

**University of Szeged**  
**Albert Szent-Györgyi Medical School**  
**Department of Behavioral Sciences**  
**Doctoral School of Interdisciplinary Medicine**

**Enhancing smokers' engagement during Facebook-  
based smoking cessation interventions**

**Summary of PhD thesis**

**Jezdancher Watti MD**

Supervisors:

Oguz Kelemen MD, habil, PhD

Dávid Pócs MD, PhD

Szeged

2023

## List of publications

### List of full papers directly related to the subject of the thesis

- I. **Watti J**, Millner M, Siklósi K, Hamvai Cs, Kelemen O, Pócs D. How to Avoid Lower Priority for Smoking Cessation Support Content on Facebook: An Analysis of Engagement Bait. *International Journal of Environmental Research and Public Health*. 2023;20(2):958. [IF: 4,614, Q1,Q2]
- II. **Watti J**, Millner M, Siklósi K, Kiss H, Kelemen O, Pócs D. Smokers' Engagement Behavior on Facebook: Verbalizing and Visual Expressing the Smoking Cessation Process. *International Journal of Environmental Research and Public Health*. 2022;19(16):9983. [IF: 4,614, Q1,Q2]
- III. **Watti J**, Mohos A, Kelemen O, Pócs D. Actualities in first-line pharmacotherapy for smoking cessation support (A dohányzásleszokás-támogatás első vonalbeli gyógyszeres terápiájának aktualitásai). *Orvosi Hetilap*. 2021;162(40):1610-1618. [IF: 0,707, Q4]
- IV. **Watti J**, Pócs D, Tari G, Kelemen O. Medical support of cessation for pregnant smokers (Dohányzó várandósok leszokásának támogatása). *Orvosi Hetilap*. 2023 Jul;164(30):1194-1203. [IF: 0,600, Q4]

**Cumulative impact factor of papers directly related to the subject of thesis: 10,535.**

### Other full papers

- I. Pócs D, Ovari T, **Watti J**, Hamvai Cs, Kelemen O. How to create social media contents based on Motivational Interviewing approach to support tobacco use cessation? A content analysis. *JOURNAL OF SUBSTANCE*. 2022.;27(6):591-597. [IF: 0,895, Q3]
- II. Pócs D, Adamovits O, **Watti J**, Kovács R, Kelemen O. Facebook Users' Interactions, Organic Reach, and Engagement in a Smoking Cessation Intervention: Content Analysis. *Journal of Medical Internet Research*. 2021 Jun;23(6): 27853. [IF: 7,077 D1]

**Total cumulative impact factor: 18,507.**

# Summary

## Background and purposes

Our research focused on an internet-based smoking cessation intervention. We analyzed the application of interaction buttons (comments, shares, and Facebook reactions) in response to Facebook posts supporting smoking cessation on a Hungarian Facebook (FB) page called "CigiSzünet" (English name: Cigarette Break – used later in the summary of the PhD thesis). Engagement expresses the commitment of the participants in the intervention. Through our research, we strive to help public health professionals running smoking cessation Facebook pages to increase their user's engagement.

In our first research, we selected smokers based on user comments. We identified the language use pointing towards smoking cessation in their comments applying the psychological approaches of the Transtheoretical Model (TTM) and Motivational Interviewing (MI). The expressions used by the smokers in their Facebook comments (verbalization) were compared to their use of Facebook reaction buttons (visualization). Our aim was to explore the correlations between the verbal and visual expressions of smokers in which they indicated smoking cessation in order to understand and subsequently stimulate engagement.

In our second research project, we dealt with engagement bait, a strategy for creating specific Facebook posts. Facebook imposes sanctions on posts which use this strategy and reduces their visibility by demoting them (i.e., these posts are moved to the bottom of the News Feed). Sanctioning contents which use engagement bait is performed by Facebook's algorithm, but this process is unfamiliar to the users. Our goal was to explore the mechanism of engagement bait and its effects on contents aiming to help smoking cessation, and to find alternative strategies which can circumvent this sanctioning and increase engagement.

## Methodology

In the first research, a total of 821 comments made by smokers were analyzed (N = 821). In the comments analyzed, we identified the processes of change (which are elements of the Transtheoretical Model) and the motivational language (which was assessed as part of Motivational Interviewing). The language use was compared to the use of Facebook reaction buttons.

