The analysis of the influence of advertising on the purchase of pharmaceutical products

Jana VALEČKOVÁ, VŠB-TU Ostrava

Abstract

The size of the pharmaceutical market and sales is increasing constantly. Market is flooded with new drugs and preparations. There is an increasing number of the advertising (e.g. television and print) for these medicaments. This paper aims to analyze the relationship between (1) the awareness of the advertising and the purchase of the medicaments and (2) noticing the advertising leaflets in a pharmacy and the purchase of the medicaments. Five groups of drugs are monitored there, namely vitamins and minerals, immunity support medicines, painkillers, pharmaceutical cosmetics and medicines to support the nervous system. Analysis is made by using the logistic regression, there are determined odds ratio of purchase and purchase probability. The coefficients are estimated by using the maximum likelihood. The contribution involves the list of pharmaceutical products whose purchase is influenced by the advertising.

Keywords

Advertising, logistic regression, marketing research, odds ratio, over-the-counter products, pharmaceutical market, purchase probability.

JEL Classification: M31, M37

1. Introduction

Currently, there is a large pharmaceutical market boom and expansion of products which are offered by the pharmaceutical companies. The Company Healts IMS predicts that the pharmaceutical market will grow by 5-8 % annually to 2014 and the sale of pharmaceutical products will grow around 4 % to 6 % annually (Kroček, 2010). The main areas of interest for pharmaceutical manufacturers are product quality, customer satisfaction and loyalty. Pharmaceutical companies try to identify their customers, define the target group and manage marketing activities, and gain customer loyalty (Szeinbach et al., 1997).

When the market is growing, there is increasing importance of marketing activities in connection with the development of new products or upgrade of existing ones and also new concepts of marketing communications (advertising) and new distribution channels occur. These activities are linked to the analysis of customers and monitoring a decision-making process of OTC, supplements and other products of pharmaceutical company. It is necessary to identify the factors which influence the purchase. Factors affecting customer’s purchase may be personal characteristics, customer’s experience, attitude to products, health and role of influencer (doctor, pharmacist and family), need for purchase, availability of medicaments, medicaments advertising, and prices of medicines.

The advertising expenditures are increasing every year. Direct-to-customer spending activity of the pharmaceutical manufacturers increased from 266...
million of dollars in 1994 to 2467 million of dollars in 2000 (in the United States). In 2000, 36.4% were spent on print and other media and 63.6% were spent on television advertising, (Vogel et al., 2003). Manufacturers often show two types of advertising: (1) help-seeking advertisements (disease description but not treatment description) and (2) reminder advertisements (product name, without indication), (Vogel et al., 2003).

This paper is concerned with identifying the relationship between these variables: (1) the purchase of preparation (drugs) and the awareness of relevant advertisement and (2) the purchase of the preparation (drugs) and the noticing the advertising leaflets in a pharmacy. The aim of this paper is to identify if there is a relationship between the purchase and advertisement views and to quantify the strength of this relationship (relationship between the purchase and advertisement views). The dependent variable (purchase of drugs in both the above cases) is a binary, the analysis will be carried out by using the logistic regression. The paper analyzed five categories of drugs, namely vitamins and minerals, immunity support medicines, painkillers, pharmaceutical cosmetics and medicines to support the nervous system.

The paper contains a theoretical background of purchasing decisions and the impact of advertising on purchase, then theoretical background of logistic regression. Fourth part of the paper is devoted to the description of the methodology of data collection and analysis. Results are summarized at the end.

2. Purchasing decisions and impact of advertisement

Customer behaviour reflects the totality of their decisions regarding the goods, services, activities and ideas. This is the behaviour regarding the acquisition, consumption and disposition with goods or services, (Hoyer and MacInnis, 2007).

Kotler (2003) says that the behaviour of customer is influenced by cultural, social, and personal factors. Cultural factors are presented as the largest and broadest group. For example cultural factors are ethnicity, religion, racial group, and social class. Social factors are family, reference groups, social role, and a position in a society. Personal factors include age, occupation or lifestyle.

There are two approaches to analysis of customers - quantitative analysis and qualitative analysis. Qualitative analysis may be performed by the black box model. The black box model is based on stimulus and response. Advertising can be one of the stimuli. A marketer looks for the reasons that has led the customer to respond. Another qualitative analysis is based on the process of decision making, which includes (1) recognizing of the problem, (2) searching for information, (3) evaluating the alternatives, (4) purchase decision, and (5) behaviour after purchase, (Spáčil, 2003).

Customer behaviour is an ongoing process. This process does not end with the purchase and payment. It involves the handling of products, repeating the purchases, and satisfied or unsatisfied behaviour, (Solomon et al., 2006). Customer behaviour involves many different actors. Each of them has a different role. Each role may be performed by 1 person or 1 person can perform many roles. The purchaser and user of a product may not be the same person. Other roles include informant, decider and influencer, (Solomon et al., 2006).

