Infodemic and Mental Health Consequences

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A B S T R A C T

Since the beginning of the COVID-19 pandemic, a tremendous amount of information is spread through social media, including wrong/ misinterpreted information and rumors. World Health Organization (WHO) named this mis/disinformation spread about the pandemic as "infodemic". In this research, Scopus and PubMed databases were searched with 'infodemic' and 'mental health' keywords. The data gathered revealed that mental health disorders, including perceptual disorders such as depersonalization and derealization, anxiety disorders, depressive disorders and, also suicidal ideation, increased as a result of the infodemic. Another significant result obtained was the change in discourses among the members of mental health disorder support groups: more negative loads such as hopelessness, helplessness, loneliness, and even suicide were increased.

Key words: COVID-19, pandemic, infodemic, mental health, social media

Introduction

COVID-19 is highly fatal and contagious, yet the information about COVID-19 shared on social media and other sources has become more contagious than the virus itself. The rapid spread of information about COVID-19 through social media and other sources led to the formation of a new word: "infodemic" (the combination of information and epidemic). WHO describes infodemic as follows:

"…an overabundance of information, both online and offline. It includes deliberate attempts to disseminate wrong information to undermine the public health response and advance alternative agendas of groups or individuals. Mis- and disinformation can be harmful to people's physical and mental health; increase stigmatization; threaten precious health gains; and lead to poor observance of public health measures, thus reducing their effectiveness and endangering countries' ability to stop the pandemic".[1]

The fear of the virus created by social media is more contagious to the general population than COVID-19 itself.[2] Rumors and misinformation about COVID-19 on social media could lead to a more serious result that can be accounted for as a disaster.[3] The infodemic that aggravates the impact of COVID-19 creates anxiety and chaos among people.[4] Besides, information overload and infodemic about COVID-19 is more dangerous than the virus itself in the modern internet-based connected world. Although the internet increases the worldwide flow of infor-

mation about authoritative knowledge in regard to COVID-19, it also brings with it some disadvantages. Infodemic regarding COVID-19 have spawned false news such as magical cures, racist discrimination, and stigmatization and conspiracy theories. All of these were shared via social media and other sources.[5] Lockdown and the other social changes during the COVID-19 pandemic also caused some difficulties, especially in children and other vulnerable groups such as older individuals and psychiatric patients, and disabled individuals in the community.[7]

Misinformation spread through the media among the community reinforces discrimination about older adults' vulnerability to COVID-19. This infodemic stigmatization of older adults may result in mental health issues, as depression and suicidality.[6]

Lockdown during COVID-19 may aggravate panic disorders, anxiety, depression, obsessive-compulsive disorder, and related disorders such as hoarding, paranoid ideation, and post-traumatic disorders. This aggravation may again be due to the infodemic spread via different social media platforms. Racism, stigmatization, and xenophobia against particular social groups are also being widely reported.[7]

On the other hand, the various conducted scientific research regarding COVID-19 in a short period of time can lack proper methodology and pieces of evidence, journals that offer pre-print publications without appropriate review processes may cause distortions about healthy and

true information for health professionals and also general population which can also lead to misinformation about the pandemic.[8,9]

Not only the pandemic era but the post-pandemic era comes into the front. For example, Bell et al.[10] examined the main topics that counseling and psychotherapy will cover in the post-COVID-19 era. They suggested that post-COVID-19 major research topics must include topics such as the health and well-being of helping professionals, infodemic, discrimination and minority stress, couple and family stress, resilience, and the issues around spiritual and existential dynamics. They indicated that the COVID-19 pandemic has changed both normal life and counseling and psychotherapy, bringing them to a new era which can be called the Post COVID-19 era.[10]

The scope of this review is to summarize the mental health disorders that aggravated with the effect of infodemic, main themes and discourses about COVID-19 on social media, and guidelines for safe information flow about COVID-19.

Methodology

Scopus and PubMed databases were searched with 'infodemic' and 'mental health' keywords. Forty articles were reached in these two databases. The below-given inclusion and exclusion criteria were applied for the data of this review.

Inclusion and Exclusion Criteria:

1. Articles published before 2020 were eliminated.
2. Review articles, commentaries, perspectives, and viewpoints were eliminated.
3. Articles that were found in both databases were checked, and only one of them was included.
4. Articles that were interested in the post-COVID-19 era were eliminated.
5. Only research articles were included.

