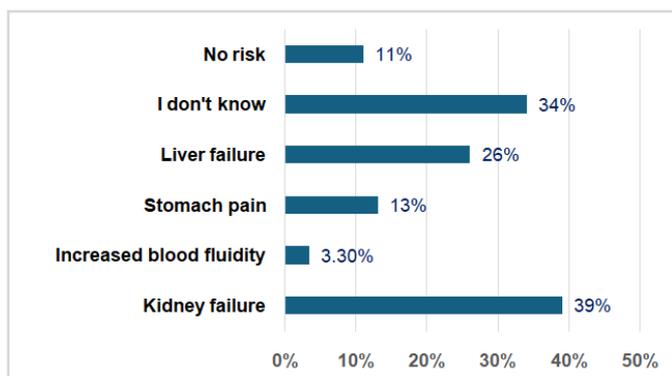
More than 7 out of 10 participants knew that an overdose of paracetamol could have serious and irreversible consequences on health [Figure 1].



**Figure 1: Respondents' knowledge of the serious and irreversible consequences associated with paracetamol overdose (N = 300)**

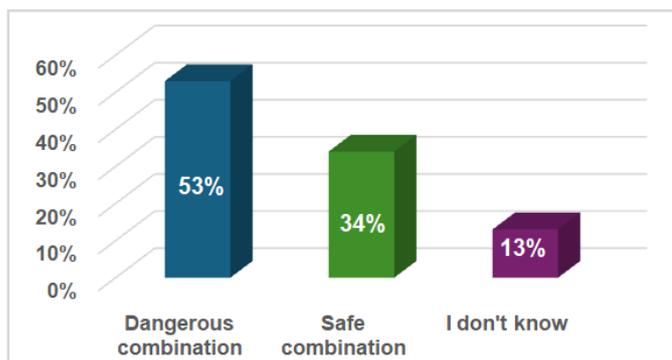
Regarding the organs that can be affected in the event of an overdose, only 26% of respondents were aware of the risk of hepatotoxicity, while the majority believed that the kidneys were the main organ affected. Furthermore, 34% admitted that

they did not know which organ was affected in the event of an overdose, while 11% believed that paracetamol was safe to use regardless of the dose [Figure 2].



**Figure 2. Respondents' knowledge of the organs affected or the risk of paracetamol overdose (N = 300)**

When asked about the negative health consequences of combining paracetamol with alcohol consumption, more than half knew that this was a dangerous combination and should be avoided. However, 34% thought that there was no risk and 13% did not know whether such a combination carried any risks [Figure 3].



**Figure 3. Respondents' knowledge of the potential negative consequences of taking paracetamol and consuming alcohol at the same time (N = 300)**

## DISCUSSION

The Covid-19 pandemic has been a period of unprecedented social and economic upheaval for Africa [12, 13]. The disorganisation of healthcare systems and limited access to hospital care have led the majority of patients seeking treatment to turn to private pharmacies [14, 15]. Our study of 300 individuals who visited a private pharmacy in Abidjan to purchase paracetamol without a prescription is, to our knowledge, the first source of data on awareness of the risks associated with paracetamol misuse during the first wave of the COVID-19 pandemic. Our results showed that the majority of respondents were able to identify Doliprane®, the best-selling brand in Côte d'Ivoire and the subject of advertising, as containing paracetamol. However, only 5% were able to identify the three medicines offered that actually contained paracetamol. This situation is alarming in that these medicines are likely to be used simultaneously by participants, potentially exposing them to a risk of hepatotoxicity due to cumulative doses of paracetamol [16, 17]. Our results indicate that 32% of subjects who obtained paracetamol without a prescription during the COVID-19 pandemic occasionally purchased it

outside of pharmacies, on the street market. This trend is much higher than that observed in Conakry before the pandemic, where 20.3% of users who self-medicated with paracetamol turned to the street market [18]. Overall, our study reveals that a majority of respondents had a good understanding of the use of paracetamol in the treatment of pain and fever, symptoms associated with COVID-19, but also with malaria, which is endemic in Côte d'Ivoire. This finding is consistent with results observed elsewhere in West Africa [18,19].