Customer behaviour reflects five elements which are shown in Figure 1. Each of these elements has the influence on the marketing strategies and tactics. In model of customer behaviour there are many questions which describe the behaviour accurately, for example what customer buys, when and where customer buys it, etc. Subjects of investigation can be products, services, activities or ideas. The actors in a decision-making process have many roles: information gatherer, influencer, decider, purchaser and user. Decision-making process takes place at a certain time.

Advertisement can play one of the important roles in a decision-making process. It’s role lie in informing and influencing. Advertising informs about new and existing medicaments, and it has an important role in decision-making process. An advertisement may have different forms such as television and radio advertising, advertising on the Internet, in the pharmacies, or in the magazines. This is valid for the medicaments freely available.

In 1999 pharm. companies spent 1.8 billion dollars on direct-to-consumer advertisements. In 1994 it was less than 300 million dollars, (Woloshin et al., 2001). The research (which was carried out in the USA) has shown that customers are increasingly exposed to direct-to-consumer advertisements. This research monitors prescription drugs. Results show that doctors are increasingly confronted with the patients who ask questions or who make suggestions on the basis of these advertisements, (Woloshin et al., 2001).

3. Theoretical background of logistic regression

Logistic regression is a mathematical modelling approach that can be used to describe the relationship of several independent variables to a dichotomous dependent variable. Dependent variable can take two values, it is zero (for example dissatisfaction, ignorance brand, product is not purchased) and it is one in
the second case (for example satisfaction, brand awareness, purchase of product). Model can predict the probability, (Kleinbaum and Klein, 2010).

3.1 A formulation of the model

Consider a binary variable $Y_i$ characterizing the positive and negative response to the $i$-th respondent for $i = 1,...,N$, where $N$ is the number of respondents. Each respondent is characterized by the vector $x_i = (x_{i1}, x_{i2},...,x_{ik})$ containing $K$ the elements (Pecáková, 2007).

The likelihood of a positive response of the $i$-th respondent $P_i = P(Y_i = 1)$ on the basis of its characteristic vector $x_i$ can be expressed as function $F(\beta, x_i)$, which is increasing and have a domain of definition $(-\infty, +\infty)$ and a range $(0,1)$, so is accepted that $F(-\infty) = 0$ and $F(+\infty) = 1$ likelihood function of a response can be written as

$$ P_i = F(\beta, x_i), \quad (1) $$

where $\beta$ is vector of parameters $(\beta_0, \beta_1,...,\beta_k)$.

These properties are the cumulative distribution function of the logistic distribution in the shape

$$ P_i = P(Y_i = 1) = F(\beta, x_i) = \frac{e^{\beta x_i}}{1 + e^{\beta x_i}}, \quad (2) $$

which is a function of the probability of the answer. The probability of a negative response is $1 - P_i$. (Hosmer and Lemeshow, 2000).

Definition of the percentage probability of positive and negative responses (odds) in the form (Pecáková, 2007)

$$ \frac{\pi}{1 - \pi} = \frac{P(Y_i = 1)}{P(Y_i = 0)} = e^{\beta x_i}. \quad (3) $$

The odds ratio for dichotomy variable ($x_j$ takes values 0 or 1) is following (Hilbe, 2009)

$$ OR(1,0) = \frac{\pi(x_j = 1)}{\pi(x_j = 0)} = \frac{1 - \pi(x_j = 0)}{1 - \pi(x_j = 1)} = \exp(\beta_j). \quad (4) $$

3.2 An estimate of model parameters

Unknown parameter $\beta$ is estimated by using method of maximum likelihood. This method consists in finding a likelihood function, which is maximized after that. The likelihood of a positive answer of $i$-th respondent which is a characterized by the vector $x_i$, then

$$ P(Y_i = 1 | x_i) = \pi(x_i), \quad (5) $$

and the likelihood of a negative response as $1 - \pi(x_i)$.

The combined probability of positive and negative responses can be written then as (Hosmer and Lemeshow, 2000)

$$ P(Y_i | x_i) = \pi(x_i)^y [1 - \pi(x_i)]^{1-y}. \quad (6) $$

If each observation is independent, then the likelihood function is defined as the result of equation (6) for all respondents. Parameters using maximum likelihood method are obtained by maximizing the logarithm of the likelihood function in the form (Hosmer and Lemeshow, 2000)

$$ L(\beta) = \ln l(\beta) = \sum_{i=1}^{N} y_i \cdot \ln(\pi(x_i)) + (1 - y_i) \cdot \ln(1 - \pi(x_i)). \quad (7) $$
4. Analysis of the influence of the advertising on the purchase

The following chapters describe the methodology of data collection through primary research and analysis of the various categories of pharmaceutical products.

4.1 Data collection methodology

The data used in the model was collected through marketing research. Data was obtained from the written questionnaire in a Moravia region on December 2010. The data was collected by non-representative sampling techniques, namely it was a method of a snowball. Group of respondents approached another respondents. The condition of the place of residence (Moravia region) and the condition of age (more than 18 years old) were fulfilled for all respondents. The size of the sample is 289 respondents. The distribution of the advertisement awareness (yes or no) can be seen in Table 1 in appendix. It is categorized according to groups of medicaments. The contingency table (Table 1) shows the number of respondents who made or made not the purchase of (1) vitamins and minerals, (2) immunity support medicines, (3) painkillers, (4) pharmaceutical cosmetics or (5) medicines to support the nervous system. The analysis was performed by using the statistical program called Stata.