Based on the above criteria, 14 research articles from PubMed and Scopus databases were included in this review study. Research articles that are related to infodemic were classified according to their main themes and basic findings are given according to this classification.

Findings

The summary and the properties of the examined research articles are given in Tables 1–3. Out of 14 research articles 8 articles were related to the direct psychological effects of infodemic among social media users, 4 articles were related to discourse changes due to COVID-19 pandemic among social media users with regard of infodemic and 2 articles were related to guidelines that can be used to reduce the effects of infodemic upon social media.

Psychological effects of infodemic among social media users

During COVID-19 pandemic and lockdowns researchers studied especially mental health problems including depression, anxiety, and sleep disturbances in different populations in relationship with social media exposure. In this research gender differences among the participants were found to be a significant variable. Female participants have higher degrees of stress and anxiety symptoms than male participants, while male participants' resilience to stress is found to be higher. Spending more time on COVID-19 related information via social media increases the severity of stress. The research conducted suggests that, social media is the main source of updating the COVID-19 related information.[11]

Some studies focused on the prevalence of anxiety and sleep disturbance at the early stage of the pandemic. In one of them[12] the prevalence of probable clinically relevant anxiety was 61% and 45% at the first and second-time points, and more than half of the participants in this anxiety group also reported mild to severe sleep disturbance. Differences were found between the participants who see themselves as having enough and not enough information about COVID-19. Participants who reported that they did not have enough information about COVID-19 reported higher levels of COVID-19 infection anxiety and sleep disturbances. Moderated mediation analysis identified two groups who were more vulnerable to both psychological problems: high blunders who sought COVID-19-related information online more frequently and high monitors who sought such information offline less frequently.[12]

Social media exposure and mental health problems such as depression and anxiety were other topics examined during COVID-19 pandemic. These studies showed that the citizens exposed to social media were more prone to anxiety, depression, and a combination of anxiety and depression. Also Chinese citizens expressed their negative feelings such as fear, anxiety, worry, and nervousness upon social media, which became contagious themselves also besides the false information and reports about COVID-19, which are also infodemic in nature.[13]

Social media users including health professionals and community-based adults use social media as a platform for updating their information about COVID-19. Both community-based adult sample and health care professionals reported that they spend more than two hours or more per day searching and updating their information about COVID-19 via social media and television. Both of the samples reported probable anxiety and depression. The ones who spent more than two or more hours on social media searching for news about COVID-19 again in both samples were found to be more prone to probable anxiety and depression. Watching COVID-19 news on television was not associated with probable anxiety and depression in both samples. The researchers had concluded that the infodemic effect of social media worsens the symptoms

