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Nudging Medicine Users to Handle Unused Medicines Correctly (a Study of the Czech Republic and the Slovak republic)

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Abstract

This paper on the case of the Czech Republic and the Slovak Republic examines the effect of information nudging on changing the behavior of medicine users with unused medicines. We introduce a new concept of nudge into the theory as an explanatory tool used in the form of subsumption. In our explanatory model, explanans represents the initial conditions of research (C). The explanatory theory of ET is nudge theory. Explanandum E is the explained phenomena. The initial conditions consist of two classes of conditions - namely, C0 and C1. The C0 conditions are those conditions that characterize the state where drug users (respondents) act without the information provided by us. C1 conditions are those states where we provide boring information to the medicine users in the form of a leaflet on how to dispose of unused medicines. We examine how the conditions change the behavior of users (respondents) based on the change in the behavior of users (respondents). Empirical analysis shows that nudging in the form of additional information has a positive effect on behavior. Respondents who received additional information in the information campaign about the proper handling of medicines showed a 23.4% increase in the declared return of unused medicines (condition C1) compared to

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condition C0 when no nudging was done. We find that respondents who check the expiry date are more likely to hand in medicines at the pharmacy. The more information people have about how to manage unused and expired medicines, the more medicines are returned to the pharmacy. Similarly, people who have enough information return unused and expired medicines to the pharmacy. Therefore, nudging in the form of additional information can be seen as an appropriate public policy tool to increase the effective management of unused medicines.

Keywords:
additional information, Czech Republic, medicine handling, Slovak Republic, unused medicines

1. Introduction

Modern societies spend a considerable amount of money on medicines, with large amounts of prescribed (and patient-collected) medicines remaining unused. This leads to waste. In addition, some patients throw these medicines in the trash, flush them down the toilet, dump them in landfills or otherwise mishandle them after the expiry date. This endangers the environment. This is confirmed by the cases of the Czech Republic and the Slovak Republic. In the Czech Republic, according to data from the State Institute for Drug Control (SÚKL), only 52% of patients return unused medicines to a pharmacy. Almost a third of respondents (24%) admitted that they throw medicines in the trash, and another 7% flush them down the toilet (SÚKL, 2015). Similar disposal of unused medicines is also observed in the Slovak Republic. According to the statistical outputs of the National Centre of Health Information (NCZI, 2019), the total consumption of human medicines in the Slovak Republic increased from 2018 to 2019 by 6.2% to 1,903 million EUR.

Thus, we can see that incorrect handling of medicines induces two key problems: wasting resources and endangering the environment and the health of the population. One way to help correct the status quo is to find ways to change patients' behavior in handling their medicines. This study attempts one such avenue. Based on the nudge concept and a questionnaire survey among respondents in the Czech Republic and the Slovak Republic, we investigate how to achieve a change in patients' behavior with unused medicines. We investigate how respondents (patients) change their attitudes towards the disposal of unused medicines after receiving additional information about the correct disposal of unused medicines.

The paper's main contribution can be seen in the original investigation of this problem using data from the Czech Republic and the Slovak Republic. The methodological approach called subsumption under theory is also original. We develop our own explanatory model that explains how additional information changes

users' behavior with unused medicines. The subsumed theory is the nudge theory. In the results section, we formulate the scientific findings and conclude the study with practical recommendations for public policy.

In the study, we use the term "patient" (medicine user) and "respondent" as equivalent terms (synonyms). We address the same group of respondents in two time phases. They are users (patients) of unused medicines. That is, these people are both respondents and patients who handle unused medicines.

2. Theoretical and conceptual framework. Behavioral aspects of medicine waste in households

The theoretical inspiration for our research was the results of similar scientific research by other authors. Tong et al. (2011) conducted a survey of 13 peer-reviewed international studies investigating the attitudes, practices and ways in which patients (respondents) manage unused medicines. They concluded that the toilet, sink, or garbage disposal are popular methods of disposal of medicines worldwide. Attitudes and practices towards the disposal of medicines may be influenced by environmental awareness. A study by Kaloi et al. (2021), Paut Kusturica et al. (2016) and Gidey et al. (2020) show that the majority of patients (respondents) dispose of unused and expired medicines in household garbage and toilet/sink. There was found to be a very low level of knowledge on the correct disposal of unused medicines. Based on the analysis of data from SÚKL (Czech Republic) and NCZI (Slovak Republic), we conclude that patients (respondents) in the Czech Republic and the Slovak Republic have similar behavior.

