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**THE MANAGEMENT OF PHARMACEUTICAL
TRANSPORT IN CONTEXT
OF THE COVID-19 PANDEMIC**

**ZARZĄDZANIE TRANSPORTEM MEDYKAMENTÓW
W KONTEKŚCIE PANDEMII COVID-19**

Abstract: Transport, which is considered the most important part of the logistics chain, has experienced many changes in recent years. During the global pandemic, the transport of various goods in many countries was severely restricted or entirely blocked. The restrictions were most noticeable in the areas most affected by the coronavirus especially. The management and organisation of each mode of transport required the implementa-

tion of new measures. The medical transport industry was of particular importance, as the demand for which has increased significantly. The research was conducted in companies involved in the 45 transportation of medical products. The undertaken research topic is particularly important in the current market situation, which is characterized by high instability in many economic areas. Especially transport, which has always been characterized by the possibility of unexpected circumstances caused by, for example, unfavorable weather conditions, had to adapt to the new standards and difficulties introduced today. Therefore, the comparison of changes taking place especially in this field of transport is, according to the author of the article, very important in terms of research and development. This article may be the basis for other further research. The main objective of the study is to analyse the changes occurring in the management of logistic processes such as shipping and transport in times of the spread of the coronavirus pandemic.

This article presents the impact of the global COVID-19 pandemic on international long-distance transport. The number of long-distance transports over the past 20 years has been studied. All modes of transport have been affected by the Covid-19 pandemic situation, which has introduced huge changes and restrictions to all modes of transport. The transport situation during the global crisis caused by the pandemic was also analyzed on the basis of the pharmaceutical industry, which played a significant role during the pandemic.

This article presents the aspect of long-distance transportation of medical products in times of the global pandemic. Transport is the most important element in the area of logistics, which should now be studied and analyzed for scientific purposes assessing the impact of a pandemic on the economy. Never before in the modern world have such far-reaching threats to the health and life of citizens arise, which have spread all over the world in such a short time. The pandemic is considered to be something special that cannot be dealt with by any country around the world, and therefore, according to the author, it is an element of social novelty that must be analyzed in a scientific article. The situation in domestic and international markets is now something worthy of study and analysis to avoid mistakes in the future.

Keywords: global COVID-19 pandemic, crisis, transport management, management of logistics processes, pharmaceutical transport

Streszczenie: Transport, który jest uważany za najważniejszą część łańcucha logistycznego, przeszedł w ostatnich latach wiele zmian. Podczas globalnej pandemii transport różnych towarów w wielu krajach był poważnie ograniczony lub został całkowicie zablokowany. Ograniczenia były najbardziej widoczne w obszarach najbardziej dotkniętych koronawirusem. Zarządzanie i organizacja każdego rodzaju transportu wymagały wdrożenia nowych działań. Szczególne znaczenie miała branża transportu medycznego, na którą zapotrzebowanie znacznie wzrosło. Badania przeprowadzono w 45 firmach zajmujących się transportem wyrobów medycznych. Podjęta tematyka badawcza jest szczególnie istotna w obecnej sytuacji rynkowej, która charakteryzuje się dużą niestabilnością w wielu obszarach gospodarczych. Zwłaszcza transport, który zawsze charakteryzował się możliwością wystąpienia nieprzewidzianych okoliczności spowodowanych np. niekorzystnymi warunkami atmosferycznymi, musiał dostosować się do nowych standardów obecnych trudności. Dlatego przedstawienie zmian zachodzących zwłaszcza w tej dziedzinie zarządzania transportem jest, zdaniem autorki artykułu, bardzo ważne z punktu widzenia badań i rozwoju. Artykuł ten może być podstawą do dalszych badań. Głównym

celem opracowania jest analiza zmian zachodzących w zarządzaniu procesami logistycznymi, takimi jak spedycja i transport w czasach rozprzestrzeniania się koronawirusa. W artykule przedstawiono aspekt transportu wyrobów medycznych na duże odległości w dobie globalnej pandemii. Transport jest najważniejszym elementem w obszarze logistyki, który powinien być obecnie badany i analizowany do celów naukowych oceniających wpływ pandemii na gospodarkę. Zdaniem autorki jest to element społecznej nowości, którą należało poddać analizie w niniejszym artykule.

Słowa kluczowe: globalna pandemia COVID-19, kryzys, zarządzanie transportem, zarządzanie procesami logistycznymi, transport farmaceutyczny

Introduction

The most important factor in economic development is transport, with which goods can be distributed throughout the world. The progress made in relation to each type of transport has been very dynamic over many years¹. Transport activities enable other sectors of the national economy to function and influence their development². The ability to transport goods enables the economic development of all countries³. Every manufacturing company must ensure that its product can be delivered to the customer. For this reason, the development and modernisation of transport infrastructure is so crucial. Transport, as a part of the logistic system, is inseparably connected with the shipping activity, which deals with the organisation of transport⁴. Each type of cargo must be directed to the right place, at the right time, at a certain cost. Care must be taken to allocate financial resources to develop transport investments in a sustainable way, so that needs can be adequately addressed⁵. Years of development work on all modes of long-distance transport have resulted in its unlimited global reach⁶. The year 2020 saw a complete change in the perception of transport around the world. In January 2020, the first news of the SARS-CoV-2 coronavirus emerged. This virus was spreading very rapidly

¹ R. Grytnes, H. Shibuya, J. Dyreborg, S. Grøn B. & Cleal, *Too individualistic for safety culture? Non-traffic related work safety among heavy goods vehicle drivers*. Transportation Research Part F: Psychology and Behaviour, 2016 40, p. 145–155.

² L.A. Bettencourt, S.W. Brown, N.J. Sirianni, *The secret of true service innovation*, "Business Horizons" 2013, 56, p. 13; E.K.R.E. Huizingh, *Open innovation: State of the art and future perspectives*, "Technovation" 2011, 31, p. 2.