TABLE 1

PAPERS ON PSYCHOLOGICAL EFFECTS OF COVID-19 AMONG SOCIAL MEDIA USERS

Author/s	Subject	Sample	Methods	Instruments	Results
Hou et al.(2020)	Gender differences of depression and anxiety among social media users in China during COVID-19 pandemic.	General population (n=3063) 43.32% male, 56.67% male	Online survey	Patient Health Questionnaire (PHQ-2), Generalized Anxiety Disorder Scale (GAD-2), and Connor-Davidson Resilience Scale.	The prevalence of depression and anxiety was increased in female participants.
Cheng et al.(2020)	The prevalence of anxiety and sleep disturbances at the early stage of the COVID-19 pandemic.	First application:16–22 March 2020.1647 adults from United Kingdom (UK), and 623 adults from US (United States). Second application: 18–24 May 2020. 2573 adults from UK and 475 adults from US.	Online survey	PROMIS™ Sleep Disturbance short form, State-Trait Anxiety Inventory- Form Y1 (STAI-Y1), COVID-19 Infection Anxiety Scale, and Miller Behavioral Style Scale.	The prevalence anxiety and severe sleep disturbance have increased. The participants perceived themselves as not having enough COVID-19-related information, and reported higher levels of COVID-19 infection anxiety and sleep.
Gao et al.(2020)	The prevalence of mental health problems and examine their association with social media exposure.	4872 adults from general population.	Online survey	WHO-Five Well-Being Index (WHO-5), Generalized Anxiety Disorder Scale (GAD-7), and Social media exposure (SME)	The prevalence of depression, anxiety and combination of depression and anxiety was increased during COVID-19 pandemic. Social media use was positively associated with higher levels of anxiety.
Liu et al.(2020)	The relationship between the levels of depression, anxiety and stress with exposure to COVID-19 news on social media and using governments official WhatsApp chanell.	1145 adults in general population.	Online survey	Depression, Anxiety, and Stress Scale (DASS-21).	Depression scores were associated with increased time spent receiving COVID-19 updates, whereas use of the official WhatsApp application emerged as a protective factor.
Ni et al (2020)	Examine risk factors, including the use of social media, for probable anxiety and depression in the community and among health professionals.	1577 community-based adults and 214 health proffesionals.	Online survey	Generalized Anxiety Disorder(GAD)-2, Patient Health Questionnaire (PHQ)-2, and Medical Outcomes Study Social Support Survey (MOS-SSS).	Community-based adults, and health proffesionals reported probable anxiety and deppression. Close contact with individuals with COVID-19 and spending ≥2 hours daily on COVID-19 news via social media were associated with probable anxiety and depression in community-based adults.
Escolà-Gascón et al. (2020)	Examine the psychological effects of social quarantine on the psychotic phenotype and pseudoscientific beliefs-experiences of the general nonclinical population.	174 adult participants from general population	Online survey	Multivariable Multiaxial Suggestibility Inventory – 2 Reduced (MMSI-2-R), Australian Sheep-Goat Scale (ASGS), and Community Assessment of Psychic Experiences-42 (CAPE-42)	A significant increase in pseudoscientific beliefs, especially derealization and depersonalization are the most reported perceptual disturbances after quarantine. The sharpest increase was observed in paranoid perceptions.
Radwan et al. (2020)	Determine how social media affects the spread of panic about COVID-19 among primary and secondary school students.	942 primary and secondary school students.	Online survey	Questionnaire which was prepared by the researchers.	Psychologically, female students are more affected than male students. Female students experienced greater fear about COVID-19 pandemic.
Ahmad and Murad (2020)	Determine how social media affects self-reported mental health and the spread of panic about COVID-19.	516 social media users from general population.	Online survey	Questionnaire which was prepared by the researchers.	Participants reported that social media has a significant impact on spreading fear and panic related to the COVID-19. Negative influence on people's mental health and psychological well-being.

TABLE 2

SOCIAL MEDIA DISCOURSE CHANGES DUE TO COVID-19 PANDEMIC

Author/s	Subject	Sample	Methods	Instruments	Results
Hung et al. (2020)	Analyze discussions on Twitter related to COVID-19 and to investigate the sentiments toward COVID-19.	Total of 1,001,380 tweets were retrieved from 334,438 unique Twitter users.	Artificial Intelligence and NLP sentiment analysis	902,138 tweets analyzed on Twitter	5 themes related to COVID-19: health care environment, emotional support, business economy, social change and psychological stress. Out of 902,138 tweets analyzed, sentiment analysis classified 48.2% tweets as having a positive sentiment, 20.7% as neutral, and 31.1% as negative.
Xue et al. (2020)	To examine COVID-19-related discussions, concerns, and sentiments using tweets posted by Twitter users.	4,196,020 Twitter messages related to COVID-19 pandemic using a list of 20 hashtags.	Machine learning approach -Latent Dirichlet Allocation (LDA)	Twitter	5 themes related to COVID-19: public health measures to slow the spread of COVID-19, social stigma associated with COVID-19, COVID-19 news, cases, and deaths, COVID-19 in the United States, and COVID-19 in the rest of the world. The dominant sentiments for the spread of COVID-19 were anticipation that measures can be taken, followed by mixed feelings of trust, anger, and fear related to different topics.
Dong et al. (2020)	To explore whether public emotions are related to the dissemination of online rumors in the context of COVID-19.	1 million comments collected from Weibo divided into 5 categories: happiness, sadness, anger, fear, and neutral.	Web-crawling tool Scrapy-	Comments on two social media platform in China	Public emotions are related to the rumors spread online in the context of COVID-19.
Low et al. (2020)	To identify changes in topics of mental health support groups during the initial stage of the pandemic.	826,961 unique users from 2018 to 2020.	NLP (natural language processing)	15 mental health support groups on the website Reddit and 11 non–mental health groups	Support groups related to attention-deficit/hyperactivity disorder, eating disorders, and anxiety showed the most negative semantic change during the pandemic out of all mental health groups. Health anxiety emerged as a general theme on Reddit. The suicidality and loneliness clusters more than doubled in the number of posts during the pandemic.