A study by Peltoniemi & Suomi (2019) shows that wasting medicines leads to large economic losses. Thus, improper disposal of unused medicines poses a public health policy problem. (Nemec et al., 2020, Malý, 2021) The role of the state is to regulate negative externalities. Other authors try to make changes. Gidey et al. (2020) see the creation of an effective system for the disposal of unused medicines as a change factor. To this end, they recommend the use of a large-scale media campaign to educate customers about safe medicine disposal practices and, through an appropriate communication vehicle, to conduct an awareness campaign on the appropriate method of disposal of medicines.

Using Simon's idea of bounded rationality and Akerlof's idea of information asymmetry, we propose to use our proposed concept of additional information as a tool to explain changes in user behavior with unused medicines. We examine these behavioral changes after additional information based on nudge theory (Thaler & Sunstein, 2008; Thaler, 2015). Nudge theory represents a relatively new phenomenon that has emerged in the contemporary behavioral theory of economics. (Tversky &

Kahneman, 1981; Cartwright, 2011; Camerer & Loewenstein, 2004; Dolan et al., 2010). This theory explores how it is possible to positively influence the behavior and decision-making of various actors without forcing them to do anything. If people are hesitant in their decision-making, we can help them in their decision-making by "pushing" them with some of the nudging tools (Dolan et al., 2010; Damgaard & Nielsen, 2018). In our case, we focus on just one of the many nudging tools. This is the provision of additional information. The vehicle for this additional information is a leaflet delivered to users of unused medicines. The leaflet contains two streams of additional information: 1) information on how to handle unused medicines after their expiry date, 2) information on what belongs in the medicines collection container. We expect that there should be a noticeable change in unused medicine behavior after nudging has been carried out. We derive this expectation from the nudge concept. The concept of nudge appears in our study as an explanatory tool, where we explain the studied phenomena in the form of subsumption under theory (Ochrana, Novotný & Angelovská, 2022). The concept of subsumption under theory is a modification of the Hempel-Oppenheim model (Hempel & Oppenheim, 1948), where the explanans is the initial conditions of *C*. The explanatory theory of *ET* is the nudge theory. Explanandum *E* is the explained phenomena. The initial conditions consist of two classes of conditions. C_0 conditions where patients handle medicines spontaneously (no information provided by us). C_1 conditions are those in which we provide nudging information to medicine users in the form of a leaflet on how to dispose of unused medicines. That is, we seek to explain changes in the behavior of the same group of respondents in two time horizons – before the information is provided (under conditions C_0) and under to post-information condition (C_1). The explanatory theory of *ET* is the nudge theory. At the same time, we consider the previous discussion about nudging factors, as shown by the checklist of influences on our behavior (Dolan et al., 2010).

Regarding the limitations of our investigation, we state that our study operates with similar assumptions to behavioral economics. We assume that the behavioral changes of the group of respondents in dealing with unused medicines are the result of providing additional information.

Research questions

In our study, we pose the following research questions and hypotheses.

RQ Number	Research question (RQ)
1	How does checking the expiry date of a medicine affect delivery to a pharmacy?
2	What is the impact of the awareness level on the return of the medicine to a pharmacy?

3	How do socio-demographic characteristics affect the level of awareness of the proper disposal of medicines?
4	How has additional information influenced the behavior of individuals in handling unused and expired medicines?

The answer to RQ 1 will provide information about C_0, and how patients themselves manage their medicines. The answer to this question allows us to divide medicine users into a group that self-monitors the shelf-life of medicines and expiry and a group that does not. Research questions RQ 2 and RQ 4 refer to conditions C_1, i.e., conditions after having been given information on how to handle medicines. RQ 3 refers to conditions C_0 and C_1. Answering this question allows us to find out how socio-demographic characteristics influence the level of awareness of the correct disposal of medicines. We explain the results of the answers to the research questions by subsuming them under the explanatory nudge theory.