The distribution of the respondents' answers to the leaflets in the pharmacies can be seen in Table 2 in appendix. The aim of this question was to detect whether the respondents observe the advertising leaflets and brochures. There were three options: respondents ignore the leaflets; respondents observe the leaflets, but are not interested in them; respondents observe the leaflets and are interested in them. The table is again categorized according to groups of medicaments. The contingency table (Table 2) shows the number of respondents who made or made not the purchase of (1) vitamins and minerals, (2) immunity support medicines, (3) painkillers, (4) pharmaceutical cosmetics or (5) medicines to support the nervous system.

In the following section a five groups of drugs are analyzed. They are statistically tested on whether relationship between the advertisement awareness (print and television) and purchase of drugs is significant. We define the rate of chance to purchase If a customer noticed the advertisement (or not noticed). We determined the degree of the probability of purchase when customer noticed an advertisement and when customer did not notice it.

The main points of the analysis are the estimation of the logistic regression models. The relationship between the variables will be quantified. There are also further information obtained from the primary research (on December 2010) which are listed in the analysis. Such information deal with reasons for the buying the medicaments (purchase as prevention and purchase after the outbreak the disease).

Testing is carried out at 5% significance level. Dependent variable is the purchase of medicaments (1 = yes; 0 = no). The first independent variable is the advertisement awareness (1 = yes; 0 = no) and second independent variable is the interest in leaflets and brochures of pharmaceutical products (1 = ignore; 2 = observe, not interested in; 3 = observe, interested in). Confirmation or rejection of the significance of the model is determined by the P-value. If the P value is greater than the significance level (0.05) then model is not statistically significant. P value can be obtained from the estimated regression model or through the use of MS Office Excel functions FDIST(F²,vyp,df,df) (Zmeškal, 2004).

In section 3.2 to 3.6 are estimated models for categories of pharmaceutical products. In each category there are two estimations. There were analyzed the relationship among (1) the awareness of the advertising and the purchase of the medicaments and (2) noticing the advertising leaflets in the pharmacy and the purchase of the medicaments. There are ten estimated models.

4.2 The vitamins and minerals

The category vitamins and minerals is analyzed first.

Advertisement awareness

There is investigated the relationship between the buying the vitamins and minerals and the advertisement awareness of these pharmaceutical products. This relationship will be quantified. The results of the first analysis are presented in Figure 2 below. Customers who are not exposed to advertisements are the reference group. Rvitamins (in Figure 2) include customers who noticed advertising for the vitamins and minerals.

Figure 2 shows the estimation of logistic regression model for vitamins and minerals. Low R² value in logistic regression is the norm and it presents a problem when reporting their values to the audience accustomed to seeing linear regression values. It may be helpful as a statistic tool to evaluate competing model, (Hosmer and Lemeshow, 2000). In the logistic model is not appropriate to use a classic R². Pseudo R² is used instead. There are several ways to calculate the Pseudo R², (Hilbe, 2009).

Value P for the coefficient is less than 0.05 (significance level is 5 %). P-value for the coefficient is equal to 0.005. The relationship between the purchases and the awareness of advertisements for vitamins and
minerals is significant. The purchase of vitamins and minerals is dependent on advertisement (print or television). Thus the advertisement is an important factor which impacted purchase.

The relationship between the two observed variables is significant. The result of the analysis shows the odds ratio, which is 2.151. This is presented in Figure 3. Odds ratio formula is given in Chapter 3.1, it is the Formula 4. Odds ratio is the ratio between an odds of the purchase when customers are exposed to advertisement and odds of the purchase when customers are not exposed to advertisement. The odds ratio is greater than 1 so the odds of purchase are greater when the customers are aware of the advertising.

The odds of the purchases of the vitamins and minerals when the customers are exposed to advertisement are 2.868 and the odds of the purchases when the customers are not exposed to advertisement are 1.334. The probability of the purchase is 0.742 in the first case and probability of purchase in the second case is 0.571. Results are based on Formula 2 in Chapter 3.1.

Equation of estimated model in this case is as follows:

\[ P_i = P(Y_i = 1) = \frac{e^{(0.2876821 + 0.7659065 \cdot x_i)}}{1 + e^{(0.2876821 + 0.7659065 \cdot x_i)}}, \]

where \( P \) is probability of purchase of vitamins and minerals, \( i = 1, \ldots, N \), where \( N \) is number of respondents. If the customer is exposed to advertisement then \( x_i \) is 1 and if the customer is not exposed to advertisement then \( x_i \) is 0.