TABLE 3

RESEARCH PAPERS ON SOCIAL MEDIA USE FOR PUBLIC HEALTH LITERACY

Author/s	Subject	Sample	Methods	Instruments	Results
Furstrand et al.(2020)	Guidance in social media on trustworthy health information.	200 volunteer physicians answering the questions between medical experts and public and over 57000 users.	Direct communication physicians	Facebook group "Ask a Doctor About Coronavirus"	With this Facebook group, researcher stated that physicians can provide valid health information and also prevent the effects of infodemic in the general community.
Porat et al.(2020)	Practical guidelines for public health and risk communication communication strategies during COVID-19.	20 scientific papers on health health and risk communication that will enhance current recommendations and will cut through the infodemic.	Self-Determination Theory Meta-analysis	Systematic research of the literature on health communication strategies during COVID19	5 practical guidelines for public health and risk communication that will cut through the infodemic and support well-being and sustainable behavior change: create an autonomy-supportive health care climate; provide choice; apply a bottom-up approach to communication; create solidarity; be transparent and acknowledge uncertainty.

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and perceptions over anxiety and depression in community-based adults and health professionals.[14]

An original research was done in Singapore to assess the well-being during the pandemic, exposure of COVID-19 news, and the linkage between the psychological distress and if the official WhatsApp channel can reduce the risk of infodemic.[15] Researchers has conducted an online survey of 1145 volunteer adults with the age range 21 to above 65. The study results highlight that 10% of the participants reported extremely severe symptoms of either depression or anxiety, or stress during this period. Depression symptoms were highly related to time spent receiving COVID-19 updates, and using the official WhatsApp channel reduces the participants' stress, anxiety, and depression levels. Official WhatsApp channel gives trustful information and updates from directly through the government, and these trustful updates reduce the risk for psychological symptoms.[15]

Not only the mental health issues but also the psychological effects of social quarantine on the psychotic phenotype and pseudoscientific beliefs-experiences of the general nonclinical population were investigated. Escolà-Gascón et al.[16] found significant differences for the variables positive psychotic and depressive symptoms and certain perceptual alterations. They also indicated a significant increase in pseudoscientific beliefs. Especially derealization and depersonalization are the most reported perceptual disturbances after quarantine. Paranoid perceptions showed the highest increase. They conclude that the excess amount of information and pseudoscientific information, among other variables, may increase paranoid perceptual alterations. The researchers have concluded that disinformation in social media negatively affects individuals' ability to distinguish between reliable and unreliable information and may cause paranoid perceptions.[16]

Some researhes have focused on self-reported social media effects on mental health and the spread of panic and fear about COVID-19 among adults, children and adolescents. The results showed that social media negatively affects the mental health and psychological well-being of the adult participants. Also, they found out that social media fastens the spread of COVID-19 fear and panic.[17] Primary and secondary school students between 6–18 ages gives the same results with adults. Female students are more affected psychologically than male students. Female students experienced greater fear about the COVID-19 pandemic. The main source of following the news about COVID-19 among students reported as Facebook. The researchers concluded that the panic and fear about the COVID-19 pandemic spread more rapidly via social media use.[18]

