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ARTICLE

Analysis of Status and Influencing Factors of Psychology Resilience Level in Cancer Patients Undergoing Radiotherapy and Chemotherapy

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ABSTRACT

Objective: To analyse the status and discuss influencing factors of the psychology resilience level of cancer patients undergoing radiotherapy and chemotherapy, and to provide evidence for clinical rehabilitation intervention. **Methods**: A total of 320 patients with cancer undergoing radiotherapy and chemotherapy who were hospitalized in the Affiliated Hospital of North China University of Science and Technology and Tangshan Worker's Hospital in China from September 2022 to November 2022 were selected as the research subjects. The surveys were conducted using the general information questionnaire, Connor-Davidson Scale (CD-RICS), Perceived Social Support Scale (PSSS) and Pittsburgh Sleep Quality Index Scale (PSQI). **Results:** The psychology resilience score of cancer patients undergoing radiotherapy and chemotherapy was 64.23 ± 15.20, lower than the average level of resilience of adults in China (70.50 ± 13.48) and American adults' normal value (80.4 ± 12.8). Perceived social support was 58.13 ± 14.04 and positively correlated with the level of psychology resilience ($r = 0.210$, $P < 0.05$). Sleep quality was 10.57 ± 4.85, which showed most people have sleep quality disorder and was negatively correlated with the level of psychology resilience ($r = –0.200$, $P < 0.05$). Multiple linear regression analysis showed that age, education level and disease stage were the main influencing factors in the level of psychological resilience in cancer patients undergoing radiotherapy and chemotherapy ($P < 0.05$). **Conclusions**: The level of psychological resilience of cancer patients undergoing radiotherapy and chemotherapy is at a low level, and there are many influencing factors. Targeted medical care should be carried out according to the factors affecting the level of resilience to promote the mental health of patients.

Keyword: Psychology resilience; Chemotherapy; Radiotherapy

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1. Introduction

In recent years, the number of cancer patients around the world is on the rise, and the age of cancer patients is becoming younger. The Cancer Progress report released by the American Association for Cancer Research (AACR) in 2017 predicts that the number of new cases of cancer worldwide may increase from 15.2 million to 24 million in 2035 [1]. With the increasing incidence of malignant tumours and the continuous progress of medical technology, the cure rate and survival rate of cancer patients are also increasing year by year worldwide [2]. Radiotherapy and chemotherapy are two important means of cancer treatment that can effectively control or destroy cancer cells which have been widely recognized and achieved good curative effects. However, in addition to bringing economic pressure to patients, these treatments will also cause a series of related symptoms, such as pain, vomiting, nausea, constipation, and other symptoms that weaken the patient's physical and mental function, cause cancer-related fatigue, and then reduce the patient's enthusiasm for treatment and compliance, affecting the rehabilitation effect and quality of life of patients in the later period. At present, the research on the psychological characteristics of patients with cancer radiotherapy and chemotherapy is mostly focused on negative psychological factors such as anxiety and depression, while there are few studies on the subjective positive initiative of individual patients. Psychological resilience belongs to the category of positive psychology, which can help individuals achieve good adaptation in times of adversity [3]. American Psychology Association [4] defined psychology resilience as the good adaptation process of individuals in the face of adversity trauma, tragedy, threats or other major pressures. It has been pointed out [5] that psychological resilience can prevent the adverse effects of single symptoms on patient outcomes. Therefore, this study aims to investigate the status of the psychological resilience level of patients with cancer radiotherapy and chemotherapy, and analyse its influencing factors, to provide a basis for improving the rehabilitation effect of patients.

2. Materials and methods

2.1 Participants

Using the cross-sectional sampling method, cancer patients who were hospitalized in the Affiliated Hospital of North China University of Science and Technology and Tangshan Worker's Hospital in China from September 2022 to November 2022 were selected as the research subjects. According to the requirements of statistical variable analysis, the number of samples is 10-20 times the number of variables. There are 13 variables involved in this study, and the sample size is 130-260 cases. Here, it is calculated by 20 times. Considering the loss to follow-up rate of 15%, the final sample size of this study should be at least 299 cases. The questionnaires were distributed to 340 patients, 320 questionnaires of valid answers were collected after excluding invalid answers, and the effective recovery rate was 94.12%. Inclusion criteria: (1) age ≥ 18 years old; (2) patients diagnosed with cancer and hospitalized for radiotherapy, chemotherapy and radiochemotherapy; (3) patients who received standard cycles of chemotherapy and radiotherapy and completed the treatment cycle; (4) have cognition function to cooperate with researchers; (5) volunteer to participate in this study after explaining the purpose of this study. Exclusion criteria include (1) patients suffering from other serious physical and mental diseases or complicated with serious complications; (2) patients who have not completed the treatment cycle; (3) patients who cannot cooperate with investigators due to communication or cognitive impairments.