Research questions 2, 3 and 4 are followed by hypothesis 1

Hypothesis 1: More than 50% of the respondents have sufficient information about how to dispose of medicines correctly.

To test the hypothesis, we set the following indicators: a) information on how to handle medicines after their expiry date; b) knowing how to dispose of unused medicines; c) realistic management of unused medicines. We test the hypothesis with the questions: "Do you think you have enough information on how to dispose of unused and expired medicines correctly?", "Do you know about the possibility of returning unused and expired medicines to a pharmacy?", "Do you return unused and expired medicines to a pharmacy?"

3. Data and methods

The object of our research is the population of the Czech Republic and the Slovak Republic. Their selected socio-demographic features are presented in Table 1. Both groups of respondents were surveyed first in the Slovak Republic and then in the Czech Republic, using the same questionnaire and procedure. Respondents were approached through an electronic questionnaire created in Click4survey via social media (Facebook) and patient organizations (particularly the Association of Patients and the Association of Diabetics of the Czech Republic). Data were collected from 30 March until 21 April 2022. The same research was also conducted in the Slovak Republic. At the beginning of the questionnaire, we explained to the respondents the importance of proper handling of medicines, or correct dosage and use of medicines and the problems associated with their improper disposal due to their accumulation.

The first part of the questionnaire included socio-demographic questions

(gender, age, educational attainment and economic activity).

In the main part of the questionnaire, we focused on identifying individuals' medicine use behavior and reasons for taking medicines. The questions focusing on the control of medicines expiry were based on the 'ego' factor (Dolan et al., 2010). We hypothesized that if a respondent marked the option "Yes, I check the expiration date of the medicines in the medicine cabinet at home", regardless of whether they do so or not, they can be expected to check their medicine cabinet in the future, as expressed by their commitment. Thanks to the question "What do you think does not belong in a medicine collection container?", we were able to discover whether the information leaflets increased the respondents' awareness of medicine handling. Questions about the possibility of returning medicines respond to the factor, which is the report (Dolan et. al. 2010), i.e., it depends on who communicates the information to the respondent. According to the most frequently marked answer, we can determine whether it is an expert or, on the contrary, a layman, and we can target nudging more precisely. At the end of the questionnaire, we were interested in the reasons for returning or not returning medicines and whether individuals' motivations change when they are rewarded for returning medicines to a pharmacy. Using this methodical procedure, we simulated ('elicited') two types of conditions in the questionnaire – conditions C_0 and C. We were thus able to obtain information about the respondent's attitude without the information nudge (leaflet) and after providing the information leaflet. We chose this procedure to be able to explain the E effects, i.e., the manifestations of changes in the respondents' attitude (behavior) after the information nudging. We use the research label Sample I for the group in C_0 conditions (i.e., no nudging). For the group in C_1 conditions (the 'targeted nudging' group), we use the label Sample II. We processed the questionnaire outputs using relevant mathematical and statistical methods and used them to evaluate the questionnaire results. We used IBM SPSS Statistics 19 statistical software for the evaluation. In evaluating the results, we consider 0.05 to be the level of statistical significance. From statistical methods, we used the Chi-square test, Spearman's correlation coefficient, Cramer's V, Multiple response analysis, the Friedman and Wilcoxon test, the Binomial test and the Mann-Whitney test. Using the frequency in SPSS, we processed the number and percentage of individual responses to the questionnaire questions for Samples I and Samples II. We verified the representativeness of the sample with the Chi-square test. In our case, the samples are not representative, as the structure of the basic set, i.e., all inhabitants of the Czech Republic, in terms of gender, age and educational attainment, does not correspond to the structure of our sample for the individual groups (control and experimental). The same empirical procedure was applied in the Slovak Republic. The comparison of the two countries is presented in the 'Results and Discussion' section. We note that in no way do we claim that the observed changes are only the result of the impact of additional information.

4. Results and discussion

The total number of respondents in Sample I was 338 and 342 in Sample II. Table 1 compares the structure of respondents according to selected socio-demographic features. The structure of the respondents according to the selected socio-demographic features is the result of random selection.