Social media discourse changes due to COVID-19 pandemic

According to the WHO description excessive information both online and offline channels can cause infodemic.[1] During COVID-19 pandemic, lockdowns and curfews made individuals to stay at home and the only connection to the outer world and pandemic updates can only be possible upon traditional and new media including social media. From this point of view social media discourse changes evaluated in the means of infodemic effects upon users. Researchers evaluated the most common topics about COVID-19 including before and after pandemic on certain social media platforms including Twitter, Weibo and Reddit.[19–22] Such studies emphasize especially social stigma related to COVID-19, fear of death, and infection were the most popular topics and themes, and the emotions spread through around that topics are mixed feelings of trust, anger, and fear.[20] Social media users emotions were found in a continuum from anger, fear and sadness to neutral, and happiness. Researchers found out that the angrier the public felt, the more rumors spread via the internet, and they observed the relationship between fear and rumors and between sadness and rumors. Also, a significant positive correlation between fear and fearful rumors was found.[21] Low et al.[22] examined the language change over the mental health support groups on Reddit. They used posts from 826,961 unique users from 2018 to 2020. In their research, they found out that during COVID-19 for specific groups, including the categories "economic stress," "isolation," and "home," significantly increased while others such as "motion" significantly decreased. Among the groups which are related to attention-deficit/hyperactivity disorder, eating disorders, and anxiety showed the most negative semantic change during the pandemic out of all mental health groups. Health anxiety, self-harm, and entertainment come forth as a general theme across Reddit. They also found the suicidal ideation and loneliness feelings posted more frequently. Especially support groups in borderline personality disorder and post-traumatic disorder, posted on suicidal ideation the most.[22]

The results of the above mentioned studies showing that public emotions are related to rumors spread online in the context of COVID-19 [21] can be used by public officials not only to navigate the negative feelings towards positive in the community[19] but also to use sharing via social media about COVID-19 to deepen the knowledge about infodemiology.[20]

Social media use as public health literacy

Social media can bu used for public health benefit. Especially two studies which were included in this research can provide excellent examples of beneficial use of social media to reduce the effects of infodemic via social media. Furstrand et al.[23] in response to the infodemic about the COVID-19 pandemic, formed a Facebook group named 'Ask a Doctor About Coronavirus.' In this group, laypersons can post their questions about COVID-19, and physicians with administrator privileges answer the posted questions. Incoming inappropriate questions including politically motivated comments, weblinks to misinformation, and personalized health information were rejected by the researchers. In a short time period, the volunteer physicians entered the group and took an active part to answer the questions reach over 200, and the member of the group reach over 57000

laypersons. With this Facebook group, the researcher stated that physicians can provide valid health information and also prevent the effects of infodemic in the general community. The approach with close thread of discussions and without room for debate, fostered a sense of calmness, trust, and safety among the questioners[23]

The other beneficial study was conducted by Porat et al.[24] who designed a practical guideline for public health and risk communication to produce behavior change during the COVID-19 pandemic and lessen the effects of the infodemic. They suggested that forming a guideline in such pandemics, including the individuals' psychological needs such as competence, autonomy will promote relatedness to support well-being and results in sustainable behavior change. They conducted a literature review of the promoting health behaviours and sustainable behavior change over the case of wearing face-coverings. In their proposed guideline for public health, they found out that fostering autonomy with creating an autonomy-supportive health care climate and provide choice within the limitations; fostering competence with applying a bottom-up communication and fostering relatedness with creating solidarity and being transparent and acknowledging uncertainty will lessen the effects of infodemic and promote health care behaviors.[24]

Discussion

COVID-19 pandemic changed our lifestyles. When WHO declared COVID-19 as a pandemic, there was a high level of uncertainty all around the world. Governments and authorized institutions start to take measures in order to prevent COVID-19 spread throughout the world. WHO recommends wearing face masks, using disinfectants to disinfect surfaces, frequent hand washing and maintaining social distancing as personal precautions to prevent transmission of the virus. At the same time, governments have begun to take measures to stop the spread of the virus in their communities, with major quarantines, school closures, flight suspensions and other means of transport declared to prevent inbound and outbound virus transport and spread. Large campaigns spread through social media and media as a government policy signifying 'STAY HOME.' Nearly the whole population of the world communicated with each other and updated their information about COVID-19 by using their social media accounts. The changed lifestyle, which so-called *new normal,* contributes to the problems that the human community has to deal with. WHO again has declared that infodemic is a new burden for humanity which is related to excessive and fake or wrong news about COVID-19.