2.2 Methods

General information questionnaire

The questionnaire was self-designed, and its content mainly includes age, gender, education level, economic situation, marital status, tumour type, duration of illness, and stage of illness.

Connor-Davidson Scale (CD-RICS)

This scale was compiled by American scholars [6] and translated by Chinese scholars [7]. It was

used to measure the positive psychological quality of individuals in coping with adversity. There are 25 items in total, using Likert 5-level scoring, from "completely inconsistent" to "completely consistent" scoring 0 to 4 points, with a total score of 100 points. A higher score indicates a higher level of resilience. The Cronbach's α coefficient of the scale is 0.91 in this study, which has good reliability.

Perceived social support

The Perceived Social Support Scale (PSSS) was compiled by Zimet et al. [8] and translated by Jiang Qianjin [9]. It is a social support scale that emphasizes individual self-understanding and self-feeling. At the same time, the total score reflects the total degree of social support that the individual feels. PSSS contains 12 self-assessment items, and each item uses a seven-point scoring method from 1 to 7, which are strongly disagree, strongly disagree, slightly disagree, neutral, slightly agree, strongly agree, and strongly agree, total score of 12-84 points. According to the total score of the scale, perceived social support is divided into 3 levels, 12-36 is the low level, 37-60 is the medium level, and 61-84 is the high level. The questionnaire has good reliability and validity, and Cronbach's α of the total scale is 0.922 in this study.

Pittsburgh Sleep Quality Index Scale (PSQI)

The scale was compiled by Byysse et al. [10] of Pittsburgh Medical Center in 1989, to measure the subjective sleep quality of the patient in the last month. The score of each component is the total score of PSQI, and the total score ranges from 0 to 21 points. The higher the score, the worse the sleep quality, and the PSQI > 7 points means that there is a sleep quality disorder. The Cronbach's α of this scale in this study is 0.84 in this study.

2.3 Investigation method

After explaining the purpose of the study to the patients and obtaining consent, the researcher signed the informed consent form. Questionnaires were issued and collected on the spot, and the quality of the questionnaires was checked immediately, and patients were asked to modify them in time if any problems were found. Patients completed the questionnaire in a quiet environment. After the questionnaires were collected, all data were entered and checked by two persons at the same time.

2.4 Statistical methods

Using SPSS 26.0 for data analysis. The measurement data were all in a normal distribution, and the measurement data were represented by mean ± standard deviation ($x \pm s$), and the count data were represented by frequency and percentage; *t*-test and one-way analysis of variance was used to conduct single-factor analysis on the psychology resilience level of patients with cancer radiotherapy and chemotherapy; Pearson correlation was used to analyse the correlation between psychology resilience, perceived social support and sleep quality; multiple linear regression was performed with factors with statistically significant differences in univariate and correlation analysis as independent variables, and $P < 0.05$ was considered statistically significant.

3. Result

3.1 Univariate analysis of cancer-related fatigue in patients with cancer radiotherapy and chemotherapy

The single factor results showed that there were statistically significant differences in the psychology resilience scores of different ages, occupations, education levels, payment methods, economic conditions, tumour types, disease stages, metastasis, social cognitive support, and sleep disorders ($P < 0.05$). see **Table 1**.

3.2 Correlation analysis of psychology resilience, perceived social support and sleep quality in patients with cancer radiotherapy and chemotherapy

The results showed that the score of the patient's psychology resilience level in this study was (64.23 ± 15.20). Perceived social support was (58.13 ± 14.04) and positively correlated with the level of psychology

resilience (r = 0.210, $P < 0.05$). Sleep quality (10.57 ± 4.85) showed that most people have sleep quality disorder and was negatively correlated with the level of psychology resilience (r = –0.200, $P < 0.05$). See **Table 2**.