³ E. Nedeliaková, R. Stasiak-Betlejewska, *Transport management in Polish cities in the context of the European sustainable transport concept*, "Transportation Research Procedia" 2019, 40, 1150–1157.

⁴ J. Belas, L. Belas, M. Cepel, Z. Rozsa, *The impact of the public sector on the quality of the business environment in the SME segment*, "Administratie si Management Public" 2019, 32, pp. 18–31.

⁵ K. Grinerud, W. Aarseth, R. Robertsen, *Leadership strategies, management decisions and safety culture in road transport organizations*, "Research in Transportation Business & Management" 2021, 6 (pdf).

⁶ T.-O. Nævestad, B. Elvebakk & R.O. Phillips, *The safety ladder: Developing an evidence-based safety management strategy for small road transport companies*, "Transport Reviews" 2018, 38(3), p. 372–393.

around the world, and it was facilitated by the movement of people and goods. The need to reduce the possibility of further spread of the dangerous virus forced all countries to reduce the number of social integrations⁷. The spread of the coronavirus has also influenced more effective risk management in company operations⁸. Market uncertainty and problems arising in the field of transport have influenced the need to implement many changes and new solutions⁹.

Cargo Transport Management

Nowadays, the right type of transport is selected to transport the product taking into account many different factors¹⁰. The international business environment brings many changes that increase the risk of doing business¹¹. It is important to properly organize the transport pharmaceutical process, most suitable to the needs of production companies and customers¹². Factors affecting the selection of the type of transport pharmaceutical include¹³:

- speed (time) of delivery,
- frequency of services offered,
- quality of service provided,
- timeliness,
- cargo weight,
- cost of transport,
- cargo security
- and contact with the supplier.

⁷ J. Kubás, K. Hollá, K. Repková Štofková, M. Ballay, M. Polorecka, *Strategy Management of Telematics Systems in the Transport Sector with Regard to Safety*, "Transportation Research Procedia" 2021, 55, 1498-1505.

⁸ J. Šimíčková, K. Bugarová, E. Mošková, *Specifics of the Agile Approach and Methods in Project Management and its Use in Transport*, "Transportation Research Procedia" 2021 55, 1436-1443.

⁹ S.P. Choudary, M.W. Van Alstyne and G.G. Parker, *Platforms and blockchain will transform logistics*, "Harvard Business Review", available at: <https://hbr.org/2019/06/platforms-and-blockchain-will-transform-logistics> 2019.

¹⁰ B. Gaudenzi, I. Confente, I. Russo, *Logistics service quality and customer satisfaction in B2B relationships: a qualitative comparative analysis approach*, "The TQM Journal" 2021 Vol. 33, No. 1, 125-140.

¹¹ M. Hudáková, M. Masár, L. Šimák, D. Brezina, *The current state of the application of risk management in the transport sector*, "Transportation Research Procedia" 2019, 40, 1073-1079; M.T. Lee, R.L. Raschke, R.St. Louis, *Exploiting organizational culture: Configurations for value through knowledge worker's motivation*, "Journal of Business Research" 2016 69, 5442-5447.

¹² O. Kopishynska, Y. Utkin, A. Kalinichenko, D. Jelonek, *Efficacy of the cloud computing technology in the management of communication and business processes of the companies*, "Polish Journal of Management Studies" 2016, 14(2), 104-114; L. Mooren, R. Grzebieta, A. Williamson, J. Olivier & R. Friswell, *Safety management for heavy vehicle transport: A review of the literature*, "Safety Science" 2014, 62(C), 79-89.

¹³ M. Man et al., *The Cost for the Entire Life Cycle of the Product Respecting Quality Standards*, "Polish Journal of Management Studies" 2011, vol. 4; B.P. Hughes, S. Newstead, A. Anund, C.C. Shu & T. Falkmer, *A review of models relevant to road safety*, "Accident Analysis and Prevention" 2015, 74, 250-270.

Any pharmaceutical transport should be well planned, minimising its cost and delivery time. However, it should be remembered that the initial plan may differ from the actual one¹⁴. This is affected by many parameters pharmaceutical that are variable, such as the loading/unloading date, which can change at any time, regardless of the initial arrangements.

The organisation of transport pharmaceutical is the responsibility of forwarders, who, through careful analysis and experience, must choose the most convenient mode of transport that will meet customer expectations and be profitable for the company¹⁵. Modern logistic problems caused by the pandemic have led to the analysis of new methods, such as mobile warehouses, which would provide an alternative to the current situation¹⁶. An essential component of any transport pharmaceutical is its cost, which should be accepted by the customer. The development of world economies is most influenced by road transport, which has developed very well in recent years¹⁷. Road transport pharmaceutical compared to other types is the most cost-effective for most shipments¹⁸. This transport pharmaceutical is mostly used because of its ability to deliver any product to the customer's doorstep.

Transport – data analysis

Cargo transport in recent years has increased due to the growing interest in the needs of transporting an increasing number of loads. The impact of the COVID-19 pandemic on the amount of cargo carried by various modes of transport pharmaceutical is noticed. This hypothesis was confirmed on the basis of the following analysis of data from recent years. Below is the number of cargo transportation in 2000-2019 in Poland taking into account the different modes of transport (in thousand tonnes).

¹⁴ N. Sirina, V. Zubkov, *Transport Services Management on Transport and Logistic Methods*, "Transportation Research Procedia" 2021, 54, 263-273; T. Economist, The global logistics business is going to be transformed by digitization, Economist, available at: <https://www.economist.com/briefing/2018/04/26/the-global-logistics-business-is-going-to-be-transformed-by-digitisation>. \ 2018.