### Advertising leaflets in pharmacy

The figure 4 presents the estimation of the logistic regression model for category of the vitamins and minerals. The customers who ignore the leaflets in pharmacy are the reference group. _Iletak_2 (in Figure 4) means the customers who observe leaflets (but they are not interested in them) and _Iletak_3 mean the customers who observe leaflets (and they are interested in them).

In this case is apparent that the independent variables are statistically significant. The purchase of vitamins and minerals is dependent on the attitude to leaflets in pharmacy. P-values of independent variables are less than 0.05.

The odds of the purchases of the vitamins and minerals when the customers observe the leaflets (but are not interested in them) are 3.237, the odds of the purchases of the vitamins and minerals when the customers observe leaflets (and are interested in them) are 15.393, and the odds of the purchases when the customers ignore the leaflets in pharmacy are 1.079. The odds are greater when the customers are interested in the leaflets. It is confirmed by the level of the probability of the purchase. The probability of the purchase when the customers observe the leaflets and are interested in them is 0.939. The probability of the purchase when the customers observe the leaflets but are not interested in them is 0.764. The probability of the purchase when the customers ignore the leaflets is 0.519. If interest in the leaflet increases then the probability of the purchase of the vitamin and mineral increases too. The odds ratio is given by Formula 4 in Chapter 3.1 and the probability of the purchase is based on the Formula 2 listed in Chapter 3.1.

The odds ratio equals 3.25. It means that the odds of the purchase are 3.25 times larger when the customers observe the leaflets (listed in Figure 5).

The significant influence of the advertisement on the purchase of vitamins and minerals is proven by the analysis. If the customers are noticed the advertising messages in print or on television, the probability of the purchase of this medication category is significantly increased. The probability of the purchase is greater
by 0.17. The relationship between the advertising leaflets in the pharmacy and the purchase of the medicaments is also demonstrated. If the customers are interested in the leaflets strongly then the probability of the purchase is 0.42 larger than in case that they are not interested in them.

The results of the primary research show too that 75% of users buy vitamins and minerals before the disease occurs and 25% buy it after the disease occurs. Because most customers buy these medicaments before disease they have time to get information from many sources.

Customers receive information from different sources and from many sources at the beginning of the decision-making process. The information is from internal sources (own experience) or from external sources. They can obtain information about medicaments from previous own experience, from family, friends, doctors, pharmacists or the discussion forums on the Internet. The marketing communication (specifically advertising) is also an important source of information.

Customers are looking for more information from the above listed sources before the outbreak of the disease (probably in the winter months). The advertisements in print or on television are an important source of such information. The influence of the advertisement on the purchase of vitamins and minerals is shown above. The research results do not reveal the intensity level of information resource on a customer’s decision. There is identified a relationship between an advertising message and executing the purchase.

Equation of estimated model in this case is as follows:

$$P_i = P(Y_i = 1) = \frac{e^{(0.074108+1.97932x_{ij}+2.666732x_{ij})}}{1 + e^{(0.074108+1.97932x_{ij}+2.666732x_{ij})}}$$  \hspace{1cm} (9)$$

where $P$ is probability of purchase of vitamins and minerals. If the customer ignore the leaflets then $x_{ij} = 0$ and $x_{ij} = 0$. If the customer observe the leaflets but are not interested in them then $x_{ij} = 1$ and $x_{ij} = 0$. If the customer observe the leaflets and are interested in them then $x_{ij} = 0$ and $x_{ij} = 1$.

The best estimated model is a model related to category vitamins and minerals. This is indicated by Pseudo R². Pseudo R² of all estimation is low. This is helpful as a statistic for evaluating competing model. The best quality estimation is model for vitamins and minerals. The actual results are visible in figures above.

### 4.3 The immunity support medicine

The immunity support medicines are the second testing category.

#### Advertisement awareness

Figure 6 shows the estimation of the logistic regression model for this group of medicaments. The customers who are not exposed to advertisement are the reference group. Rimunita (in Figure 6) means the customers who have noticed the advertising for the immunity support medicine.

It is necessary to determine whether the relationship between two variables is statistically significant. P-value for coefficient is equal 0.069. Testing is carried out at 5% significance level. The purchase of immunity support medicine is not dependent on the advertisement awareness (print or television). Conclusion is that the advertisement awareness is not an important factor which determined the purchase of the immunity support medicines.
The relation between the purchase and the interest in leaflets is tested in the following part. The customers who ignore the leaflets in a pharmacy are the reference group. _Iletak_2 (in Figure 7) means the customers who observe the leaflets (but they are not interested in them) and _Iletak_3 means the customers who observe the leaflets (and they are interested in them).

Dependence is identified. It is based on a statistical testing, carried out at 5% significance level. Comparing the significance level and P-values we can say that the coefficients are statistically significant. P-value for an independent variable is less than 0.05 (listed in Figure 7). There is a statistic significance between the purchase of the immunity support medicines and interest in the leaflets which are placed in a pharmacy.