Table 1:

Structure of respondents according to selected socio-demographic features

Socio-demographic feature		CZ SAMPLE 1 (%)	CZ SAMPLE 2 (%)	SK SAMPLE 1 (%)	SK SAMPLE 2 (%)
Gender	Male	23.08	38.60	38.61	17.85
	Female	76.92	61.40	61.39	82.15
Age group	up to 18	0.00	8.77	1.98	3.12
	19-25	21.30	26.32	4.95	23.80
	26-40	7.10	29.53	62.05	55.52
	41-60	40.83	32.46	27.39	17.00
	over 61	30.77	2.92	3.63	0.57
The highest level of education attained	basic education	0.00	8.77	1.65	2.83
	secondary education without sitting final exams	12.43	5.85	5.61	1.70
	secondary education after sitting final exams	55.62	41.23	31.02	29.18
	higher education	31.95	44.15	61.72	66.29
Economic activity	Student	19.53	35.09	6.27	23.23
	Employed	39.05	50.29	65.68	53.26
	Unemployed	0.00	2.92	1.98	3.12
	Self-employed	8.88	5.85	11.22	5.38
	Retired (old-age, disabled)	32.54	2.92	4.62	1.42
	Maternity or parental leave	0.00	2.92	10.23	13.60

Source: author's own, 2022

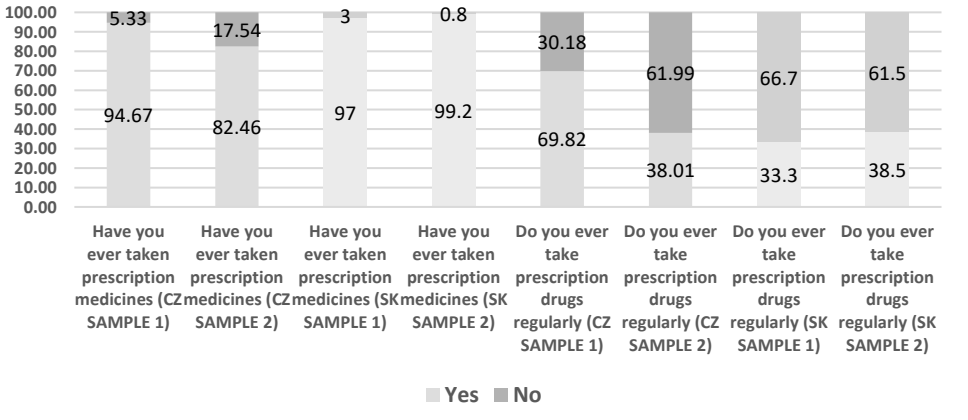
As is clear, Sample I and Sample II are a construct. This is an expedient procedure so that we can check the (presumed) behavior of respondents after receiving an

information push. Again, note that this is a simplification. The problem is in fact much more complex, as e.g., Dolan et al. (2010) have shown. An individual's decision-making and behavior are certainly influenced by the environment in which one finds oneself. The respondent (patient) is affected by various sensations that he feels, sees and hears during decision-making (Aarts & Dijksterhuis, 2003); Greitemeyer, 2009; Dijksterhuis & Bargh, 2001). However, we do not in any way rigorously claim that the observed differences in the behavior of Sample I and Sample II respondents are an inevitable consequence of information nudging. That would be a simplistic claim. Therefore, we must be cautious in interpreting the research results.

In our survey, we were interested in how often respondents buy over-the-counter medicines. In this case, we found that the behavior of respondents from each sample varied considerably, with fewer respondents from SAMPLE 1 buying over-the-counter medicines only occasionally (up to 57% from SAMPLE 1 versus 74 % from SAMPLE 2). The following graph (Figure 1) shows the proportion of responses in SAMPLE 1 and SAMPLE 2 to: question 5 (Have you ever taken prescription medicines?), question 6 (Do you take prescription medicines regularly?) and question 7 (Have you ever been discouraged from taking your own medicines by side effects?). In these questions, we were trying to discover how many respondents had actual experience with taking prescription medicines. As can be seen in the graphs, almost all respondents have taken prescription medicines at some time. However, there is considerable variation among the samples. SAMPLE 1 respondents were more likely to take prescription medicines and fewer of them experienced some level of deterrence due to side effects. Question 7 offered us the opportunity to determine respondents' discipline in taking medicines because a large volume of unused medicines is made up of medicines that have not been fully used.