In the second research, the three-year period following the introduction of sanctions on engagement bait was examined, with a total of 791 Facebook posts (N = 791). The contents were categorized into three groups: "engagement bait", "alternative strategy", and "control" groups. Engagement and reach data were compared across the different groups.

### **Key results**

Our first research found that smokers who reacted with the "Haha" button in response to a quit smoking post were significantly more likely to write expressions indicating their reluctance to quit smoking, than those who reacted with the "Like" button. Smokers who reacted with the "Love" button to comments were significantly more likely to write expressions supporting smoking cessation than those who did not use these reaction buttons.

Our second research revealed that the reach of the Facebook page fans was significantly lower in the engagement bait group than in the control group. No significant difference in reach data was found between the alternative strategy group and the control group. The alternative strategy group had significantly lower rates of negative Facebook interactions (e.g., hide posts or report contents) and significantly higher click rates compared to the control group.

### **Conclusions**

We studied the behavior of the participants in real-life conditions in the Facebook-based intervention. Analyzing the engagement, the use of the "Haha" reaction button was found to be a negative indicator of engagement. The "Like" reaction was a neutral indicator, whereas the "Love" reaction was a positive indicator. Therefore, if smokers respond to a Facebook post related to cessation with a "Haha" reaction, they presumably do not intend to quit, and if they respond with a "Love" reaction, they are probably inclined to quit. In terms of cessation, the use of the "Like" reaction button was found to show a neutral attitude.

Our second research was the first in literature to analyze the way Facebook sanctions the Facebook page for engagement bait and understand the algorithms Facebook uses to select whether a particular content is shown to more or fewer users. Among those users who had not previously liked the page, no sanction was applied. Regarding the page fans, however, the alternative strategy we compiled helped us avoid sanctioning. Our alternative strategy was to use indirect questions instead of direct instructions to interact. In fact, this strategy resulted in fewer negative Facebook interactions and more clicks in the alternative strategy group than in the control group. Therefore, alternative strategies seem to be suitable to increase engagement.

# **Introduction**

## **1.1. Epidemiology**

Smoking is a common risk factor for many diseases worldwide and a major contributor to premature mortality. In Hungary, around half of all deaths are attributable to behavioral risk factors. Both smoking and secondhand smoke were responsible for 21% of all deaths in Hungary in 2019, which is sadly higher than the European Union average of 17%. There are significant gender differences in smoking. In Hungary, the proportion of regular smokers in the 18–34 age group is 35% for men and 27% for women. Although the prevalence of smoking is slightly lower for women, it should be noted that in the population of women of reproductive age, the adverse effects of smoking on the fetus during pregnancy should also be considered.

## **1.2. Nicotine addiction treatment and management**

There are two treatment methods available for nicotine dependence: pharmacological treatment and the techniques of behavioral medicine. The primary goal of pharmacological treatment is to treat physical dependence by reducing nicotine withdrawal symptoms during cessation. For those who do not experience withdrawal symptoms, pharmacological treatment is not required, their dependence can be managed with psychological interventions. Nevertheless, practical experience has shown that smokers who smoke more than 10 cigarettes a day or light up within one hour after waking up in the morning may experience frequent withdrawal symptoms. In such cases, in addition to psychological interventions to promote general behavior change, the use of pharmacological treatment is also justified. Combining pharmacological treatment with behavioral techniques increases the chance of successful cessation. The choice of pharmacological treatment depends on the degree of nicotine dependence, age (especially in adolescents), pregnancy, and the co-morbidities of the patient.

There are two evidence-based psychological interventions to support smoking cessation: Motivational Interviewing and Cognitive Behavioral Therapy. Motivational Interviewing answers the question "Why should I quit?" and places the emphasis on motivation. Cognitive Behavioral Therapy focuses on the question "How do I quit?" and helps change mindset and behavior.

### **1.3. Behavioral medicine**

Psychological interventions are the basis of all cessation support methods. They have been shown to be effective complements to pharmacological treatment, but they can also be effective treatment options on their own. Psychological interventions should be the first choice for occasional smokers, and they are of particular importance when the use of pharmacological treatment is limited (e.g., to support smoking cessation in pregnant women).