In the COVID-19 pandemic, infodemic, rumors and misinformation spread through social media are more contagious than the virus itself.[2,3] Many researchers argued that with the large number of research about COVID-19, information pollution occurred not only in social media but also in the scientific arena.[8,9,24] In addition to the infodemic disseminating on social media, the em-

phasis made by both WHO and governments has strengthened the likelihood of mental health disorders occurring in the community and made private groups more vulnerable. Classifying older adults, based on chronological age, as a higher risk and the most vulnerable group in COVID-19 transmission, has contributed to the increased risk of loneliness, despair, stigma, isolation from society, and related traumatic experiences.[6] In addition to the elderly COVID-19 pandemic has adverse effects also on children and adolescents' psychological well-being, resulting in the rapid spread of fear and panic among them.[17,18]

Research done during the COVID-19 pandemic highlighted the increased prevalence of depressive disorders, anxiety disorders, and sleep disorders among adults.[11–15] Excessive social media use (2 or more hours per day) can cause sleep disturbances, depressive and anxiety disorders among the users.[25,26] The anxiety and depression levels were found significantly higher among the participants who stated that they used social media too much during the COVID-19 pandemic, the participants who reported social media as a place to update information about COVID-19, and those who used social media because they did not have sufficient information about COVID-19. Further, in these studies, more social psychological phenomena such as racist discrimination, stigmatization of certain groups as well as sleep disorders, fear, panic, and paranoid ideations such as believing magical cures and conspiracy theories were identified.[5,7,11–17] Some conducted research also emphasized that especially healthcare workers may experience depression and anxiety as well as burnout syndrome, and counseling and psychotherapies will reflect the COVID-19 pandemic in therapeutic processes, and the main themes may change as survival and grief after losses.[7,10]

In the extraordinary circumstances created by the COVID-19 pandemic, uncertainty has increased the use of social media, sleep disorders, anxiety, and depression among the general community.

Infodemic circulating in social media has also changed the discourse. In the content analysis conducted with social media messages, it was observed that themes such as suicidal thoughts, hopelessness, and loneliness were used more frequently in addition to expressions of negative emotions.[19–22] COVID-19 pandemic changed the known lifestyle to a more socially isolated lifestyle, particularly in the curfew and quarantine measures that the governments took to prevent the spread of the virus. In those circumstances, the only socialization chance for human beings left behind is using social media. Repeatedly, the infodemic became more dangerous in these circumstances as the fake news and mis/disinformation about COVID-19 have a high speed spread due to unauthorized channels and unauthorized users. On the other hand, social media and official website portals and channels can be used in a positive way to increase online health literacy.[23,24] In social media, authorized channels can provide valid health information, fight against the infodemic, facilitating public health, through fostering and promoting healthy behavior.

Limitations

The main limitation of this study is that only two databases were scanned. A second limitation is that the concept of infodemic is a new term which entered our dictionaries only recently. Besides, there has not been enough research on this subject yet.

Conclusion

In this review study, mental health disorders, in particular depressive disorders, anxiety disorders, and sleep disorders, were more prevalent in the studied populations. It was suspected that infodemic was associated with mental health disorders. Moreover, infodemic can be spread not only through social media but also through authorized statements. The necessity for the information and warnings of authorized persons or institutions to develop discourses by considering all segments of the society came to the fore. During significant psychosocial crises that affect all parts of the world, such as the pandemic, it has become clear that states have to take national and international measures, especially in the use and filtering of social media. The second measure that can be taken is to increase social media and media literacy through lifelong education. If a student receives the basic knowledge to filter which information is trustful and which one is not, it can be the best way to stop the effects of infodemic. The most important point that should not be forgotten is that we have not passed the post-pandemic period yet. In the post-pandemic period, we need to be prepared for the difficulties that may arise, especially in the field of mental health, and take national and international measures.

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INFODEMİJA I POSLJEDİCE NA MENTALNO ZDRAVLJE

S A Ž E T A K

Od početka pandemije COVID-19, ogromna količina informacija širi se društvenim medijima, uključujući pogrešne/krivo interpretirane informacije i glasine. Svjetska zdravstvena organizacija nazvala je ovo širenje dezinformacija o pandemiji "infodemijom". U ovom istraživanju baze podataka Scopus i PubMed pretražene su s ključnim riječima 'infodemija' i 'mentalno zdravlje'. Prikupljeni podaci otkrili su da su poremećaji mentalnog zdravlja, uključujući poremećaje percepcije kao što su depersonalizacija i derealizacija, anksiozni poremećaji, depresivni poremećaji i, također, suicidalne ideje, učestaliji kao rezultat infodemije. Drugi značajan rezultat je uočen u promjeni diskursa među članovima grupa za podršku mentalnog zdravlja: javlja se više negativnih opterećenja poput beznađa, bespomoćnosti, usamljenosti, pa čak i samoubojstva.