Furthermore, our results showed that a large proportion of respondents had poor general knowledge about paracetamol and its proper use, which is consistent with the results reported by Mostafa et al. in Egypt during the COVID-19 pandemic and Touré in Guinea Conakry before the pandemic [18, 20]. It should be noted that a large proportion had relatively good knowledge of the unit dose per intake. However, knowledge of the daily dose per intake, the spacing between doses, and the weight at which a dose adjustment was necessary was very low. More specifically, knowledge of the risks associated with misuse or overdose of paracetamol showed some gaps. A number of participants were unaware of the toxicity risks or negative health consequences associated with irrational use of paracetamol. In our study, two-thirds of participants believed that taking an excessive dose of paracetamol could have serious and irreversible health consequences, in line with a study conducted in France among patients admitted to emergency departments [21]. However, only 1 in 4 respondents were aware of the risk of hepatotoxicity caused by paracetamol overdose. These results contradict those of Mosfata, who found that 34.7% of subjects who purchased paracetamol without a prescription from a pharmacy in Egypt were aware that the liver was the main organ affected in cases of overdose [20]. The risk of hepatotoxicity may also be increased in cases of fasting, malnutrition, and chronic alcoholism [22]. In our sample, only half were aware of the potential toxicity risk associated with alcohol consumption when taking therapeutic doses of paracetamol. Furthermore, 34% of respondents believed that there was no risk in combining alcohol and paracetamol. In several American studies, subjects at risk of unintentional poisoning were alcoholic patients suffering from chronic pain who consumed paracetamol over a long period of time [23-26]. Our findings suggest that during the COVID-19 pandemic, participants occasionally purchased paracetamol outside of pharmacies (street market) and tended to use it for off-label indications, particularly to prevent COVID-19 infection. However, purchasing paracetamol on the street market was much less common than in Guinea Conakry, where nearly 72% of people who purchased paracetamol without a prescription expressed a desire to obtain it outside the legal drug distribution channel [18]. Although the mortality rate associated with paracetamol-induced hepatotoxicity in the Ivorian population is currently unknown, the toxicity risk associated with misuse remains significant given the limited knowledge of our sample. Our study has some limitations. On the one hand, the questionnaire was administered by a PharmB student or assistant pharmacist, which may have introduced a desirability bias, prompting respondents to be more cautious in reporting doses, frequency of use and perception of toxicity risk. Secondly, the sample was limited to subjects who purchased their paracetamol in pharmacies, whereas a proportion of the general population purchases it on the street market, which prevents any generalisation of our results to paracetamol users in Côte d'Ivoire.

## Conclusion

Our study highlighted gaps in knowledge about the negative consequences associated with paracetamol misuse among individuals who purchased this medicine without a prescription during the COVID-19 pandemic. In addition, our results showed that a large proportion used the drug for off-label indications and tended to obtain it outside the legal drug supply chain. The inappropriate use of paracetamol during the study period exposed subjects to risks of hepatotoxicity with a poor prognosis in a country where liver transplants are virtually inaccessible. The findings made during this Covid-19 pandemic should serve as a basis for establishing health policies to effectively prevent the risks of unintentional paracetamol poisoning.

**Declaration of interests:** The authors declare that they have no conflicts of interest.

## Authors' contribution

**Study design:** Aïssata Diakite

**Definition of methodology:** Aïssata DIAKITE and Kadio Jean-Jacques Olivier KADIO

**Conducting the investigation:** Djedji Mériadec Jacquelyn OBIKOI

**Interpretation of results:** César Pacôme BÉKÉGNRAN

**Manuscript written by:** Aïssata DIAKITE

**Critical review of the manuscript:** Pierre MANDA and Béatrice Tigori Sangaré

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#### ADDITIONAL FILE 1: Survey form (in french)

- **Sexe :** Masculin Féminin
- **Poids :** .....kg
- **Profession/Niveau d'étude :** .....
- **Souffrez-vous d'une maladie douloureuse chronique ?** (Une seule réponse)  
Oui Non
- **À quelle fréquence consommez-vous des médicaments contenant du paracétamol ?** (Cochez la case qui se rapproche le plus de votre consommation de paracétamol)  
Moins d'une fois par mois Plus d'une fois par mois
- **En général, dans quel cas utilisez-vous du paracétamol ?** (Plusieurs réponses)  
Soulager la douleur Faire baisser la fièvre  
En Cas de nervosité En cas de fatigue  
Douleurs d'Arthrose En prévention de la grippe
- **En cas de besoin, à quelle fréquence maximale pensez-vous du paracétamol ?** (Une seule réponse)  
1 fois / j  
1 à 4 fois / j  
Plus de 4 fois / j
- **Quelle dose maximale de paracétamol vous autorisez-vous en une prise ?** (Une seule réponse)  
500 mg  
1 g  
2 g  
Il n'y a pas de dose maximale / prise
- **Quelle dose maximale de paracétamol vous autorisez-vous par jour ?** (Une seule réponse)  
2 g  
3 g  
4 g  
Plus de 4 g  
Il n'y a pas de dose maximale
- **Parmi ces 3 posologies, laquelle choisirez-vous en cas de besoin ?** (Une seule réponse)  
1 g toutes les 3 heures  
1 g toutes les 4 heures  
1 g toutes les 6 heures