Figure 1:

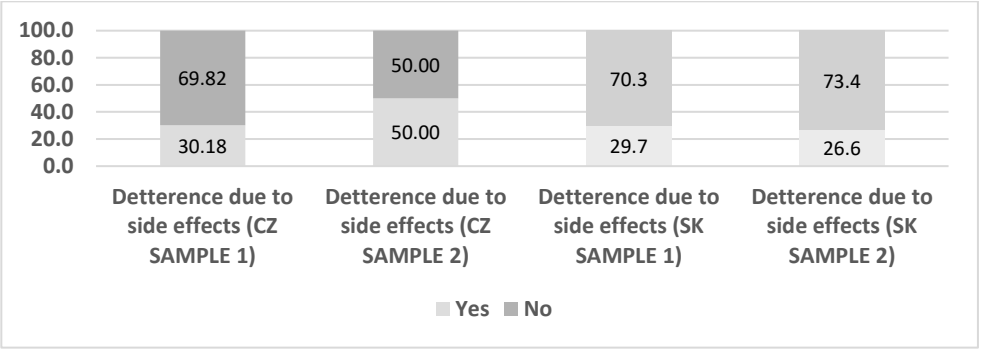
Proportion of respondents' answers to questions 5 and 6



Source: author's own, 2022

Figure 2:

Proportion of respondents' answers to question 7



Source: authors' own, 2022

In addition to the apparent differences between SAMPLE 1 and SAMPLE 2, we identified the phenomenon of discipline as an important factor. From a theoretical point of view, this finding is a stimulus for further interdisciplinary research. In public policy we are faced with the question of how to achieve targeted behavior change in patients with the support of nudging. This is a recommendation that has universal validity. It goes beyond influencing patient behavior with unused medicines. Thus, government health policy can focus on developing a strategy or approach to applying behavioral incentives to citizens to promote health.

We were also interested in the source from where the respondents obtained information on the possibility of returning medicines to a pharmacy. The largest source of information for respondents in SAMPLE 1 was medicine package leaflets (32 %), pharmacist (21 %) and people in their area who do this (19 %). SAMPLE 2 respondents' information came mostly from people in my neighborhood (31 %), the internet (28 %) and medicine package leaflet (24 %).

We further surveyed the frequency of handing in unused and expired medicines to a pharmacy. In SAMPLE 1, 254 out of 338 respondents answered the question before the nudge, of which 162 respondents handed in medicines less than once a year, 74 respondents give 1-2 times a year and 18 respondents answered more than 1-2 times. In SAMPLE 2, this was 171 respondents out of 342 after nudging. The largest proportion was 81 respondents who hand in medicines 1-2 times a year, whereas 80 responded rarely more than once a year. One of the factors that influence a consumer to do something repeatedly and correctly is a pleasant and positive experience.

To determine the impact of nudging information on respondents' behavior in each sample, we focused on determining the correct answers of what does or does not belong in the collection container. The responses were processed by multiple response analysis, as respondents could indicate multiple correct answers (Table 2).

Table 2:

What DOES NOT BELONG in a medicine collection container?

What do you think DOES NOT BELONG in a medicine collection container?	CZ SAMPLE 1		CZ SAMPLE 2		SK SAMPLE 1		SK SAMPLE 2	
Answer	**number of selections**	**% of cases**	**number of selections**	**% of cases**	**number of selections**	**% of cases**	**number of selections**	**% of cases**
prescription medicines	44	13.02 %	41	11.99 %	21	6.93 %	11	3.12 %
over-the-counter medicines	8	2.37 %	10	2.92 %	6	1.98 %	8	2.27 %
cosmetics purchased in a pharmacy	246	72.78 %	271	79.24 %	196	64.69 %	303	85.84 %
outer packaging of medicines (packets, tubs)	216	63.91 %	252	73.68 %	227	74.92 %	310	87.82 %
medical devices	192	56.80 %	282	82.46 %	211	69.64 %	315	89.24 %
nutritional supplements	120	35.50 %	201	58.77 %	91	30.03 %	220	62.32 %
hearing aid batteries	288	85.21 %	321	93.86 %	269	88.78 %	345	97.73 %
veterinary medicines	108	31.95 %	40	11.70 %	45	14.85 %	47	13.31 %
homeopathic items	30	8.88 %	181	52.92 %	43	14.19 %	199	56.37 %