Psychological interventions are based on behavioral theories and cognitive models, according to which smoking behavior is the result of a complex interaction between an individual and their environment, and this interaction is determined by cognitive and evaluative processes. Smoking behavior is also influenced by the individual's personal values and expectations about tobacco use. In addition to developing a trusting relationship, psychological interventions emphasize the processes of assessment, monitoring, and feedback. They build on learning models (e.g., either self-reward or external incentives) and actively use the principles of cognitive psychotherapy. Motivational Interviewing is a widely used communication technique designed for addictive disorders, which fits well with behavioral models. Another approach widely used in addiction treatment is DiClemente's Transtheoretical Model, which supports behavioral interventions by analyzing processes of change and their stages, and by assessing readiness to change.

An exciting new and presumably cost-effective area is the creative use of information technology, digital tools, and the internet to address health problems, or even promote healthy behavior. Facebook is a popular and widely accessible platform, which is ideal for creating health interventions for adolescents and young adults. In order to study the potential benefits of this platform, the present thesis used two psychological approaches in the online space: the Transtheoretical Model and Motivational Interviewing.

#### **1.3.1. Transtheoretical Model (TTM)**

The Transtheoretical Model combines different psychological theories by focusing on the process of behavior change and aiming to understand and influence this process. In essence, the model comprises a set of events in the process of behavioral change, which are divided into temporal stages and psychological processes. The processes of change are defined as specific actions people take to change their health behavior. The Transtheoretical Model is regularly applied to design and evaluate online health interventions.

### **1.3.2. Motivational Interviewing (MI)**

Motivational Interviewing is a person-centered, goal-oriented counseling method designed to help clients explore their own motivations and ambivalence about behavioral change. Motivational Interviewing is an evidence-based approach to addiction treatment and prevention in personal counseling. While the Transtheoretical Model is easy to apply to online interventions, the complex communication strategy of Motivational Interviewing is naturally more difficult to integrate into internet-based cessation support, and therefore the evidence on its effectiveness is conflicting.

Of particular interest regarding motivational language is gender difference, which is currently addressed in only a small part of the literature.

### **1.4. Internet-based smoking cessation intervention**

Internet-based interventions can offer new opportunities for smoking cessation support as they are widely accessible without geographical barriers and can even rationalize operating costs. During the COVID-19 pandemic, the role of the internet became even more important for health workers and patients. Internet users tend to be more interactive on social media platforms than on other internet platforms.

Facebook can be useful in helping users manage their health problems by providing information and peer support. Facebook gives users the opportunity to express themselves by reacting to Facebook posts using reaction buttons. These reaction buttons are named after different emotions and come with an associated icon: "Like", "Love", "Haha", "Wow", "Sad", or "Angry". In addition to using the reaction buttons, users can also express their opinion by writing comments on the Facebook post. The Facebook reaction buttons marked with icons are means of emotional-visual expression, while comments provide a more cognitive-verbal expression. Both can be considered indicators of engagement, i.e., the degree of involvement in online interventions. This may explain why it is important to understand the relationship between Facebook reactions and comments. So far, there have been only a few quantitative analyses of engagement in response to health interventions.

## **2. Goals of the thesis**

### **2.1. Primary focus of the research**

Our first research sought to explore the relationship between verbal and visual expressions of smoking cessation by smoker Facebook users in order to understand and subsequently stimulate engagement.

Our second research aimed to reveal the mechanism of engagement bait and its effects on cessation-related content and to identify alternative strategies that can circumvent sanctions imposed by Facebook on comments which use engagement bait and increase engagement.

### **2.2. Research questions**

#### **2.2.1. First Research**

- *What is the relationship between smokers' gender and verbal expressions from the Transtheoretical Model and Motivational Interviewing?*
- *How do smokers combine Facebook post reactions with verbal expressions from the Transtheoretical Model and Motivational Interviewing?*

#### **2.2.2. Second Research**

- *How does Facebook sanction engagement bait posts that support smoking cessation?*
- *What are the advantages of using alternative strategies over engagement bait in reaching and engaging Facebook users?*



## **3. Methods**

### **3.1. The investigated Facebook-based smoking cessation intervention**

Cigarette Break is an online smoking cessation intervention run jointly by students and teachers at the University of Szeged. The program was launched on March 7, 2017, with contents posted on the Facebook page every day or every other day. The number of users increased steadily during the study period. The primary objective of the Facebook-based intervention was to promote smoking cessation.