3.3 Multivariate linear regression analysis on the factors affecting the psychology resilience of patients with tumour radiotherapy and chemotherapy

The total score of the psychology resilience scale was used as the dependent variable, and the variable with statistical significance in the univariate analysis was used as the independent variable for multiple linear regression analysis. The results showed that age, education level, staging nature of the disease, perceived social support and sleep quality were the main factors affecting the psychology resilience level of cancer patients undergoing radiotherapy and chemotherapy ($P < 0.05$), which could explain 28.8% of the total variables. The variable assignment method is shown in **Table 3**, and the multivariate analysis results of factors affecting the psychology resilience level of cancer patients undergoing radiotherapy and chemotherapy are shown in **Table 4**.

Table 1. Differences in psychology resilience when grouped according to profile ($x \pm s$) (n = 320).

Group	**N**	**Resilience level**	***t/F***	**P**
Age			6.982	0.001
< 50 years old	33	72.58 ± 17.15		
50-59 years old	167	64.44 ± 15.32		
≥ 60 years old	120	61.64 ± 13.67		
Gender			1.481	0.140
Male	127	65.78 ± 14.46		
Female	193	63.21 ± 15.63		
Education level			20.658	0.000
Primary school and below	50	53.14 ± 12.96		
Junior high school	93	61.76 ± 12.80		
High school	101	65.82 ± 14.81		
Bachelor degree or above	76	72.44 ± 14.78		
Payment method			3.271	0.039
Own expense	5	62.40 ± 13.61		
Residential medical insurance	253	63.19 ± 15.20		
Employee insurance	62	68.63 ± 14.76		
Personal monthly income			6.772	0.000
< 2000	109	59.09 ± 14.76		
2000-3000	85	66.26 ± 14.52		
3000-5000	97	67.58 ± 14.65		
＞ 5000	29	66.41 ± 16.31		
Marital status			1.938	0.123
Married	276	64.20 ± 15.40		
Single	18	64.89 ± 14.09		
Divorced	10	73.10 ± 15.67		
Widow/Widower	16	58.44 ± 10.33		
Diagnose			2.677	0.047

Table 1 continued

Group	**N**	**Resilience level**	***t/F***	**P**
Gynecologic oncology	136	63.88 ± 15.89		
Head and neck tumours	64	64.72 ± 15.18		
Digestive tract tumours	47	69.19 ± 16.50		
Chest tumours	73	61.27 ± 12.24		
Years of illness			2.436	0.089
< 1 year	245	65.26 ± 15.43		
1-5 years	67	60.97 ± 13.10		
＞ 5 years	8	60.00 ± 21.32		
Staging nature of disease			8.312	0.000
Stage I	13	73.54 ± 11.22		
Stage II	147	65.70 ± 14.12		
Stage III	115	64.94 ± 16.34		
Stage IV	45	54.93 ± 12.85		
Metastasis			–3.367	0.001
Yes	84	59.51 ± 15.00		
No	236	65.91 ± 14.95		
Surgery			1.580	0.115
Yes	85	66.46 ± 15.92		
No	235	63.43 ± 14.88		

Table 2. Correlation between psychological resilience, perceived social support and sleep quality (n = 320).

Variable	**Score ($\bar{x} \pm s$)**	**Psychology resilience**	**Perceived social support**	**Sleep quality**
Psychology resilience	64.23 ± 15.20	1.000	0.210 *	–0.200 *
Perceived social support	58.13 ± 14.04	0.210 *	1.000	–0.200 *
Sleep quality	10.57 ± 4.85	–0.200 *	–0.200 *	1.000

Table 3. Independent variable assignment method.

Variable	**Assignment method**
Age	< 50 years old = 1, 50-60 years old = 2. ≥ 60 years old = 3
Education level	Bachelor's degree and below = 1, junior high school = 2, high school = 3, undergraduate and above = 4
Payment method	Self-pay = 1, resident medical insurance = 2, employee insurance = 3
Personal monthly income	< 2000 = 1, 2000-3000 = 2, 3000-5000 = 3, > 5000 = 4;
Diagnose	Gynecological tumours = 1, head and neck tumours = 2, digestive tract tumours = 3, breast tumours = 4;
Staging nature of disease	Stage I = 1, Stage II = 2, Stage III = 3, Stage IV = 4
Metastasis	yes = 1, no = 2
Perceived social support	the original value
Sleep quality	the original value
Psychology resilience	the original value

Table 4. Multivariate analysis of factors affecting psychology resilience (n = 320).