Source: authors' own, 2022

Table 3 describes the reasons for returning the medicines to a pharmacy. In both samples, the most common answer is "Medicines after expiration are no longer effective and therefore there is no point in storing them" (63.16% of Czech SAMPLE 1 vs. 68.82 % of Slovak SAMPLE 1). However, the results significantly differ in the question "I want to protect the environment" (46.78 % in Czech SAMPLE 2 vs. 79.1% in Slovak SAMPLE 2).

Table 3:

Reasons for returning medicines to a pharmacy

What are your reasons for returning medicines to a pharmacy?	CZ SAMPLE 1		CZ SAMPLE 2		SK SAMPLE 1		SK SAMPLE 2	
Answer	**number of selections**	**% of cases**	**number of selections**	**% of cases**	**number of selections**	**% of cases**	**number of selections**	**% of cases**
Medicines after the expiry date are no longer effective, so it makes no sense to store them.	168	63.16 %	61	35.67 %	117	68.82 %	196	75.97 %
I want to protect the environment.	140	52.63 %	80	46.78 %	108	63.53 %	204	79.07 %
A pharmacy is near my place of residence, so I return the medicines to the pharmacy.	54	20.30 %	20	11.70 %	20.0	11.76 %	39	15.12 %
The place where medicines can be returned to is clearly marked, so I have no problem returning them after the expiry date.	36	13.53 %	10	5.85 %	38	22.35 %	43	16.67 %
I know about regular spring and autumn medicine collections, so I return them at those times.	0	0.00 %	0	0.00 %	3	1.76 %	2	0.78 %
Change of medicines.	66	24.81 %	0	0.00 %	19	11.18 %	20	7.75 %
Death of a loved one.	36	13.53 %	0	0.00 %	25	14.71 %	18	6.98 %

Source: authors' own, 2022

These findings are very interesting. More than half of the respondents recognize that the effectiveness of medicines decreases (or is lost) after the expiry date. In the case of Slovak SAMPLE 2, we see that four-fifths of respondents agree that they return medicines to protect the environment. This finding may signal a gradual acceptance of

'green public policy' by society. Surprisingly, less than half the Czech respondents mentioned this reason.

Table 4 describes the reasons for not returning medicines to a pharmacy. In both groups, the most common choice is "I usually take all medicines before the expiry date" (70 % and 31.41 % of responses). Czech SAMPLE 2 was single-choice and Czech SAMPLE 1 was multiple-choice, so the numbers are not comparable.

Table 4:

Reasons for not returning medicines to a pharmacy

What are your reasons for returning medicines to a pharmacy?	CZ SAMPLE 1		CZ SAMPLE 2		SK SAMPLE 1		SK SAMPLE 2	
Answer	number of selections	% of cases	number of selections	% of cases	number of selections	% of cases	number of selections	% of cases
I cannot be bothered	12	10.00 %	31	16.23 %	28	21.05 %	24	25.00 %
It is easier for me to throw them in the rubbish bin.	24	20.00 %	60	31.41 %	39	29.32 %	29	30.21 %
I usually take all medicines before the expiry date.	84	70.00 %	60	31.41 %	77	57.89 %	55	57.29 %
When taking medicines, I do not notice the expiry date, so it can happen that I also take them after the expiry date.	30	25.00 %	40	20.94 %	20	15.04 %	17	17.71 %
If prescription medicines have worked for me, I assume that they will also work for my friends.	18	15.00 %	0	0.00 %	5	3.76 %	2	2.08 %
Medicines are expensive, so I do not return them to a pharmacy.	0	0.00 %	0	0.00 %	5	3.76 %	2	2.08 %
If they did not work for me, I pass the medicines on to my friends	0	0.00 %	0	0.00 %	2	1.50 %	0	0.00 %

Source: authors' own, 2022

Table 5 describes the factors influencing the motivation to return medicines to a

pharmacy in addition to the financial reward. In the first group, the most frequent answer is "Opportunity to support a good cause" (49.09%), in the second group, the most common answer is "Higher awareness" (32.16%). Czech SAMPLE 2 was single-choice and Czech AMPLE 1 was multiple-choice, so the two data are not comparable. In Czech SAMPLE 1 some people did not select any answers, these were excluded.