The Odds of the purchases of the immunity support medicines when the customers observe the leaflets (and are interested in them) are 2.3; the odds of the purchases of the immunity support medicines when the customers observe the leaflets (but are not interested in them) are 1.278, and the odds of the purchases when the customers ignore the leaflets in pharmacy are 0.686. The odds are greater than the customers are interested in the leaflets. The probability of the purchase when the customers observe the leaflets and are interested in it them is 0.697. The probability of the purchase when the customers observe the leaflets but are not interested in them is 0.561. The probability of the purchase when the customers ignore the leaflets is 0.407. If interest in the leaflets increases then the probability of the purchase of the immunity support medicines increases too. The probability of the purchase is based on the formula number 2 listed in Chapter 3.1.

The odds ratio equals 1.839. It means that the odd of purchase is 1.839 times larger when the customers observe the leaflets (listed in Figure 8). The odds ratio in this product category is less than in the previous category (vitamins and minerals). The odds ratio is given by Formula 4 in Chapter 3.1.

The probability of the purchase of the immunity support medicine increases when the interest in print advertising in pharmacies increases too. This claim is statistically proven. The immunity support medicines are intended to prevent. Thus the customers would probably use (or buy) this group of drugs before the outbreak of the disease.

The research showed that 65% of the users buy the medicaments before the outbreak of the disease and 35% of users buy it after the outbreak of the disease. The customers make reserves of these medicaments as in the previous case of the vitamins and minerals. The immunity support medicines and vitamins can be identical in some cases. The reasons for consumption may be the same.
These categories (the immunity support medicines and vitamins) may show similar results but the effect of the advertising message on the purchase of immunity support medicines has not proven. The effect of information leaflets on the purchase of the immunity support medicines is proven. This effect is significantly higher in case of the vitamins and minerals.

The immunity support medicines are seasonal affairs. Greater demand and greater concentration of interest are probably higher at the end of the year and the beginning of a new one, so in the winter time. The demand and the interest are probably lower in the summer time. The customer’s interest in information will increase during this period. It is a good time for print advertising in pharmacies because the influence has been proven.

Equation of estimated model in this case is as follows:

$$P_i = P(Y_i = 1) = \frac{e^{(-0.3746934+0.6191468 x_1 + 1.207603 x_2)}}{1 + e^{(-0.3746934+0.6191468 x_1 + 1.207603 x_2)}}, \quad (10)$$

where $P$ is probability of purchase of the immunity support medicines, similar as interpretation of formula (9).

4.4 The painkillers

The category called the painkillers is analyzed in the third section.

Advertisement awareness

Figure 9 shows the estimation of logistic regression model for the painkillers. The customers who are not exposed to advertisement are the reference group. Rbolest (in Figure 9) means the customers who have noticed the advertisements for the painkillers.

The coefficients are estimated by using maximum likelihood method. The coefficient and constant are statistically significant, P-value for coefficient equals 0.041 (0.041<0.05). So, awareness of the advertising is the important factor that determines purchase of the painkillers.

The odds ratio is listed below the text in Figure 10. The number 1.858 means the odds of the purchases when customers are aware of the advertisement on these medicaments to the odds of the purchases when the customers are not aware the advertisement. The odds of the purchases when the customers are aware of the advertisement are 4.568 and the odds of the purchases when the customers are not aware of the advertisement are given by a constant value $\exp(0.8994836) = 2.458$. The probability of the purchase in the first case is 0.82 and the probability of the purchase in the second case is 0.711. The results are based on the formulas in Chapter 3 (Formula 2 and Formula 4).

Equation of estimated model in this case is as follows:

$$P_i = P(Y_i = 1) = \frac{e^{(0.8994836+0.6194972 x_1)}}{1 + e^{(0.8994836+0.6194972 x_1)}}, \quad (11)$$

where $P$ is probability of purchase of the painkillers, similar as interpretation of formula (8).

Advertising leaflets in pharmacy

The customers who ignore the leaflets in a pharmacies are the reference group. _Iletak_2 (in Figure 11) means a customers who observe leaflets (but they are not interested in them) and _Iletak_3 mean a customers who observe leaflets (and they are interested in them).

P-values for the both coefficients are greater than 0.05 (testing is carried out at 5% significance level). The estimation results are presented in Figure 11. The information brochures and leaflets located in a pharmacies are not decisive for purchase of this category of pharmaceutical products.

The painkillers are purchased by consumers if they or their close people suffer painful problems (occasionally or regularly). Consumers buy drugs on a regular basis if they know their problems. These medicaments can be purchased for a random pain or in case of same serious health complications. In the second case medicaments are usually prescribed by a physician.

The painkillers are medicaments that solve the problems which have developed or will develop in the near future. 44 % of the users buy painkillers before the disease occurs as prevention and 56 % of the users buy it after the disease occurs.

The influence of the advertising on the purchase of painkillers has been shown. Advertising is likely to affect group of the users who suffer from minor health problems and who know that the problems will occur.

4.5 The pharmaceutical cosmetics

The pharmaceutical cosmetics is another group. There are analyzes of advertisement awareness and advertising leaflets in pharmacy.