### **3.2. Participants**

The participants of the present research were Facebook users who viewed the social media contents posted on Cigarette Break. Based on the reach data recorded by Facebook, the study population consisted mostly of young adults aged between 18 and 35 years, generally living in Hungary, with a nearly equal proportion of men and women. Facebook Insights database provided us with aggregated and anonymized demographic data, which were exported on September 14, 2020. On that date, the total weekly reach was 11,507 users.

### **3.3. Analysis of intervention content**

The intervention content of public health Facebook pages is the Facebook post. A total of 1,294 posts were published on the Facebook page during the period of the first research, from March 7 to September 14, 2020. We selected Facebook posts which met the principles of Motivational Interviewing, which were image-based, supported smoking cessation, and had at least one comment about cessation. A total of 178 Facebook posts met the inclusion criteria.

The second research was conducted during a different study period, so the intervention content included differed from the content included in the first research. A total of 1,026 social media posts were published on the Facebook page under study between June 25, 2018 and June 25, 2021. Out of these posts, 791 Facebook posts met the inclusion criteria, i.e., they were image-based, non-paid, they aimed at promoting smoking cessation, and were published at the studied time interval. As the included posts matched these criteria, they were suitable for the analysis of Facebook's content ranking algorithm.

### **3.4. Design and procedure**

User response to intervention content (Facebook posts) as "online stimuli" was examined in both of our studies. In this online context, users can respond by using various interaction

buttons (e.g., Facebook reactions, comments, shares, and clicks). This interaction can also express the degree to which the participant is engaged in the online intervention. Thus, by measuring user response (interactions), it is also possible to measure and assess the engagement of the participants.

In our first research, we looked at the use of reaction buttons and the submitted comments. The analysis of engagement was based on the submitted comments, therefore, the number of cases included in the study was calculated from the number of comments. Each comment was written by a different participant, so the number of cases represents the number of participants included in the analysis. In total, 821 participants commented on the 178 Facebook posts included in the study ( $N = 821$ ). Only first comments on the intervention content were considered; further comments (second and third comments) were excluded from the analysis. The 821 comments analyzed were divided into two groups: comments accompanied by the use of reaction buttons, and comments without the use of these buttons. If the Facebook user used a reaction button in relation to a specific content supporting cessation, we also recorded the type of reaction: "Like", "Love", "Haha", "Wow", "Sad", or "Angry".

The comments were divided into different groups according to the Transtheoretical Model and the Motivational Interviewing approach. We identified the processes of change (TTM), which can be divided into two broad groups: experiential processes and behavioral processes. In addition, we also examined motivational language, which can also be divided into two groups: change talk and sustain talk.

In our second research project, we looked at the effects of engagement bait and alternative strategies. Two raters separately classified all the 791 Facebook posts into three categories: posts with engagement bait, posts applying alternative strategies, and a control group (Cohen's kappa value: 0.972). A total of 341 pieces of content used alternative strategies without engagement bait. The control group consisted of 375 Facebook posts which did not use engagement bait or alternative strategies. In the two study groups and in the control group, the parameters expressing engagement were examined, which were as follows: Facebook reactions, comments, shares, click rates, and negative Facebook interactions (e.g., hide posts, report contents).

### **3.5. Statistical analysis**

We used a non-parametric statistical test, because neither the number of motivational words (first research), nor the reach and activity data of Facebook posts (second research) were with

normal distribution. In the statistical analysis of the first research, Pearson's Chi-square test was used to compare these categorical variables, and the effect size was determined using Cramer's V coefficient. In the second study, the Kruskal-Wallis H test was applied in conjunction with the Dunn test. For comparison, the effect size was calculated in each case using eta squared. All analyses were performed using the Statistical Package for the Social Sciences software. A p-value of less than 0.05 was considered a significant effect, and a p-value of less than 0.001 was considered a highly significant effect.

