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PULSE OXIMETERS IN ZAPORIZHZHIA PHARMACIES

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Summary. Nowadays, with the increasing number of COVID-19 cases, the focus is centered on monitoring the respiratory system, which is largely due to the ubiquitous usage of pulse oximeters for remote and self-monitoring. Thus, it was decided to study their available models presented on the websites *Tabletki.ua* and *Liki.com* of Zaporizhzhia (Ukraine).

Keywords: pulse oximeters, Zaporizhzhia pharmaceutical market, COVID-19

This article is a continuation of our research on pulse oximeters in Ukraine [1]. The global pulse oximeter market size is estimated at \$ 2.3 billion in 2021 and is expected to grow at a compound annual growth rate of 10.1% from 2021 to 2026 [2]. Among the USA Food and Drug Administration (FDA) expert-approved finger pulse oximeters were reported: Oxiline Pulse 7 Pro, SantaMedical Generation 2, Innovo Premium and Deluxe iP900AP [3]. When focused on over-the-counter oximeters that not all were reviewed and regulated by FDA, but made to be used at home and by people who aren't healthcare professionals, as the top ones were found: Ankovo Store Pulse Oximeter, Walgreens, CVS Health, Wellue BabyO2, Metene and 2 clinically tested ChoiceMMed MD300C29 and Contec CMS50DL [4].

We were aimed to summarize the currently available pulse oximeters in Zaporizhzhia Pharmacies on October 6, 2021 using the web sources *Tabletki.ua* [5] and *Liki.24* [6], to analyze their country of origin, prices and popularity.

As can be seen from Table 1, the pharmaceutical market for pulse oximeters is represented by 18 companies from 5 countries (People's Republic of China

(61.1%), Ukraine (16.7%), Singapore (11.1%), the United Kingdom (5.6%) and Germany (5.6%) on the Tabletki.ua website [5].

Table 1

The pulse oximeters in the Zaporizhzhia Pharmacies

Country	Company	Model	
People's Republic of China	Shenzhen Bioeasy Biotechnology Co., Ltd.	Linke LK88	
	Xuzhou Yongkang Electronic Science Technology Co., Ltd.	YK-81C	
	Changzhou Huaang Medical & Health Instruments	OKCI (P-01)	
	Contac Medical Systems Co., Ltd	CMS50D	
	Shenzhen Bioeasy Biotechnology Co., Ltd.	CY901L	
	Aeon, Ltd.	AEON A310 L	
	Shanghai Berry Electronic Tech Co., Ltd.	BERRY BM1000B	
	Aeras Medical Pte, Ltd	SONOSAT-F02T	
	Shenzhen Yimi Life Technology Co., Ltd.	Yimi Life YM201	
	Shenzhen IMDK Medical Technology Co., Ltd.		C101A3
			iMDK C101A2
	Cmics Medical Instruments Co., Ltd.		S6
S10			
S8P			
Ukraine	Medhause-Ukraine, Ltd.	ProMedica XP-20	
	Dopomoga-1, Ltd.	Medicare	
	Dolphi-Ukraine Llc.	Gamma Oxy Scan	
the United Kingdom	Heaco Medical Technology Co. Ltd.	Heaco CMS50C	
		Heaco CMS50B	
Singapore	Beijing Choice Electronic Technology Co., Ltd.	MD300C19	
	Little Doctor International (S) Pte, Ltd	MD300C23	
Germany	Beurer GmbH	Beurer PO 40	

data are formed from [5]

Among all companies, only "Cmics Medical Instruments Co., Ltd." offers 3 devices, among which S6P is designed as a toy for children.

The People's Republic of China also leads in the number of models with 63.6%, while others have: Ukraine (13.6%), Singapore (9.1%), the United Kingdom (9.1%) and Germany (4,5%) with a total of 22.

When analyzing prices, the cheapest pulse oximeters were Linke LK88 for UAH 95 and Cmics S6 for UAH 289 (Fig. 1). The most expensive were Medicare - UAH 1,514 and Beurer PO 40 - UAH 1799, as they are positioned as the most accurate and high-quality (Germany origin).