¹⁵ T.-O. Nævestad, I.S. Hesjevoll & R.O. Phillips, *How can we improve safety culture in transport organizations? A review of interventions, effects and influencing factors*, "Transportation Research Part F: Psychology and Behaviour" 2018, 54, 28-46.

¹⁶ S. Srinivas, R. Marathe, *Moving towards "mobile warehouse": Last-mile logistics during COVID-19 and beyond*, "Transportation Research Interdisciplinary Perspectives" 2021, Vol 10, June; N. Burganovaa, P. Grznara, M. Gregora, S. Mozol, *Optimalisation of Internal Logistics Transport Time Through Warehouse Management: Case Study*, "Science Direct Transportation Research Procedia" 2021, 55, 553-560.

¹⁷ BP Energy Outlook: edition. <https://www.bp.com/content/dam/bp/business-sites/en/global/corporate/pdfs/energy-economics/energy-outlook/bp-energy-outlook-2019.pdf> [access: 3.02.2021].

¹⁸ R.K. Miler, M.J. Kisielewski, A. Brzozowska, A. Kalinichenko, *Efficiency of Telematics Systems in Management of Operational Activities in Road Transport Enterprises*, "Energies" 2020, 13(18).

Table 1. Number of cargo transported between 2000 and 2019 in Poland (in thousand tonnes)

Tabela 1. Liczba przewozów ładunków w latach 2000-2019 w Polsce (w tys. ton)

Year	Road Transport	Rail Transport	Air Transport	Maritime Transport	Inland waterway Transport
2000	1,006,705	187,247	28	22,774	104,333
2005	1,079,761	269,553	34	9,362	9,607
2010	1,491,253	255,708	38	8,362	5,141
2015	1,505,719	244,687	42	6,963	1,1928
2019	1,921,073	252,089	77	8,727	4,681

Source: own elaboration based on [www.transport__wyniki_dzialalnosci_w_2019_r.%20\(1\).pdf](http://www.transport__wyniki_dzialalnosci_w_2019_r.%20(1).pdf) (date of access: 1st Feb, 2021).

Table 1 shows the volumes of cargo transported in Poland by road, rail, air, inland waterway and sea during the analysed 19 years. An increase in freight transport has taken place in the case of road transport with an increase of 914,368 thousand tonnes, rail transport by 64,842 thousand tonnes and air transport by 49 thousand tonnes. Undoubtedly, the growth has been called, the growing consumer need. The average in the analyzed years in road transport was 1,400.9022 thousand tonnes. This means that since 2010, the amount of cargo transported by road has been above the average in the analyzed period. When analyzing the data on rail transport, it can be noticed that the number of transports is consistently on the average level in the analyzed years. Air transport showed a great increase in 2019 compared to the average of the studied years. Nowadays, it can be observed that you need to order supplies and that is why it is a growing product and service. The increase in road transport in the analyzed years is a sign of an increase in production. Manufactured products are to be handled. The best method is door-to-door transport, which does not need any other means of transport. On the other hand, maritime and inland waterway transport showed a decrease in the amount of freight transported during the surveyed 19 years by 14,047 thousand tonnes maritime transport and 99,652 thousand tonnes inland waterway transport.

The increasing number of transportations proves, among other things, the necessity to constantly develop the road infrastructure in order to improve the quality of transport service provision¹⁹. It was also necessary to pay attention to the

¹⁹ L. Yang, L. Zhang, M. Stettler, M. Sukitpaneinit, D. Xiao, K. van Dam, *Supporting an integrated transportation infrastructure and public space design: A coupled simulation method for evaluating traffic pollution and microclimate*, "Elsevier" 2020, Vol. 52.

use of logistics land area, through the use of multi-storey facilities²⁰. The situation in 2020 has completely changed the very prosperous transport industry. The following (Table 2) shows the cargo volumes in 2020, from January to September, by different transport modes.

Table 2. Cargo transport in 2020 in Poland (in thousand tonnes)

Tabela 2. Przewóz ładunków w 2020 roku w Polsce (w tys. ton)

Month	Road Transport	Rail Transport	Maritime Transport
January	22,449	16,822	584
February	23,052	17,572	574
March	23,753	18,847	652
April	22,397	16,281	511
May	22,277	16,074	548
June	22,609	16,935	754
July	23,114	18,154	553
August	21,428	18,499	612
September	22,928	19,253	743
Total	183,667	158,437	5,531

Source: own elaboration based on <https://stat.gov.pl/obszary-tematyczne/inne-opracowania/informacje-o-sytuacji-spoleczno-gospodarczej/biuletyn-statystyczny-nr-92020,4,104.html>.

The data in Table 2 shows the three types of cargo transport, the volumes of which were published on the Polish Central Statistical Office website. Lack of complete data does not allow detailed analysis, however the difference between the amount of transported goods between January and September 2020 in comparison with the previous year is noticeable. In road transport, transport was carried out at a similar level during the examined three quarters of 2020 and amounted to, respectively: in the first quarter the number of transports was 69,254, in the second quarter it was 67,283, and in the third quarter 67,470. In the second quarter of 2020, we notice a significant decrease in the number of transports in rail transport. However, in the following quarter, this figure returned to normal, and even rose above the August's average. Sea transport in April and May also showed a decrease in the amount of goods transported. The decrease in the number of transports was mainly due to the epidemiological situation in the country and decreased demand for transport of manufactured goods. The Polish