Advertisement awareness

Figure 12 shows the estimation of the logistic regression model for the pharmaceutical cosmetics. The customers who are not exposed to advertisement are the reference group. Rkosmetika (in Figure 12) means a customer who noticed the advertising for the pharmaceutical cosmetics.

P-value is less than 0.05. The statistic shows that an important factor for the purchase is the awareness
of the advertising, in print or on television. The purchase of the pharmaceutical cosmetics is very dependent on watching the advertisements (print or television). Other factors are not analyzed. The pharmaceutical cosmetics are slightly different in relation to the other medicaments.

Some customers buy these products because they provide a sense of higher values than the cosmetics which are sold at chemists chains. Health is not the only reason for the purchase of the pharmaceutical cosmetics. The need to test the quality cosmetics may be a reason for the purchase. The information about the existence of this product is very often obtained from the advertising.

The odds ratio for the purchase of the pharmaceutical cosmetics is presented in Figure 13. The odds ratio is 2.617. This number means that the purchase of the pharmaceutical cosmetics is 2.617 times greater when customers are aware of the advertisement than in case than customers are not aware of the advertisement.

The odds of the purchases when the customers are often aware of the advertisement are 1.914 and the odds of the purchases of these medicaments when the customers are not aware of the advertisement are 0.731. The probability of the purchase in the first case is 0.657 and the probability of the purchase in the second case is 0.422. The odds ratio is given by Formula 4 in Chapter 3.1 and the probability of the purchase is based on the Formula 2 listed in Chapter 3.1.

Equation of estimated model in this case is as follows:

$$P_i = P(Y_i = 1) = \frac{e^{(-0.3126834 + 0.9620279 x_i)}}{1 + e^{(-0.3126834 + 0.9620279 x_i)}},$$ (12)

where $P$ is probability of purchase of pharmaceutical cosmetics, similar interpretation as formula (8).
Advertising leaflets in pharmacy

The estimation of the logistic regression for the cosmetics from pharmacies is listed in Figure 14. The customers who ignore the leaflets in pharmacies are the reference group. _Iletak_2 (in Figure 14) means a customers who observe the leaflets (but they are not interested in them) and _Iletak_3 means a customers who observe the leaflets (and they are interested in them).

The value of coefficients and constant follows. It is necessary to determine whether there is a relationship between the purchase of the pharmaceutical cosmetics and the interest in leaflets in a pharmacies. This relationship is confirmed by the P-value. The P-value of the first coefficient is statistically significant, it is less than 0.05; specifically 0.012 (respondents observe the leaflets, but are not interested in them).

The P-value of the second coefficient is not statistically significant, it is greater than 0.05, specifically 0.165 (respondents observe the leaflets and they are interested in them). It is necessary to the combine categories and makes a new estimation of the logistic regression.

A reference variable is the first choice in own written questionnaire, thus respondents ignore the leaflets in pharmacies. If the one coefficient is significant and the second is not significant, it is necessary to recode the alternatives. The first choice (respondents ignore the leaflets) and the third choice (respondents observe the leaflets and they are interested in them) in the questionnaire are merged. The results of the new estimation are presented in Figure 15. P-value is less than 0.05, thus the coefficient is statistically significant.

Figure 16 shows the odds ratio (Formula 4, Chapter 3.1) of the purchase of this category of products. It equals 1.672. This product category is recoded. In the first group there are customers (patients) who ignore the leaflets and those whose observe them intensively, and in the second group there are customers who observe the leaflets but are not interested in them. The odds of purchases in the first group are 0.667, the probability of the purchase is 0.44. The odds of the purchases for the second group are 1.135, and the probability of the purchase is 0.568. This is the result of own statistical test. The first group includes the customers who ignore the leaflets and the customers who are interested in them. It represents to different ways of behaviour in one group. The probability of the purchase is based on the Formula 2 listed in Chapter 3.1.

The purchase is influenced by the print and the television advertising, which has been statistically proven. A significant influencer is confirmed but the first step (one’s of need) in the buying decision process can be different. Different customers have different needs.

The elimination of skin problems can be the first reason for purchasing the pharmaceutical cosmetics; the problems are eliminated after their occurrence. 46 % of the users buy the pharmaceutical cosmetics after the disease occurs.

Preventing skin problems is another reason to buy this product group. 54 % of users buy the pharmaceutical cosmetics before the disease occurs. If the customers buy pharmaceutical cosmetics preventively then the advertising on television, in magazines, or in pharmacies may play an important role. The advertising will be a great source of information in the buying decision process. It is verified by the own testing.

The range of pharmaceutical cosmetics and the intensity of advertising campaigns have been growing recently. There are products such as shampoos, face and body creams, shower gels, decorative cosmetics, and solar cosmetics in the pharmacies. The pharmaceutical cosmetics substitute products from drugstore chains sometimes. The users are mostly women. The vision of a quality cosmetics with medicinal effects can be reasons to buy these products at a pharmacies rather than in drugstores chains. Information is very often communicated in various advertising campaigns.