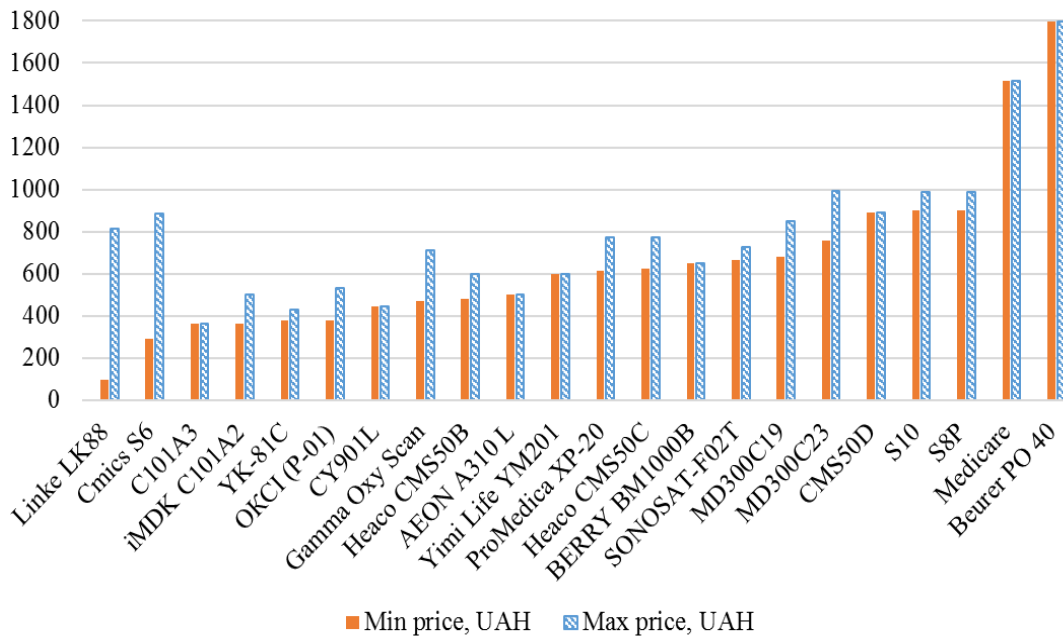


Fig. 1. Minimum and maximum prices for pulse oximeters

Surprisingly, the price range between the minimum and maximum price of the cheapest Linke LK88 model turned out to be 8.6 times (from 95 to 814 UAH) and 18.9 times compared to the price of Beurer PO 40. But apart from the declared German quality and perfusion index evaluation, there are no critical differences between the devices. Also for the Cmics S6 there was a 3.1 time price difference. Besides, the S10 and S8P vs s6 models have a built-in battery for USB charging, which makes them more expensive. But prices for most pulse oximeters differed by only 1.1–1.5 times.

Thus, the average minimum price was UAH 652.5, the maximum - UAH 787.8 for all models, and without the two top expensive ones - UAH 552.2 and 701.0. The above-mentioned popular in the USA OTC model CMS50D [4] was found in Zaporizhzhia and sold for UAH 893 among the last 6 most expensive ones.

The largest number of Pharmacies (61) was covered by the pulse oximeter Gamma Oxy Scan (Fig. 2), which costed UAH 470 (Fig. 1).

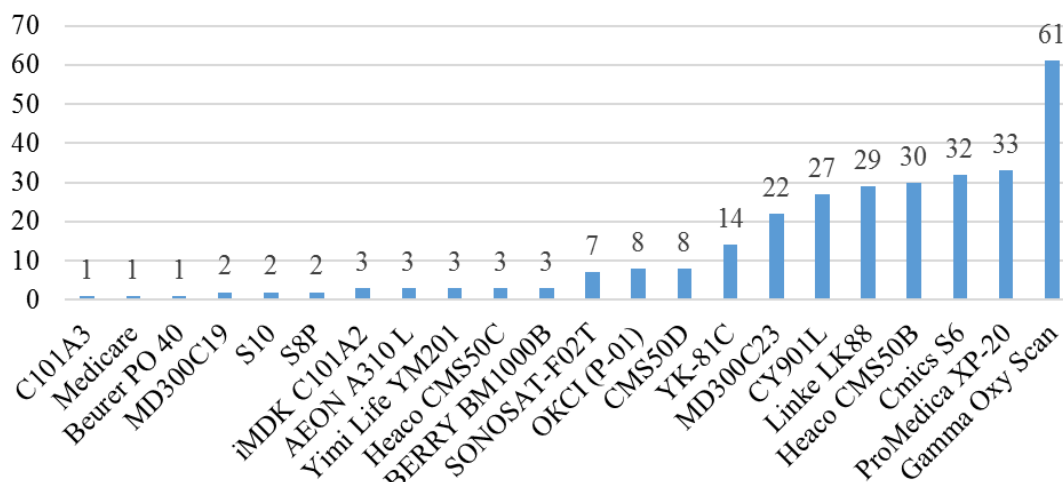


Fig. 2. The number of Pharmacies selling corresponding pulse oximeter model

When calculating the average minimum price for the most popular models (MD300C23, CY901L, Linke LK88, Heaco CMS50B, Cmics S6, ProMedica XP-20, Gamma Oxy Scan), it was UAH 450, due to UAH 95 price of Linke LK88, or UAH 509 without including it. So, people have tendency to buy not the cheapest, but the middle price devices.

