

## The Impact of EG and DEG Cases on Sales of Over-The-Counter Syrup

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**Abstract:** The Indonesian Food and Drug Authority (BPOM) investigated and listed safe and unsafe syrup products in response to the contamination of Ethylene Glycol (EG) and Diethylene Glycol (DEG), causing Acute Kidney Injury in pediatric patients. Unsafe products were recalled and removed from distribution, leading to uncertainty and panic among the public and significantly impacting over-the-counter syrup sales in several pharmacies. This retrospective observational study assessed the impact of EG and DEG contamination on the sales of over-the-counter syrup in Pharmacy X in South Denpasar. Data from three months before (August to October 18<sup>th</sup>, 2022) and three months following the official instruction was published (October 19<sup>th</sup>, 2022 to December 2022) were analyzed using Wilcoxon test. The findings reveal a staggering decline in the sales of over-the-counter syrup by 35,03% (p-value of 0.03). Moreover, there was a notable increase of prescriptions in powder forms. The contamination cases caused panic, resulting in changes in behavior and consumption patterns. Despite the availability of safety information on an official website, public hesitance toward syrup products persists, indicating the need to implement a more effective strategy to address misinformation and restore public trust. Each individual must be responsible for educating the public during crises to prevent the spread of misinformation, ultimately restoring trust and normal consumer behavior. Furthermore, efficient stock management should be implemented to anticipate potential health crises in the future proactively.

**Keywords:** *Acute Kidney Injury, EG and DEG cases, panic, pediatric, syrup sales.*

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### 1. INTRODUCTION

After three consecutive years of dealing with the COVID-19 pandemic, at the end of August 2022, Indonesia was surprised by an unexpected surge in cases of Atypical Progressive Acute Kidney Injury (APAKI), primarily affecting children under five years old. Data from November 2022 shows 323 cumulative cases and 190 recorded deaths (Kemenkes RI, 2022a). Symptoms include fever, cough, flu, anuria, reduced urine volume (oliguria), and digestive infections such as vomiting and diarrhea. These cases were suspected to result from post-Covid-19 hyperinflammatory reactions in children, also known as multisystem inflammation in children (MIS-C) (Kemenkes RI, 2022).

Around the same time, 66 pediatric deaths were reported

in Gambia due to Acute Kidney Injury (AKI) linked to contaminated syrup-based children's medication manufactured by Maiden Pharmaceuticals Limited (ACIPC, 2022). Preliminary investigations revealed the suspected products were found positive for Ethylene Glycol (EG) and Diethylene Glycol (DEG) based on reports from Gambia's Medicine Control Agency, Gambia's Ministry of Health (MoH) and The World Health Organization (WHO) (Bastani *et al.*, 2023). Following these findings, National Agency of Foods and Drug Administration and Control (NAFDAC) Nigeria issued Publication Alert No. 039/2022, regarding the alert on substandard (contaminated) pediatric cough syrups circulating in Gambia. It declared that all batches of suspected syrup were removed from distribution (BPOM RI, 2023).

In response to the similarity of AKI cases, MoH along with pediatrics experts and The Indonesian Food and Drug Authority (BPOM), launched an investigation to the suspected syrup that was linked to pediatric deaths in Indonesia. Laboratory analysis revealed that some of the samples contained EG and DEG above the safe threshold as determined by Indonesia's Pharmacopeia. These substances were found in common cosolvents used in syrup products in Indonesia, such as propylene glycol, polyethylene glycol, sorbitol, and glycerin /glycerol, which are generally considered safe (Kemenkes RI, 2020). Following these unexpected findings, BPOM implemented a blanket investigation to all syrup product that produced and distributed in Indonesia, specifically which use cosolvents.

As a result, BPOM published a list of 69 syrups that were found to contain EG and DEG above the safe threshold, leading to the recall and revocation of marketing authorizations, Good Manufacturing Practices certifications, and distribution licenses (BPOM, 2022). On October 18<sup>th</sup>, 2022, MoH issued a statement instructing the temporary suspension of the prescription and sales of syrup products and advised alternative forms of medicines such as powder, tablet, or capsule for an indefinite period. Next, on October 24<sup>th</sup> 2022, MoH re-issued official statement allowing primary health care and pharmacy to resume sales of proven safe over-the-counter syrup as published before (Kemenkes RI, 2022b).