Table 5:

Factors influencing the motivation to return medicines to a pharmacy besides a financial reward

What increases your motivation to return medicines to a pharmacy besides a financial reward?	CZ SAMPLE 1		CZ SAMPLE 2		SK SAMPLE 1		SK SAMPLE 2	
Answer	number of selections	% of cases	number of selections	% of cases	number of selections	% of cases	number of selections	% of cases
Opportunity to support a good cause (charity - I will support a charity project by returning medicines).	27	49.09 %	90	26.32 %	156	51.5 %	221	62.6 %
Awareness that it is a public benefit act (praise from society).	18	32.73 %	10	2.92 %	52	17.2 %	93	26.3 %
The knowledge that others in my area are also taking medicines back to a pharmacy.	9	16.36 %	21	6.14 %	39	12.9 %	75	21.2 %
Higher awareness (promotional campaigns, advertisements).	11	20.00 %	110	32.16 %	78	25.7 %	154	43.6 %
Collection container in a visible place.	20	36.36 %	71	20.76 %	180	59.4 %	214	60.6 %
Nothing increases it, I do not return medicines to a pharmacy.	4	7.27 %	40	11.70 %	9	3.0 %	6	1.7 %
Other	0	0.00 %	0	0.00 %	15	5.0 %	16	4.5 %

Source: authors' own, 2022

Due to these limitations, the results of the investigation do not allow closer comparability of the two samples. However, we note that in the first group, half of the respondents choose the normative response of supporting a socially beneficial cause as the most frequent response of returning unused medicines to a pharmacy. For the second group, this is the factor of greater awareness. This finding also seems to

reinforce our view of the role of additional information as a resource (tool) influencing behavior in the handling of unused medicines.

To provide some 'illustration' of the problem, we conducted a correlation analysis. The interdependence between questions and answers for Sample I and Sample II was determined using Spearman's correlation coefficient. We determined the interdependence between individual traits, or rate/degree of the relationship between the traits, as follows: values of the correlation coefficient (rs) in the interval from 0 to | 0.3 | we evaluate as weak direct, or indirect dependence, values in the interval from | 0.3 | to | 0.6 | we evaluate as moderate direct, or indirect dependence and values in the interval from | 0.6 | to | 1 | as strong direct or indirect dependence. However, we emphasize that we consider the results of the correlation analysis only as an illustration of the problem under study. We are aware that a high correlation does not necessarily imply confirmation of causality and a zero correlation does not imply independence (Meloun & Militky, 2006). If there is another kind of dependence in the data, the correlation coefficient will not capture it, especially if few observations are available. Moreover, and crucially, we anchor our research methodology qualitatively and on a non-Cartesian epistemology (Ochrana, 2012).

From comparing the interdependence between questions using Spearman's correlation coefficient, we found moderate dependence relationships between Q 12 and Q 18 in both country samples (Sufficient information and returning unused and expired medicines to a pharmacy). It is evident that the more information people have about the management of unused medicines, the more unused and expired medicines they return to a pharmacy. This is particularly confirmed in the second Czech sample, where the information is correct, and the relationship is very strong.

In the first Czech sample, the feeling of sufficient information is somewhat unjustified, since there is a moderate relationship between the number of errors in Q13 (What does not belong in the collection container?) and the feeling of sufficient information. Although respondents who made more errors also felt they had sufficient information. However, the second Czech sample has an inverse relationship between the two variables, suggesting that the first sample's subjective feeling of enough information is not objectively justifiable, which is not the case for the second sample. Furthermore, in the Czech second sample, the amount of information absorbed by the respondent (low number of errors) has a rather strong relationship with Q 18, suggesting that internalization of correct information has an impact on the return of medicines to a pharmacy. That is, respondents from the second sample are more likely to return medicine if they know more about what to return to a pharmacy container.

We wanted to test our hypotheses on the questions: "Do you think you have enough information on how to dispose of unused and expired medicines correctly?", "Do you know about the possibility of returning unused and expired medicines to a pharmacy?", and "Do you return unused and expired medicines to a pharmacy?".