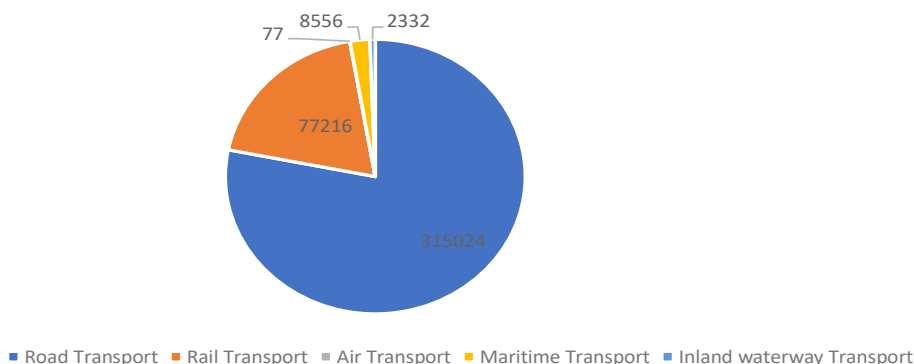
²⁰ Z. Xiao, Q. Yuan, Y. Sun, X. Sun, *New paradigm of logistics space reorganization: E-commerce, land use, and supply chain management*, "Transportation Research Interdisciplinary Perspectives", March 2021, p. 1-11, Vol. 9, 100300.

transport market is saturated mostly due to road transport²¹. Efficient management of the entire transport system in Poland allows the country to improve its image in comparison with other European Union countries and to respond to market needs with the use of new technologies²². In 2019, the volume of cargo transported by road transport expressed in tonne-kilometres accounted for 16.4% of the total transport of European Union countries. This placed Poland in the second position, after Germany, among the 28 countries of the European Union. The involvement of Polish transport companies in international transport and the achievement of very good results is a sign of the high level of quality of services provided.

Below (Figure 1) is the situation of international cargo transport in 2019.

Figure 1. Cargo transport in international transport in 2019 in thousand tonnes

Rysunek 1. Przewóz ładunków w transporcie międzynarodowym w 2019 roku w tys. ton



Source: own elaboration based on www.ec.europa.eu (date of access: 1st. Feb. 2021).

The data illustrated in Figure 1 unambiguously show that the main role in the transportation of international cargo is played by road transport. In 2019, 315,024 thousand tonnes were transported by this mode of transport. Rail transport also allowed for the international transport of 77,216 thousand tonnes of goods. This was followed by maritime transport with 8,556 thousand tonnes, inland waterway transport with 2,332 thousand tonnes and air transport with 77 thousand tonnes.

The prospects for transport around the world are increasing, so it is possible to send goods even from the furthest corners of the world. The development of transport by road, rail, air, sea and inland waterway has become a necessity of

²¹ H. Zielaskiewicz, *Analiza popytu na usługi transportowe w kontekście niektórych uwarunkowań zewnętrznych* cz. 2, „Logistyka” 2012, nr 1.

²² U. Dombrowski, I. Crespo, T. Zahn, *Adaptive Configuration of a Lean Production System in Small and Medium-sized Enterprises*, “Production Management” 2010, Vol. 4, 341-348; M. Masár, M. Hudáková, L. Šimák, D. Brezina, *The current state of project risk management in the transport sector*, “Transportation Research Procedia” 2019, 40, 1119-1126.

modern times. The customer must be given an opportunity to decide what mode of transport, at what cost, and at what time they want their goods to be delivered.

The impact of a global pandemic on the transport of medicines (medicaments)

The contemporary issues that have unexpectedly arisen in 2020 have completely changed the outlook on transport around the world. Be it road, air, rail or sea transport, all of them have changed. The emergence of the SARS-CoV-2 virus and its rapid spread to more countries has created many difficulties in private and economic life²³. Transport has become a major factor in the spread of the coronavirus around the world, so it had to be restricted. The high mobility of people from the COVID-19 outbreak areas caused problems around the world. Constant disinfection of vehicles and care for drivers was ordered, both by equipping them with antiseptics, gloves or masks, and by stopping transports to the most vulnerable regions where possible²⁴. In the initial phase of the pandemic, transport from China was completely blocked, causing major economic losses in many countries. China is home to 7 of the 10 largest container ports in the world, 80% of the world's trade in goods is carried by sea²⁵. The halt in transport has significantly impeded access to many products. Each country introduced its own restrictions, e.g. in France the transport of goods was only possible with a special certificate, Austria and Sweden temporarily suspended regulations on drivers' working and rest times, Hungary, Austria and Spain suspended weekend traffic bans²⁶. In particular, the restrictions on products related to personal protection were severe. Transport of masks, protective and medical supplies such as medical masks, medical aprons, medical gloves, medical shoes, medical goggles, and medical visors were mostly manufactured and supplied from China²⁷. International freight transport for medical products and other groups of most necessary articles at some border crossings could rely on the so-called Green Line, which sped up the passage²⁸. The increased production demand of all protective measures in all countries at the same time, made it necessary for domestic production companies to adapt to provide access to these measures in each country.

²³ G. Frederico, *Towards a Supply Chain 4.0 on the post-COVID-19 pandemic: a conceptual and strategic discussion for more resilient supply chains*, "Rajagiri Management Journal", November 2020.

²⁴ www.gov.pl/web/rozwoj/zalecenia-dla-branzy-transportowej-i-logistycznej-w-zwiazku-z-rozprzeszczaniem-sie-koronawirusa [access: 16.03.2021]; www.4trucks.pl/aktualnosci/14760/transport-drogowy-aktualna-sytuacja-na-granicach [access: 16.03.2021].

²⁵ www.matlogistic.pl/blog/koronawirus-a-transport/ [access: 6.03.2021].

²⁶ www.ifb-poland.pl/aktualnosci/koronawirus-a-transport-drogowy [access: 10.03.2021].

²⁷ www.bbats.pl/kategoria/poradnik-specjalistyczny/ [access: 16.03.2021].