Besides, it's predictable that a positive correlation was found between the minimum price of pulse oximeters and the number of Pharmacies selling them with $r^2 = 0.1323$ (Fig. 3).

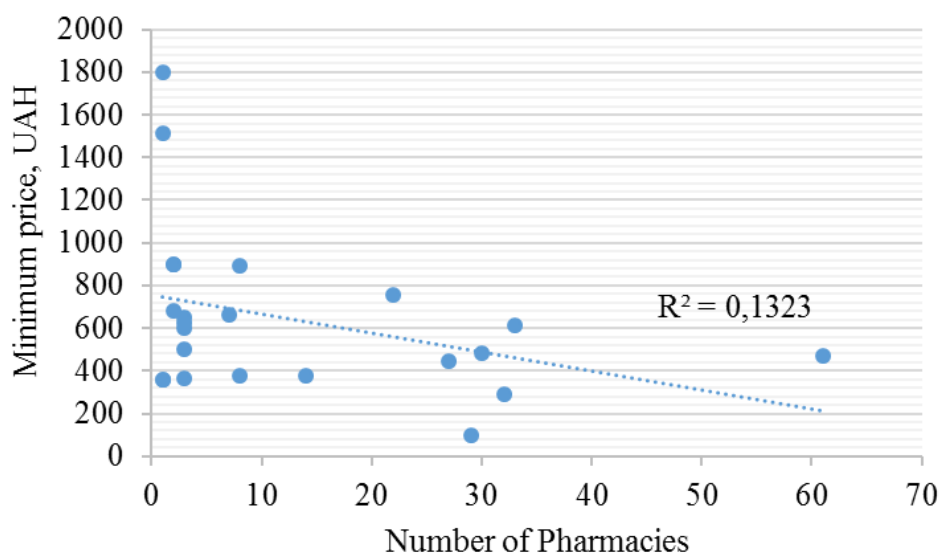


Fig. 3. The ratio of the number of pharmacies to the lowest prices for pulse oximeters

In addition, we decided to compare the above data from pulse oximeters found on Tabletki.ua [5] with data from Liki.com [6]. Also, only those models that are currently available in pharmacies were taken into account (Table 2).

Table 2

Comparison of data for pulse oximeters in Zaporizhzhia pharmacies

Company	Model	Number of Pharmacies		Minimum price, UAH		Maximum price, UAH	
		Tabletki	Liki	Tabletki	Liki	Tabletki	Liki
Shenzhen Bioeasy Biotechnology Co., Ltd.	Linke LK88	29	4	95	224	814	289
Shenzhen IMDK Medical Technology Co. Ltd.	C101A3	1	1	361	431	361	449
Cmics Medical Instruments Co., Ltd.	S6	32	1	289	300	885	700
	S10	2	1	899	989	989	1048
	S8P	2	1	899	983	989	989
Beurer GmbH	Beurer PO 40	1	1	1799	1799	1799	1799

data are formed from [5,6], prices are rounded to the nearest tens.

Thus, only 6 models were found (Linke LK88, C101A3, S6, S10, S8P and Beurer PO 40) in a significantly smaller number of pharmacies (1-4 versus 1-32). Moreover, on Liki.24 prices for almost all pulse oximeters were about 1.1-1.4 times higher. And only for Linke LK88 and S6, the maximum prices were by 0.4 and 0.8 times lower.

Moreover, what is unusual, the price for the S6 model when ordering and delivering from the Liki 24.com website was 2.3 times lower (UAH 300) than for self-delivery directly from a pharmacy (UAH 700).

Summing up, 22 pulse oximeters from 5 countries of all price categories (from UAH 95 to 1799) are presented in Zaporizhzhia. Lower prices and better variety is found on the Tabletki.ua website. Yet, it is doubtful that a client will pay 10-19 times more to measure the approximate oxygenation level, even if it can be more accurate, knowing that there are many factors affecting the readings (poor circulation, skin pigmentation, skin thickness, skin temperature, current tobacco use, nail polish, etc.). But most customers are aware of this information. It is known that if a certified pulse oximeter shows 90% oxygen saturation, then the true value in the blood is usually 86-94%, which is considered a condition for hospitalization [7]. So, if the reading is below 95% and the person has tachypnea (rapid, shallow breathing), shortness of breath or cough, they should see a doctor. And all the registered pulse oximeters could accomplish this auxiliary task.

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