The impact of campaigns in this group of pharmaceutical products is due to the characteristics of the products listed above. This fact has been confirmed by own statistical testing. Thus the significant influence of the advertisement on the purchase is confirmed.

Equation of estimated model in this case is as follows:

\[ P_i = P(Y_i = 1) = \frac{e^{(0.2423135 + 0.5142472 x_i)}}{1 + e^{(-0.2423135 + 0.5142472 x_i)}} \]

where \( P \) is probability of purchase of pharmaceutical cosmetics. If the customer ignore the leaflets and customer observe them intensively then \( x_i = 0 \). Reference category (respondents ignore the leaflets in pharmacies) was merged with the third group of questions (customer observe the leaflets intensively) in order to estimate the model. Statistical significance of coefficients was demonstrated after this merger. If the customer observe the leaflets but are not interested in them then \( x_i = 1 \).

4.6 The medicines to support the nervous system

The medicines to support the nervous system are the last category of drugs.
Figure 13 Odds ratio for the pharmaceutical cosmetics (advertisement awareness)

| Odds Ratio | Std. Err. | z     | P>|z| [95% Conf. Interval] |
|------------|-----------|-------|--------------------------|
| 2.616998   | .6693291  | 3.76  | 0.000                    |

Figure 14 Estimate of logistic regression for the pharmaceutical cosmetics (leaflets in pharmacy)

| Coef.     | Std. Err. | z     | P>|z| [95% Conf. Interval] |
|-----------|-----------|-------|--------------------------|
| _Iletak_2 | .5142472  | .2373121 | 2.17  | 0.030  | .0493241 | .9793703 |
| _Iletak_3 | .557015   | .4007175 | 1.39  | 0.166  | -.2283768| 1.342407  |

Figure 15 Estimation of logistic regression for the pharmaceutical cosmetics, recalculated (leaflets in pharmacy)

| Coef.     | Std. Err. | z     | P>|z| [95% Conf. Interval] |
|-----------|-----------|-------|--------------------------|
| _Iletak_2 | .5142472  | .2373121 | 2.17  | 0.030  | .0493241 | .9793703 |
| _Iletak_3 | .557015   | .4007175 | 1.39  | 0.166  | -.2283768| 1.342407  |

Figure 16 Odds ratio for the pharmaceutical cosmetics (leaflets in pharmacy)

| Coef.     | Std. Err. | z     | P>|z| [95% Conf. Interval] |
|-----------|-----------|-------|--------------------------|
| .522379   | .3968758  | 1.37  | 0.090                    |

Figure 17 Estimation of logistic regression for the medicines to support the nervous system (advertisement awareness)

**Advertisement awareness**

According to the results in Figure 17 it is apparent that the coefficient is not statistically significant. Customers who are not exposed to the advertisement are the reference group. _Rnervy_ (in Figure 17) means the customers who noticed the advertising for the medicines to support the nervous system.

P-value equals 0.371. The purchase of the medicines to support the nervous system is not dependent on the awareness of the advertisement (in print or on television). The purchase of these medicaments depends on other factors, for example consumer’s health or attitude to medicaments.

**Advertising leaflets in pharmacy**

Figure 18 presents the results. Customers who ignore the leaflets in a pharmacies are the reference group. _Iletak_2 (in Figure 18) means customers who observe the leaflets (but they are not interested them) and _Iletak_3 means customers who observe the leaflets (and they are interested in them).
The purchase of the medicine to support the nervous system is not dependent on customers’ observation of the leaflets in pharmacies. P-value for the first coefficient equals 0.469 and P-value for the second independent variable equals 0.049. The second value is on the limit because the estimation is carried out at 5% significance level. The odds ratio and the probability are not detected.

Category called the medicines to support the nervous system is the last area of analysis. This category includes products that are designed to eliminate insomnia and anxiety states, and includes antidepressants or medications for stop smoking.

The influence of the advertising on the purchase of this group has been demonstrated in the analysis. In this case there will be important other sources of information because it is a different group of drugs. These products are used for the psychological problems. The foregoing products (vitamins, painkillers, cosmetics, immunity support medicines) are intended for the physical problems, e.g. pain, illness, prevention.

For the four categories listed above (vitamins and minerals, immunity support medicines, painkillers, and pharmaceutical cosmetics) were showed that the advertising (advertisement awareness or advertising leaflets or both) influences the purchase. The influence of the advertisement awareness on the purchase for the medicines nervous system support is not statistically confirmed. The test confirms the claim above that it is a special group of products than any other analyzed group (it is based on the problems which the products remove). The purchase is influenced by other factors.

5. Conclusion

The aim of this paper was the analysis of the purchases on the pharmaceutical market. Specifically, the influence of advertising on the purchase of the five groups of pharmaceutical products. Selected groups of products eliminate different health problems.

There were observed the following groups: (1) vitamins and minerals, (2) immunity support medicines, (3) painkillers, (4) pharmaceutical cosmetics and (5) medicines to support the nervous system. The analysis was performed by using the logistic regression because the dependent variable is binary. The estimate of the coefficient was performed by using the maximum-likelihood method in this regression model.