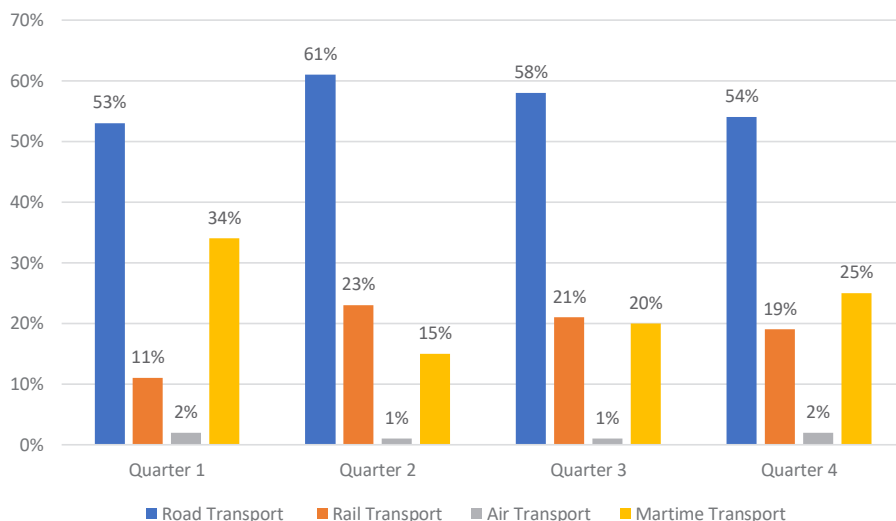
^W [arunki.transportu.lekow\(chlodnie.eu\)](http://arunki.transportu.lekow(chlodnie.eu)).

²⁸ www.truck.pl/pl/article/1313/w-ka-c5%bcdym-kraju-inaczey-jakie-ograniczenia-i-u-c5%82a-twienia-dla-transportu%2c16 [access: 16.03.2021].

The types of transport used to transport medical products in 2020 are shown below (Figure 2).

Rysunek 2. Rodzaj wykorzystywanego przewozu do transportu produktów medycznych w 2020 roku

Figure 2. Type of transport used to transport medical products in 2020



Source: own elaboration based on www.eu-transport.pl/transport-a-koronawirus (Date of access: 15th March, 2021).

Figure 2 above shows the share of medical devices transported by various means of transport in the individual quarters of 2020. Analyzing the presented data, it can be clearly claimed that road transport is a pioneer in the transport of medicines in 2020. More than half of all transported medical supplies are carried through it. The next place is the sea transport, which accounted for approximately 25% of transports in the analyzed quarters on average. The air transport, which is mainly the least profitable type due to high costs, has the lowest impact on the transport of pharmaceutical.

Initially in Europe, the countries most affected by the pandemic were Italy and Spain. Transport to and from Italy was completely halted. Additionally, carriers had to cope with complying with restrictions introduced in all countries. In March 2020, borders were closed in many countries and a lockdown was introduced²⁹. Border controls in the Schengen area were also introduced, which significantly worsened the smooth flow of goods.

²⁹ www.eu-transport.pl/wpływ-koronawirusa-na-logistykę [access: 6.03.2021].

The management of international logistics was becoming more difficult to handle day by day³⁰. The effects of the global pandemic were felt in the decreasing volume of transport orders. Competitiveness in the logistics industry in terms of transport volumes and costs became more important³¹. Transport had to adapt to the new restrictions and rules at a rapid pace³². Restrictions on the ability to obtain certain groups of goods from certain countries have also resulted in reduced production for many companies. Many deliveries of components manufactured in China were stopped or significantly delayed due to the necessity to halt work in factories and due to problems at the borders³³. This translated into a reduced demand for transport. Dependencies between countries were becoming increasingly apparent. While some industries were in serious crisis, others were booming. An example of such an industry is undoubtedly the pharmaceutical industry.

During the COVID-19 pandemic, the number of cases of disease was skyrocketing. This translated, above all, into an increase in sales of medicines and protective equipment. Pharmaceutical companies around the world increased their turnover at a very fast rate. The necessity of purchasing many medicines has proven to be essential in protecting the lives of people in many countries. Countries, in order to protect their citizens, have had to purchase significant quantities of medicines indispensable in the fight against coronavirus. The sale of all medicines to help fight the symptoms of the common cold also increased. Certain groups of medicines were bought out of stock, resulting in shortages. Transporting medicines, which has always been profitable, has now become even more profitable and viable.

The transport of medicines must be carried out in accordance with the rules that have been in force for years for the transport of this type of product. The distribution of medicines is carried out as shown below (Figure 3).

³⁰ M. Cichosz, C.M. Wallenburg A.M. and Knemeyer, *Digital transformation at Logistics service providers: barriers, success factors and leading practices*, "International Journal of Logistics Management" 2020, Vol. 31, No. 2, 209-238.

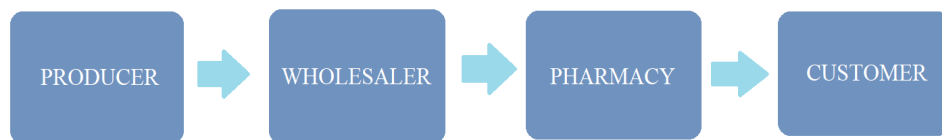
³¹ H. Choa, J. Lee, *Does transportation size matter for competitiveness in the Logistics industry? The cases of maritime and air transportation*, "The Asian Journal of Shipping and Logistics", December 2020, Vol. 36, Issue 4, 214-223.

³² S. Newnam, A. Warmerdam, D. Sheppard, M. Griffin & M. Stevenson, *Do management practices support or constrain safe driving behaviour? A multi-level investigation in a sample of occupational drivers*, "Accident Analysis and Prevention" 2017, 102, 101-109.

³³ www.eu-transport.pl/wpływ-koronawirusa-na-logistyke [access: 6.03.2021].

Figure 3. The transport process for pharmaceutical products

Rysunek 3. Proces przewozowy produktów leczniczych



Source: own elaboration based on Warunki transportu leków (chlodnie.eu).