We assume that more than 50% of the respondents have enough information on

how to dispose of medicines correctly. We tested the hypothesis with a binomial test. The hypothesis was confirmed in the first sample; more than 50% of the respondents have enough information on how to dispose of medicines correctly (p-value is 0.000).

We also assume that over 50% of respondents know about the possibility of returning unused medicines to a pharmacy. We assume that more than 50% of respondents hand in unused and expired medicines to a pharmacy. In the first case, the hypothesis is confirmed because the p-value is less than 0.05, but in the second sample, there are equal numbers of people who do and do not return medicines.

The Mann-Whitney test is used to determine whether the respondent who saw the information leaflet was influenced by its wording in questions Q12 (Do you think you have enough information on how to dispose of unused and expired medicines correctly?), Q13 (What do you think DOES NOT belong in the collection container for medicines?), Q14 (Do you know about the possibility of returning unused and expired medicines to a pharmacy?) and Q18 (Do you hand over unused and expired medicines to a pharmacy?).

Comparing the two samples, we reject the hypothesis on all three of these questions (sufficient information, knowledge of the possibility of returning unused and expired medicines to a pharmacy and actually handing over unused and expired medicines to a pharmacy). This could mean that the awareness effect is counterproductive. However, looking at the information above, when respondents have the correct information, they return medicines to a pharmacy far more frequently. This could mean that the control group was already very responsible for the way they return unused medicine, and although the relationship between the control and experimental group is not confirmed, the data suggest that the leaflet effect is positive.

The results of our research correspond with the studies in the field of priming nudges, which argue that strong arguments (Djupegot, 2019), giving instructions at the moment of making a decision (Munoz - Vilcheset al., 2019), exposure to informational placemats in a restaurant (Anzman-Frasca et al., 2018), improving the attractiveness of images accompanying healthy recipes (Starke et al., 2021), using contrasting colors (Wan, X. et al., 2021), and making claims of benefits to psychological health (Sogari et al., 2019) all have the potential to nudge people towards desired decisions.

5. Conclusion

In this study, we investigated nudging as a tool for the correct handling of unused medicines using data from the Czech Republic and the Slovak Republic. We investigated to what extent additional information in the form of nudging can lead to positive changes in medicine users' behavior. We presented the concept of nudge as an

explanatory tool used in the form of subsumption under theory. Inspired by the Hempel-Oppenheim explanatory model, we developed our own model (the explanatory model in the form of subsumption under theory). We examined information as a nudging factor and investigated how additional information changed the behavior of users of unused medicines. We discussed the detected changes based on the nudge theory.

Empirical analysis shows that nudging by means of additional information has a positive impact on behavior. Respondents who received additional information showed a 23.4% increase in the declared return of unused medicines (under the C1 condition) compared to the C0 condition when no nudging was performed. We find that respondents who check the expiry date are more likely to hand in their medicines to a pharmacy. The more information people have about the handling of unused and expired medicines, the more they actually return to a pharmacy. Respondents become more aware of returning medicines to a pharmacy correctly as they get older. The information leaflets influenced the accuracy of the determination, namely, what does not belong in a medicine collection container. We observed a higher proportion of correct responses identifying behavior change. The additional information increased awareness of the possibility to return unused and expired medicines by 10% in the Slovak Republic and even above 23.4% in the Czech Republic. The results show several correlations that influence respondents' decision-making and could be the basis for proposing further interventions. We found that environmental protection is a strong motivation to return unused medicines. Raising awareness is a very effective first step to improving the handling of unused and expired medicine. For the Slovak sample I and Slovak sample II, the hypothesis that more than 50% of respondents have sufficient information on how to dispose of medicines correctly (p-value is 0.000) was confirmed, in the case of the Czech Republic only for sample I.

It can be assumed that the above findings on the influence of nudging information on respondent behavior are of general validity. This is confirmed in particular by similar results of surveys conducted in the Czech Republic and the Slovak Republic. This means that with high probability these are, on the one hand, generalizable theoretical conclusions and, on the other hand, practical findings that information nudging can be considered as one of the important public policy tools to effectively influence medicine management.

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Appendix - Information Leaflets





Source: authors' own, 2020