- **Pensez-vous avoir une bonne connaissance du paracétamol ?** (Une seule réponse)  
Oui Non
- **Pensez-vous qu'un surdosage en paracétamol puisse avoir des conséquences graves et irréversibles sur l'état de santé ?** (Une seule réponse)  
Oui Non Je ne sais pas
- **Quel est le principal risque de consommer trop de paracétamol dans la journée ?** (Plusieurs réponses possibles)  
Problèmes de rein Problèmes de foie  
Douleurs à l'estomac Augmentation de la fluidité du sang  
Je ne sais pas Aucun risque, son utilisation est sûre
- **Pensez-vous qu'il puisse y avoir un risque à consommer de l'alcool en même temps que du paracétamol ?** (Une seule réponse)  
Oui Non Je ne sais pas
- **En dessous de quel poids faut-il diminuer la dose de paracétamol ?** (Une seule réponse)  
40 kg 50 kg Je ne sais pas
- **Parmi ces médicaments lesquels contiennent du paracétamol ?** (Plusieurs réponses possibles)  
Ibex® Diclo-Denk®  
Doliprane® Litacold®  
Fervex® Sedaspir®  
Je ne sais pas
- **Où cherchez-vous les informations concernant le paracétamol avant d'en consommer ?** (Plusieurs réponses possibles)  
Après de mon médecin traitant  
Après de mon pharmacien  
Internet  
En lisant la notice du médicament  
Après d'une personne de mon entourage exerçant un métier en relation avec la santé  
Je ne m'informe jamais avant de prendre du paracétamol
- **Aviez-vous déjà acheté du paracétamol en dehors d'une officine ?** (Une seule réponse)  
Oui Non
- **Si oui, Pourquoi ?** (Plusieurs réponses possibles)  
Parce que le prix serait moins élevé ?  
Pour pouvoir acheter en plus grande quantité ?  
Parce que ce n'est pas un produit dangereux ?  
Parce que vous pensez ne pas avoir besoin du conseil d'un pharmacien pour l'utiliser correctement ?  
Parce que lors de la délivrance, le pharmacien ne vous renseigne en aucun cas sur l'usage ?
- **Quelles sont les situations qui vous conduisent à vous automédiquer par paracétamol plutôt que de consulter votre médecin ?** (Plusieurs réponses possibles)  
Car la lecture de la notice m'aiderait  
Du fait qu'il soit en vente libre  
Symptômes mineurs  
Je ne consulte jamais un professionnel de santé pour la prise de paracétamol  
Internet

#### ADDITIONAL FILE 2: Criter

#### ia for calculating the knowledge score (in french)

#### SCORE DE CONNAISSANCE / 9 points (Questions 7 à 11 puis 14 à 17)

- **Bon connaisseur si score de connaissance > 6/9**

**Question 7 : / 1 point**

- 1 point si (douleur OU arthrose OU maux de tête) ET fièvre ;
- 0,5 point si oublie douleur (arthrose OU maux de tête) OU si oublie fièvre ;
- 0 point si nomme aussi : nervosité OU fatigue OU prévention de la grippe.

**Question 8 : / 1 point**

- 1 fois par jour : 0,5 point. Sauf si répond 2 g par prise (ou pas de dose maximum par prise) à la question 9= 0 point ;
- 1 à 4 fois par jour : 1 point. Sauf si répond 2g par prise (ou pas de dose maximum par prise) à la question 9 = 0 point ;
- Plus 4 fois/jour : 0 point. Sauf si répond 500 mg par prise à la question 9 et ne dépasse pas 4 g/j (ou NE COCHE PAS : pas de dose maximum par jour) à la question 10 = 0.5 point.

**Question 9 : / note pouvant aller de -1 à 1 point**

- 1 g par prise = 1 point ;
- 500 mg par prise = 0,5 point ;
- 2 g par prise = 0 point ;
- Pas de dose maximum par jour = -1 point.

**Question 10 : / note pouvant aller de -1 à 1 point**

- 4 g ou 3 g par jour = 1 point (3 g considère comme juste car effectivement pour certains patients la dose maximale recommandée est 3 g) ;
- 2 g par jour = 0.5 point ;
- > 4 g par jour = 0 point ;
- Pas de dose maximale par jour = -1 point.

**Question 11 : / 1 point**

- 1 g toutes les 6 heures= 1 point ;
- 1 g toutes les 4 heures = 0,5 point ;
- 1 g toutes les 3 heures = 0 point.

**Question 14 : / note pouvant aller de -1 à 1 point**

- Problèmes de foie = 1 point ;
- Autre réponse = 0 point ;
- Pas de risque, son utilisation est sûre = - 1 point.

**Question 15 : / 1 point**

- Oui = 1 point ;
- Non ou je ne sais pas = 0 point.

**Question 16 : / 1 point**

- 50 kg = 1 point ;
- 40 kg ou je ne sais pas = 0 point.

**Question 17 : / 1 point**

- 4 médicaments contenant du paracétamol : 1 point ;
- 3 médicaments contenant du paracétamol : 0,75 point ;
- 2 médicaments contenant du paracétamol : 0.5 point ;
- 1 médicament contenant du paracétamol : 0,25 point ;
- Si un médicament ne contenant pas de paracétamol ; -0,5 point.

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