Figure 3 shows the process of transportation of pharmaceuticals from the manufacturer. (the producer) to the wholesaler. The wholesaler temporarily stores the product or transfers it to another wholesaler (the intermediary) or directly to a pharmacy. The pharmacy is the place where the medicine goes directly to the customer.

Transport standards for medical products are very restrictive worldwide.

In Poland, the transport of medicines should comply with the requirements provided for in the Act of 6 September 2001. - Pharmaceutical Law [Journal of Laws 2008, No. 45, item 271 as amended] and secondary legislation thereto. Further guidelines for transportation of pharmaceutical products are provided in the provisions of the Regulation of the Minister of Health of 26 July 2002 on the procedures of Good Distribution Practice [Journal of Laws 2002, No. 144, item 1216]. The use of the RFID system in the pharmaceutical industry identifies products on an everyday basis and improves the quality of communication³⁴. The standards for loading, transporting and unloading of medicines are strictly defined, therefore it is necessary to take care of proper³⁵:

- identification of the pharmaceutical product,
- identification of the sender and the recipient;
- protection of the cargo against cross-contamination among pharmaceuticals;
- security of the cargo against contamination,
- security of the cargo against mechanical damage or theft;
- security of the cargo against the detrimental effects of high and low temperatures,
- protection of the cargo against light and ensuring adequate humidity
- and protection against other adverse factors.

For years, the transport of medicines was considered to be a specific but very profitable business. Medicines from wholesalers are transported with low loads and kilometre limits. For example, in Poland the transport of medicines is carried out

³⁴ N. Lei, *Intelligent logistics scheduling model and algorithm based on Internet of Things technology*, Vol. 61, 2021, 893-903.

³⁵ www.bbats.pl/kategoria/poradnik-specjalistyczny/, Warunki transportu leków (chlodnie.eu) [access: 16.03.2021].

up to about 350 km with a maximum load of 200 kilograms per day. Therefore, for those interested in transporting them, these are not arduous loads and are characterised by good transport rates, which are extremely profitable for carriers. The Good Distribution Practices (GDP) are related to the guidelines of the European Commission and the European Parliament primarily for the pharmaceutical industry, where high logistic standards must be observed, concerning safety rules with respect to the reception, storage and organisation of transport³⁶. The problem may arise when there is a necessity for reloading, as this can only take place in so-called reloading chambers. Transport of medicines can take place in three temperature divisions (in Celcius degrees)³⁷:

- from 2 degrees to 8 degrees;
- from 8 degrees to 15 degrees;
- from 15 degrees to 25 degrees;
- with maximum humidity deriving from the specifics of the good (up to 70%).

The obligation to comply with these requirements makes it necessary to transport medicines in modern refrigerated containers equipped with appropriate systems. Such a container should have, for example, electronic temperature monitoring, which records the temperature at which the goods are transported. Having such a register protects the carrier against possible complaints regarding the transport of medicines at an inappropriate temperature.

Vehicles used for the transport of medicines by road are:

- with a capacity of one to ten pallets (1 to 3.5 tonnes) - usually for local transport and city services,
- 33-pallet trucks – used in domestic and international transport.

The article presents the elaborated research results of an anonymously conducted questionnaire on the transport of medicines. The survey was conducted among a group of companies involved in the transport of medicines in Poland and the European Union. The survey was conducted online in January 2021. 75% of the questionnaires sent were returned. Representatives of companies organising transport of medicines from the manufacturer to wholesalers or pharmacies participated in the survey. The gender of the respondents and their age were not the main focus of the study, therefore, this paper focuses on the answers to specific questions, the analysis of which has helped to illustrate the condition of the transport of medicines in Poland.

³⁶ www.haccp-polska.pl/gdp-dobra-praktyka-dystrybucyjna [access: 16.03.2021].

³⁷ www.haccp-polska.pl/gdp-dobra-praktyka-dystrybucyjna [access: 16.03.2021].

The dynamics of pharmaceutical deliveries are presented in Table 3.

Table 3. The dynamics of growth in pharmaceutical freight by road transport
Tabela 3. Dynamika wzrostu dostaw leków transportem drogowym

Fleet of Transport	1st quarter	2nd quarter	3rd quarter	4th quarter
>50	101%	127%	158%	250%
50-100	100%	118%	201%	165%
<100	119%	103%	169%	195%

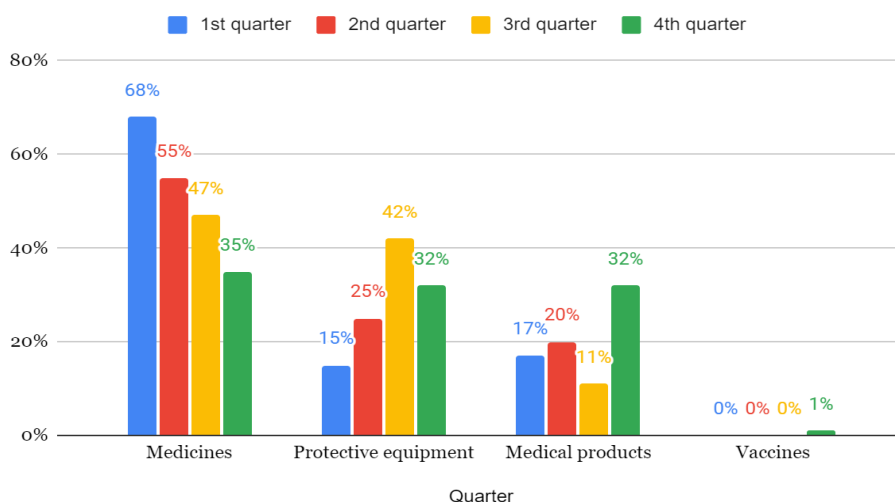
Source: own elaboration based on results of conducted surveys.