## **4. Results**

### **4.1. First research**

#### **4.1.1. Engagement: comments and reaction buttons**

From the demographic data of our first research, it can be seen that there were 1.45 times more men than women in the sample. Our results show that around 20% of the participants who wrote a comment used a reaction button alongside their comments, while the majority (80%) did not click on Facebook reactions. We could observe interesting trends in the psycholinguistic categories. People who formulated experiential processes or sustain talk in their comments were less likely to use reaction buttons than the average (14.7% and 15.8%, respectively). In contrast, the proportion of people who used reaction buttons was higher than the average among those who formulated behavioral processes or change talk (26.9% and 22.5%, respectively).

Our study also focused on motivational language and gender differences. Significant gender differences were observed during the psychological analysis of the text of the comments. Women used significantly more experiential processes ( $p < 0,001$ ) and change talk ( $p < 0,001$ ) in their comments than men. Conversely, men wrote significantly more comments containing sustain talk ( $p < 0,001$ ). Likewise, there was also a gender difference in terms of the topic of the comments. Men wrote significantly fewer comments related to cessation than women ( $p = 0,004$ ).

#### **4.1.2. Smokers' engagement based on TTM**

When analyzing the comments related to smoking cessation, it was obvious that these comments were written by smokers. Using TTM, we compared the number and proportion of psycholinguistic categories with the use of reaction buttons. We identified only one significant association between the number of processes of change and the use of Facebook reactions. Those who combined their comments with the "Love" reaction used significantly more

linguistic categories expressing processes of change than those who used the "Haha" reaction. Analysis based on TTM also revealed significant gender differences. Women wrote significantly more about experiential processes ( $p=0,018$ ) in their comments than men. Moreover, overall, they used significantly more expressions indicating processes of change in their comments ( $p<0,001$ ). These results imply that, similarly to all processes of change, the proportion of experiential processes was also higher among women than among men ( $p=0,028$ ).

#### **4.1.3. Smokers' engagement based on MI**

In the comments related to smoking cessation, we examined the number and proportion of motivational linguistic categories and compared them to the use of reaction buttons. Here again, the text of the comments made it apparent that the comments were written by smokers. Our results show that the combination of comment and "Love" reaction was associated with significantly more motivational expressions and change talk. Participants who wrote more motivational expressions ( $p=0,005$ ) and change talk ( $p<0,001$ ) used the "Love" reaction significantly more often than the "Haha" and the "Like" buttons. When looking at the subcategories of motivational language, it can be seen that, compared to all motivational expressions, the proportion of change talk was higher among those who used the "Love" reaction, while the proportion of sustain talk was higher among those who used the "Haha" reaction ( $p=0,011$ ).

Significant gender differences were also observed in terms of motivational language. Women wrote significantly more motivational utterances ( $p<0,001$ ) and change talk ( $p<0,001$ ) in their comments than men. In contrast, men used significantly more sustain talk than women ( $p<0,001$ ).

## **4.2. Second research**

### **4.2.1. Ranking of engagement-enhancing contents**

A major focus of the second research was reach data analysis. We observed that the fan reach was significantly lower in the engagement bait group than in the control group ( $p=0,031$ ). In the control group a Facebook post reached an average of 978 page fans, while in the engagement bait group Facebook posts had an average of only 810 page fans. However, no significant differences were found between the non-fan reach and the total reach across the study groups and the control group.

#### **4.2.2. Enhancing engagement in the light of Facebook reactions**

Both types of posts which used engagement bait or alternative strategies sought to increase engagement. However, when we looked at the use of Facebook post reactions in the study groups and analyzed them separately, we found no significant increase compared to the control group. The use of the "Like", "Love", "Wow", "Sad", and "Angry" reactions was almost identical in each group involved in our study. There was a significant decrease in the use of the "Haha" reaction in the engagement bait ( $p < 0,001$ ) and the alternative strategy groups ( $p < 0,001$ ), compared to the control group.

#### **4.2.3. Enhancing engagement in the light of interactions**

No significant differences were found between the engagement bait group and the control group in the parameters expressing interaction (total number of Facebook reactions, comments, shares, and click rates). This could be a consequence of the sanctions imposed on engagement bait (limiting post appearance). However, we observed a significantly higher click rate in the alternative strategy group compared to the control group ( $p = 0,018$ ).