BPOM continues monitoring and testing samples and has published a list of safe and unsafe syrup products. However, despite the safety measures, there is still panic among the public regarding syrup consumption, leading to a significant decline in sales of over-the-counter syrups in primary health care and pharmacy. Furthermore, this phenomenon has led to a significant increase in the dispensing of alternative forms of medication such as powders and capsules, as substitutes for syrup products for

children. As a result, there is an escalation in waiting time for medications and long queues at pharmacy, also experienced a decline in turnover.

This study aims to assess the impact of EG and DEG cases on the sales of over-the-counter syrup products and the number of dispensed-drug prescriptions in one of the Denpasar region's pharmacies. The findings of this study could be crucial for government authorities in formulating strategies to mitigate and respond to future outbreaks related to medication safety.

## 2. METHODS

The study utilized retrospective, analytical observational methods, using sales data from Pharmacy X in South Denpasar. Sales data from three months before the statement of suspension on prescribing syrup (August - October 18<sup>th</sup> 2022) and three months after the statement published by the MoH (October 19<sup>th</sup> - December 2022) were compared. The data included sales of over-the-counter syrup products and dispensed drug prescriptions (powders) from August to December 2022. To conduct analysis, a comparison can be made between total sales three months prior and three months following the release of statement by MoH regarding the suspension of prescribing syrup. Data was analyzed using the Wilcoxon test to compare the total sales before and after the issue.

## 3. RESULT AND DISCUSSION

Although EG and DEG contamination cannot be confirmed as the main cause AKI in pediatric patients, these cases have resulted in uncertainty and panic among parents who typically purchase syrup to treat mild symptoms in their children. This uncertainty arises from recent purchases of possibly contaminated syrup for their children before the authorities release definitive findings. Syrup is the preferred form of medication for children due to its palatable taste and smell. As a result of this ongoing

phenomenon, pharmacy have experienced a significant reduction in syrup product sales and incurred turnover losses. Based on sales data from Pharmacy X, sales of over-the-counter syrup products decreased by 35.06% during the study period (Table 1).

The most drastic decline occurred after the temporary suspension of syrup prescriptions was announced by the authorities on October 18th, 2022. The lowest sales were observed between October 19th-31st, 2022, when social

and mass media reported an escalation of death cases related to AKI in pediatric patients. Pharmacies and other primary healthcare providers were instructed to remove syrup products from their storefronts and advise patients to seek alternative medicine (IAI, 2022). Furthermore, the decline in sales was also linked to parental reluctance in administering recently purchased medication due to concerns about potential contamination with EG dan DEG, and the potential consequences of administering such drugs to their children.

Table 1. Sales Data of Over-the-Counter Syrup During August to December 2022

Month	Number of sales (bottle)	Total sales per three months (bottle)	Decline of sales (%)
August 2022	1011		
September 2022	887	2529	
October 1 <sup>st</sup> -18 <sup>th</sup> 2022	631		
October 19 <sup>th</sup> – 31 <sup>st</sup> 2022	243		35,03
November 2022	724	1643	
December 2022	676		

The types of syrup products purchased by consumers at Pharmacy X are listed in Table 2. The results showed that sales of syrup from all therapeutic classes have declined following the statement issued by the authorities. . The Wilcoxon test revealed significant impact of EG and DEG contamination on the sales of over-the-counter syrup with significance value 0.03 (<0.05). Multivitamins witnessed a notable decline in syrup sales, with a reduction of 89,47%. The most commonly sold products was flu and cough syrup, which decreased by 34,46%. Despite this decline, many parents continue purchasing these types of syrups over multivitamin, which are easily replaceable. Data from a nearby primary healthcare center, Puskesmas Denpasar Selatan III, between August to December 2022, showed that the visitors were mostly diagnosed with acute nasopharyngitis or common cold

In contrast to the phenomenon of panic buying during pandemic of Covid-19 (Chua *et al.*, 2021; Khusna *et al.*, 2021; Nurazizah, Emelia and Listiani, 2021; Sari and Susanti, 2022), these cases caused public uncertainty about consuming syrup, resulting in a decline in sales. The

potential impact of social conditions on personal health and well-being has been shown to change consumer behavior (Di Crosta *et al.*, 2021). The condition triggered negative emotions that affected the mental states of individuals, leading to withdrawal behavior and distrust, which in turn affected purchasing interest (Landau *et al.*, 2011).