Table 3 analyses the percentage increase in medicines deliveries in each quarter of 2020 compared to the previous year. The number of deliveries in companies with more than 100 vehicles increased the most in the 4th quarter of 2020. The smallest increase was in the 2nd quarter, it was 103%. In companies with 50-100 vehicles, the largest increase was in the 3rd quarter of 2020. However, in companies with fewer than 50 vehicles, the 4th quarter showed an increase in deliveries of as much as 250%. These increases are indicative of increased pharmaceutical shipments in each quarter of 2020 in each of the groups surveyed.

The groups of products transported are presented below (Figure 4).

Figure 4. Most frequently transported products in 2020

Rysunek 4. Najczęściej transportowane produkty w 2020 roku



Source: own elaboration based on results of surveys.

Figure 4 shows the division of the most frequently products carried by the surveyed companies in 2020. As can be seen, in the 1st quarter the vast majority were medicines – it was 68% of deliveries. In subsequent quarters there was a decline in the transport of medicines in favour of protective equipment such as masks, aprons, visors, medical goggles, etc. The highest number of deliveries of protective equipment was in the second quarter. The 4th quarter also saw a 1% increase in the transport of COVID-19 vaccines in the overall share of transport. The data presented shows how the demand for medical supplies in 2020 looked during the pandemic. When distributing medicines and other medical products, most of the surveyed companies ensured that they had special barcode readers to record and analyse data and transport conditions.

The surveyed enterprises have been operating in the pharmaceutical sector for at least several years and constitute a proven base of suppliers of medicines in Poland and in the other countries of the European Union. The financial situation of the enterprises under analysis was significantly improved by the COVID-19 coronavirus pandemic. Transport in many industries was reduced and caused losses, especially the decline in passenger transport. The transport of goods was reduced, but was performed in order to maintain the flow of essential goods between countries.

Conclusion

Last year the transport, which has been growing for years, underwent a crisis that had not been seen for many years. The entire world economy faced new challenges. The transport industry has also had to face them. Every mode of transport has seen its turnover fall to a greater or lesser extent. The transport of goods by road is dependent on sales in individual economic sectors, which is why the crisis in production has contributed to difficulties for many transport companies. Road transport from some of the countries of the European Union that were most affected by the pandemic was very difficult. Therefore, many shipments of goods reached a decline compared to previous years. The analyses carried out illustrated the level of transport before and during the pandemic and transport in the pharmaceutical industry. The increase in the number of transports in the analyzed years 2000 – 2019 testified to the increasing impact of transport in all sectors of the economy. In 2020 there was a differentiation in the amount of transported goods in the individual months. It is especially noticed in April and May, due to international restrictions related to the lockdown. The data analysis pretending that the hypothesis put forward in the article is right. The socio-economic situation in the world was changed by the unexpected emergence of a dangerous virus, which continues to affect world economies today.

References

- Bettencourt L.A., Brown S.W., Sirianni N.J., *The secret of true service innovation*, "Business Horizons" 2013, 56.
- Belas J., Belas L., Cepel M., Rozsa Z., *The impact of the public sector on the quality of the business environment in the SME segment*, "Administratie si Management Public" 2019 (32).
- Burganovaa N., Grznara P., Gregora M., Mozol S., *Optimalisation of Internal Logistics Transport Time Through Warehouse Management: Case Study*, "Science Direct Transportation Research Procedia" 2021, 55.
- Cichosz M., Wallenburg C.M. and Knemeyer A.M., *Digital transformation at Logistics service providers: barriers, success factors and leading practices*, "International Journal of Logistics Management" 2020, Vol. 31, No. 2.
- Choa H., Lee J., *Does transportation size matter for competitiveness in the Logistics industry? The cases of maritime and air transportation*, "The Asian Journal of Shipping and Logistics" December 2020, Vol. 36, Issue 4.
- Choudary S.P., Van Alstyne M.W. and Parker G.G., *Platforms and blockchain will transform logistics*, "Harvard Business Review", available at: <https://hbr.org/2019/06/platforms-and-blockchain-will-transform-logistics> 2019.
- Dombrowski U., Crespo I., Zahn T., *Adaptive Configuration of a Lean Production System in Small and Medium- sized Enterprises*, "Production Management" 2010, Vol. 4.
- Dz.U. 2002, nr 144, poz. 1216.
- Dz.U. 2008, nr 45, poz. 271, ze zm.
- Economist T., *The global logistics business is going to be transformed by digitization*, *Economist*, available at: <https://www.economist.com/briefing/2018/04/26/the-global-logistics-business-is-going-to-be-transformed-by-digitisation>. \ 2018.
- Frederico G., *Towards a Supply Chain 4.0 on the post-COVID-19 pandemic: a conceptual and strategic discussion for more resilient supply chains*, "Rajagiri Management Journal", November 2020.
- Gaudenzi B., Confente I., Russo I., *Logistics service quality and customer satisfaction in B2B relationships: a qualitative comparative analysis approach*, "The TQM Journal" 2021, Vol. 33, No. 1.
- Grinerud K., Aarseth W., Robertsen R., *Leadership strategies, management decisions and safety culture in road transport organizations*, "Research in Transportation Business & Management" 2021, 6 (pdf).
- Grytnes R., Shibuya H., Dyreborg J., Grøn S. & Cleal B., *Too individualistic for safety culture? Non-traffic related work safety among heavy goods vehicle drivers*, "Transportation Research Part F: Psychology and Behaviour" 2016, 40.
- Hudáková M., Masár M., Šimák L., Brezina D., *The current state of the application of risk management in the transport sector*, "Transportation Research Procedia" 2019, 40.