Furthermore, the alternative strategy group was also found to be more favorable than the engagement bait group in terms of negative Facebook interactions expressing disengagement. Significantly fewer negative Facebook interactions were found in the alternative strategy group than in the control group ( $p = 0,032$ ). There was no significant difference in the engagement bait group compared to the control group.

## 5. Discussion and conclusions

The results of our first research suggest that smokers can express the process of their smoking cessation using Facebook reaction buttons in addition to psycholinguistic categories. Thus, these verbal and visual ways of expression are linked on Facebook, and they are combined by the users. In light of the results, the use of the "Haha" reaction may indicate a closed attitude towards smoking cessation, while the use of the "Love" reaction may indicate an open attitude towards smoking cessation. Therefore, the "Haha" and "Love" reactions are in opposition to each other in this online context. Alternatively, these two reactions may be visual expressions of the ambivalence which characterizes smokers. The use of the "Like" reaction can be considered presumably neutral in this respect. Our research was hypothesis-generating, which can encourage further investigations in this area.

Further inferences can also be drawn about gender differences in engagement, and understanding these differences may be beneficial in editing Facebook posts targeting women or men to support smoking cessation. We found that female engagement is verbally characterized by experiential processes and change talk. Therefore, using questions targeting these linguistic categories may be a successful strategy for creating Facebook posts supporting smoking cessation for women and for moderating comments. In contrast, sustain talk was a verbal feature of male engagement. This suggests that questions targeting such linguistic categories should be avoided when creating Facebook posts to help male smokers quit smoking, and one should be prepared to deal with such utterances when moderating comments. As our study was retrospective in nature, the hypotheses raised are worth testing in future longitudinal studies.

In our second research project, we sought to explore how Facebook sanctions posts that it considers engagement bait. Our results suggest that the sanctions imposed by Facebook involve restricting the display of content to page fans. Notably, our research focused on Facebook posts aimed at smoking cessation, which should be exempted from sanctions because of their social utility. Facebook's Community Guidelines state that it does not sanction socially relevant content (e.g., reporting a missing child). However, our results suggest that, according to Facebook, support for smoking cessation does not fall within this scope. It is therefore proposed to initiate a dialogue between Facebook and international health organizations (e.g., the World Health Organization) with the aim of exempting public health content from Facebook sanctions.

Finally, it is worth pointing out that alternative strategies seem promising for creating Facebook posts supporting smoking cessation. On the one hand, sanctions on engagement bait

can be avoided with alternative strategies, i.e., there is presumably no restriction on the number of page fans. On the other hand, alternative strategies have a stimulating effect on click rates. This may lead to an increase in link clicks, which will direct users to a particular website. For example, this could increase traffic to a website encouraging smoking cessation. Finally, alternative strategies can achieve lower negative interaction rates. Thus, the intervention may lose fewer participants, which is particularly valuable in this area given the resistance of smokers (as addicts). Our future plans include conducting a randomized controlled trial to test these hypotheses.

## **6. Acknowledgement**

I would like to express my sincere appreciation to my supervisor, Dr. Oguz Kelemen, Head of the Department of Behavioral Sciences, University of Szeged, for his honorable and valuable support and for the opportunity to conduct my research within the framework of the institute. I owe a heartfelt debt of gratitude to my other supervisor, Dr. Dávid Pócs, without whose support, guidance, encouragement, and friendship this thesis would not have been possible.

I would like to take this opportunity to thank my colleagues, namely, Dr. Csaba Hamvai, Dr. Hedvig Kiss, Máté Millner, and Dr. Kata Siklósi for their significant contributions and constructive suggestions during the research. I am especially grateful to Dr. Katalin Bán, who supported me throughout this long journey. I would also like to express my special thanks to Dr. Omar Assani, who has been my human, moral, and professional guide alongside my father throughout my career and who has always been flexible with my research schedule.

Above all, I would like to express my deepest gratitude to my mother, Amira Watti, who sacrificed her career to dedicate her life to her children. I would also like to thank my family, my brothers, and my sister for their support. Without their help and encouragement, this doctoral thesis would not have been possible.