B POM has published an official site to check the safety of syrup products in Indonesia. Despite the availability of information, the confidence level in consuming syrup remains low. The digitalization of information has brought a positive impact in terms of access and availability, but it has also led to misinterpretation and the spread of rumors (Frank and Schvaneveldt, 2016). There has been a proliferation of misleading information, hoaxes, and click bait on social media, which tend to sway public opinion (Baker *et al.*, 2020). The public tends to disregard information from authorities and become ignorant and distrustful of the government. In social media, many people mock and doubt the government for alleged negligence in allowing contaminated syrup products to be

sold in the market. The level of public confidence in the government is influenced by various factors, such as sociodemographic characteristics (Galende *et al.*, 2022), levels of knowledge, attitudes, and perceptions of the risks associated with the current phenomenon (Beca-Martínez *et al.*, 2022). How authorities communicate information can significantly influence public acceptance. Fear-

induced information is only effective if individuals feel capable of dealing with the threat and it does not become overwhelming. However, such messages can have a double-edged effect when targeting individuals experiencing panic and lacking knowledge about the ongoing phenomena (Id *et al.*, 2020).

Table 2. Sales Data of Over-The-Counter Syrup Based on Class Therapy

Therapeutic Classes	Total sales before issue	Total sales after issue	Decline of sales (%)	p-value
Analgetic and Antipyretic	313	244	22.04	0.03*
Anti-asthma	1	1	0.00	
Anti diarrhoea	9	8	11.11	
Anthelmintic	23	11	52.17	
Antihistamine	10	3	70.00	
Laxatives	17	11	35.29	
Flu and cough	1686	1105	34.46	
Gastric disorder	188	103	45.21	
Multivitamin	38	4	89.47	
Sweeteners	38	17	55.26	
Oral rehydration	18	16	11.11	
Supplement	188	120	36.17	
<b>TOTAL</b>	<b>2529</b>	<b>1643</b>	<b>35.03</b>	

\*: *Wilcoxon test*

Table 3. Service data on drug-dispensed (powders) from August to December 2022

Month	Number of dispensed-drug prescription	Total per three months	Number of powders (packages)	Total per three months
August 2022	45	89	1223	2288
September 2022	15		258	
October 1 <sup>st</sup> -18 <sup>th</sup> 2022	29		807	
October 19 <sup>th</sup> – 31 <sup>st</sup> 2022	54	191	969	4256
November 2022	69		1664	
December 2022	68		1623	

In times of uncertainty, people often imitate others and believe that others better understand the situation (Sheu and Kuo, 2020; Zheng, Shou and Yang, 2020). This has led to a preference among parents to take their children to physician for mild symptoms that could be self-medicated. The prescription trends in Pharmacy X show a significant increase in dispensed-drug in powder form compared to

syrup product, there a significant escalation of dispensed-drug (Table 3), that reach 114,61% and the number of packages of each powder increased by 86,01%. Factors such as patient confidence and safety, influencing the prescription preference by the physician (Yağar and Dokme, 2017; Viswanath and Rao, 2019).

Health crises impact society at all levels, leading to changes in mindset and consumption patterns. Raw material sourcing, advanced analysis, and quality control are crucial in the pharmaceutical industry. In the distribution of pharmaceutical product, several unsafe syrups may need to be recalled and removed from the market. And in pharmacy services, pharmacists play a role in managing stock and educating public during crises to prevent adverse health effects.

The decline in sales may be due to the temporary suspension of syrup sales and public perception regarding EG and DEG contamination. Further research is needed to determine which factors have a greater impact. This study is expected to provides insight for government policy-making and efficient stock management for pharmacy owner to anticipate and manage potential health crises in the future.

#### 4. CONCLUSION

The EG and DEG contamination cases have induced panic among the public, resulting in changes in behavior and consumption patterns. There was a significant decline in sales of over-the-counter syrup in several months, along with the escalation of dispensed-drug prescriptions in powders. Strategies must be implemented to manage panic and anticipate possible health crises.

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