Hughes B.P., Newstead S., Anund A., Shu C.C., & Falkmer T., *A review of models relevant to road safety*, "Accident Analysis and Prevention" 2015, 74.

Huizingh E.K.R.E., *Open innovation: State of the art and future perspectives*, "Technovation" 2011, 31.

Kopishynska O., Utkin Y., Kalinichenko A., Jelonek D., *Efficacy of the cloud computing technology in the management of communication and business processes of the companies*, "Polish Journal of Management Studies" 2016, 14(2).

Kubás J., Hollá K., Repková Štofková K., Ballay M., Polorecka M., *Strategy Management of Telematics Systems in the Transport Sector with Regard to Safety*, "Transportation Research Procedia" 2021, 55.

Lee M.T., Raschke R.L., Louis R.St., *Exploiting organizational culture: Configurations for value through knowledge worker's motivation*, "Journal of Business Research" 2016, 69.

Lei N., *Intelligent logistics scheduling model and algorithm based on Internet of Things technology*, Vol. 61, 2021.

Man M. et al., *The Cost for the Entire Life Cycle of the Product Respecting Quality Standards*, "Polish Journal of Management Studies" 2011, vol. 4.

Masár M., Hudáková M., Šimák L., Brezina D., *The current state of project risk management in the transport sector*, "Transportation Research Procedia" 2019, 40.

Miler R.K., Kisielewski M.J., Brzozowska A., Kalinichenko A., *Efficiency of Telematics Systems in Management of Operational Activities in Road Transport Enterprises*, "Energies" 2020, 13(18).

Mooren L., Grzebieta R., Williamson A., Olivier J. & Friswell R., *Safety management for heavy vehicle transport: A review of the literature*, "Safety Science" 2014, 62(C).

Nævestad T.-O., Elvebakk B. & Phillips R.O., *The safety ladder: Developing an evidence-based safety management strategy for small road transport companies*, "Transport Reviews" 2018, 38(3).

Nævestad T.-O., Hesjevoll I.S., & Phillips R.O., *How can we improve safety culture in transport organizations? A review of interventions, effects and influencing factors*. "Transportation Research Part F: Psychology and Behaviour" 2018, 54.

Nedeliaková E., Stasiak-Betlejewska R., *Transport management in Polish cities in the context of the European sustainable transport concept*, "Transportation Research Procedia" 2019, 40.

Newnam S., Warmerdam A., Sheppard D., Griffin M. & Stevenson M., *Do management practices support or constrain safe driving behaviour? A multi-level investigation in a sample of occupational drivers*, "Accident Analysis and Prevention" 2017, 102, 101-109.

Šimíčková J., Buganová K., Mošková E., *Specifics of the Agile Approach and Methods in Project Management and its Use in Transport*, "Transportation Research Procedia" 2021, 55.

Sirina N., Zubkov V., *Transport Services Management on Transport and Logistic Methods*, "Transportation Research Procedia" 2021, 54.

Srinivas S., Marathe R., *Moving towards "mobile warehouse": Last-mile logistics during COVID-19 and beyond*, "Transportation Research Interdisciplinary Perspectives", June 2021, Vol. 10.

Titko M., Luskova M., *Analysis of Risks Associated with Transport Infrastructure Elements Failure due to Extreme Weather Events*, "Proceedings of the 20th International scientific conference Transport Means", Lithuania 2016, 207-212.

GUS 2019, [www.transport__wyniki_dzialalnosci_w_2019_r.%20\(1\).pdf](http://www.transport__wyniki_dzialalnosci_w_2019_r.%20(1).pdf) [access: 2.03.2021].

Zielaskiewicz H., *Analiza popytu na usługi transportowe w kontekście niektórych uwarunkowań zewnętrznych*, cz. 2, „Logistyka” 2012, nr 1.

Yang L., Zhang L., Stettler M., Sukitpaneemit M., Xiao D., van Dam K., *Supporting an integrated transportation infrastructure and public space design: A coupled simulation method for evaluating traffic pollution and microclimate*, "Elsevier" 2020, Vol. 52.

Xiao Z., Yuan Q., Sun Y., Sun X., *New paradigm of logistics space reorganization: E-commerce, land use, and supply chain management*, "Transportation Research Interdisciplinary Perspectives", March 2021, Vol. 9, 100300.

BP Energy Outlook: edition. <https://www.bp.com/content/dam/bp/business-sites/en/global/corporate/pdfs/energy-economics/energy-outlook/bp-energy-outlook-2019.pdf>.

www.4trucks.pl/aktualnosci/14760/transport-drogowy-aktualna-sytuacja-na-granicach.

www.truck.pl/pl/article/1313/w-ka%c5%bcdym-kraju-inaczej-jakie-ograniczenia-i-u%c5%82atwienia-dla-transportu%2c16.

www.eu-transport.pl/transport-a-koronawirus/.

www.eu-transport.pl/wplyw-koronawirusa-na-logistykę.

www.matlogistic.pl/blog/koronawirus-a-transport/.

www.ifb-poland.pl/aktualnosci/koronawirus-a-transport-drogowy.

www.gov.pl/web/rozwoj/zalecenia-dla-branzy-transportowej-i-logistycznej-w-zwiazku-z-rozprzestrzenianiem-sie-koronawirusa.

www.stat.gov.pl/obszary-tematyczne/inne-opracowania/informacje-o-sytuacji-spoleczno-gospodarczej/biuletyn-statystyczny-nr-92020,4,104.html.

www.poltraf.pl/dystrybucja_lekow.html.

www.poradniktransportowy.pl/09/transport-lekow-warto-oplaca-sie/.

www.hacpp-polska.pl/gdp-dobra-praktyka-dystrybucyjna.

www.bbats.pl/kategoria/poradnik-specjalistyczny/.

Warunki transportu leków (chłodnie.eu).

www.ec.europa.eu.

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