There were found the relationships between the purchase and the advertisements awareness (print and television) for vitamins and minerals, painkillers and pharmaceutical cosmetics and the relationships between the purchase and the perception of leaflets for vitamins and minerals, pharmaceutical cosmetics and immunity support medicines. The influence of advertising was not found in case of the medicines to support the nervous system. Ten models were estimated. The best quality estimation is the model for vitamins and minerals.

The customers are influenced by numerous other factors than advertising. These factors influence the process of making decisions and making purchase. Just impact of the advertising was analyzed closely in this paper. These factors will be monitored and analyzed in further research.

The next phase of the research will concentrate on the analysis of a customer. Customers can be segmented according to demographic, geographic, psychologichal and behavioral factors. This is another part of the future analysis – analysis of the relationship between segmentation criteria (demographic, geographic, psychological and behavioral) and purchase of pharmaceutical products.

Literature


Appendix

Table 1 Distribution of purchase and advertisement awareness by the groups of medicaments

<table>
<thead>
<tr>
<th>Groups of observed medicaments</th>
<th>Advertisement awareness</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td>I. Vitamins and minerals</td>
<td>152 (76%)</td>
<td>48 (24%)</td>
</tr>
<tr>
<td></td>
<td>53 (59.6%)</td>
<td>36 (40.4%)</td>
</tr>
<tr>
<td>Total</td>
<td>205 (70.9%)</td>
<td>84 (29.1%)</td>
</tr>
<tr>
<td>II. Medicines for immune support</td>
<td>83 (55.4%)</td>
<td>67 (44.6%)</td>
</tr>
<tr>
<td></td>
<td>62 (44.6%)</td>
<td>77 (55.4%)</td>
</tr>
<tr>
<td>Total</td>
<td>145 (50.2%)</td>
<td>144 (49.8%)</td>
</tr>
<tr>
<td>III. Painkillers</td>
<td>169 (74.1%)</td>
<td>59 (25.9%)</td>
</tr>
<tr>
<td></td>
<td>37 (60.7%)</td>
<td>24 (39.3%)</td>
</tr>
<tr>
<td>Total</td>
<td>206 (71.3%)</td>
<td>83 (28.7%)</td>
</tr>
<tr>
<td>IV. Pharmaceutical cosmetics</td>
<td>67 (45.9%)</td>
<td>79 (54.1%)</td>
</tr>
<tr>
<td></td>
<td>35 (24.5%)</td>
<td>108 (75.5%)</td>
</tr>
<tr>
<td>Total</td>
<td>102 (35.3%)</td>
<td>187 (64.7%)</td>
</tr>
<tr>
<td>V. Medicines to support the nervous system</td>
<td>11 (20.8%)</td>
<td>42 (79.2%)</td>
</tr>
<tr>
<td></td>
<td>37 (15.7%)</td>
<td>199 (84.3%)</td>
</tr>
<tr>
<td>Total</td>
<td>48 (16.6%)</td>
<td>241 (83.4%)</td>
</tr>
</tbody>
</table>
Table 2: Distribution of purchase and interest leaflets by the groups of medicaments

<table>
<thead>
<tr>
<th>Groups of observed medicaments</th>
<th>Purchase</th>
<th>Advertising leaflets</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Ignore</td>
<td>Observe, not interested in</td>
</tr>
<tr>
<td>I. Vitamins and minerals</td>
<td>Yes</td>
<td>56 (28%)</td>
<td>113 (56.5%)</td>
</tr>
<tr>
<td></td>
<td>No</td>
<td>52 (58.4%)</td>
<td>35 (39.3%)</td>
</tr>
<tr>
<td>II. Medicines for immune support</td>
<td>Yes</td>
<td>44 (29.3%)</td>
<td>83 (55.3%)</td>
</tr>
<tr>
<td></td>
<td>No</td>
<td>64 (46%)</td>
<td>65 (46.8%)</td>
</tr>
<tr>
<td>III. Painkillers</td>
<td>Yes</td>
<td>80 (35.1%)</td>
<td>119 (52.2%)</td>
</tr>
<tr>
<td></td>
<td>No</td>
<td>28 (45.9%)</td>
<td>29 (47.5%)</td>
</tr>
<tr>
<td>IV. Pharmaceutical cosmetics</td>
<td>Yes</td>
<td>44 (30.1%)</td>
<td>84 (57.6%)</td>
</tr>
<tr>
<td></td>
<td>No</td>
<td>64 (44.8%)</td>
<td>64 (44.8%)</td>
</tr>
<tr>
<td>V. Medicines to support the nervous system</td>
<td>Yes</td>
<td>16 (30.2%)</td>
<td>27 (50.9%)</td>
</tr>
<tr>
<td></td>
<td>No</td>
<td>92 (39%)</td>
<td>121 (51.3%)</td>
</tr>
<tr>
<td>Total</td>
<td></td>
<td>108 (37.4%)</td>
<td>148 (51.2%)</td>
</tr>
</tbody>
</table>