Constants and arguments	Standard error	Beta	t	P	B value (95% CI of B value)
(constant)	9.443		6.071	0	57.324 (38.743-75.905)
Age	1.196	–0.119	–2.376	0.018	–2.842 (–0.519-–0.489)
Education level	0.943	0.413	6.592	0.000	6.216 (4.36-8.071)
Payment method	2.202	–0.029	–0.468	0.64	–1.03 (–5.363-3.303)
Personal monthly income	0.913	–0.063	–1.053	0.293	–0.962 (–2.758-0.835)
Diagnose	0.694	0.004	0.076	0.94	0.052 (–1.312-1.417)
Staging nature of disease	1.165	–0.135	–2.269	0.024	–2.643 (–4.935-–0.351)
Metastasis	2.151	0.113	1.815	0.071	3.904 (0.329-8.136)
Perceived social support	0.053	0.17	3.506	0.001	0.184 (0.081-0.288)
Sleep quality	0.153	–0.183	–3.764	0.000	–0.574 (–0.875-–0.274)

Note: $F = 13.910$, $P < 0.001$; $R^2 = 0.310$, $\Delta R^2 = 0.288$.

4. Discussion

4.1 The status quo of the resilience level of cancer patients undergoing radiotherapy and chemotherapy

The results of this study showed that the score of the psychology resilience of cancer patients undergoing radiotherapy and chemotherapy was (64.23 ± 15.20), which is significantly lower than the average level of resilience of adults in China (70.50 ± 13.48) [11], and also lower than that of American adults' normal value (80.4 ± 12.8) [6]. It showed that the level of psychological resilience in patients undergoing cancer radiotherapy and chemotherapy is low. This may be because cancer itself, as a stressor, easily leads to a series of adverse symptoms, which leads to the impairment of patients' physiological functions, changes in their external image, influences their normal living ability and social participation ability, leads to psychological problems such as anxiety and depression, and reduces their disease adaptability. At the same time, studies have shown that chemoradiotherapy in the treatment of cancer will produce a variety of adverse reactions to the human body, such as serious gastrointestinal reactions, bone marrow suppression, toxicity, and so on [12]. These adverse reactions have a long duration and great effect on patients, seriously affecting the quality of life of patients, cancer treatment and prognosis and leading to aggravated psychological pain in patients [13].

4.2 Age

The results of the study showed that the older the patients, the lower the level of psychological resilience. This is consistent with the research results of Chinese scholars et al. [14]. As people age, the body's metabolic rate and immune system function begin to decline. When older patients receive chemotherapy and radiotherapy, their tolerance for pain is reduced, and they are more likely to have negative emotions such as tension, anxiety, or depression during disease treatment, and their confidence in the recovery of later treatment effects and physical functions is reduced, which in turn affects the level of psychology resilience of the patient. This suggests that clinical medical staff should pay more attention to the psychological state of elderly patients with cancer radiotherapy and chemotherapy, fully understand and encourage them to face the disease and improve treatment compliance.

4.3 Education level

The results of the study show that the higher the education level of cancer patients undergoing radiotherapy and chemotherapy, the higher the level of psychological resilience, which is consistent with the research results of Qiu Xiaofeng et al. [15]. People with higher education usually have a wider knowledge reserve, stronger critical analysis ability, can adopt a positive attitude to face difficulties, and

help themselves better understand the development of the disease, thereby reducing the uncertainty of uncertainty. At the same time, patients with a higher education level tend to have better cognitive and management capabilities for their own emotions and emotions. When facing negative events, they can better identify their own emotional state and adjust effectively to cope with stress or adversity. In addition, an educational level generally represents an individual's social status and economic conditions [16]. Patients with a high educational level have lower economic pressure and can seek better medical resources to solve disease problems, so the level of psychological resilience increases accordingly. It is suggested that clinical medical staff need to improve psychological care for patients with low education level, and guide patients to actively face the disease.

4.4 Staging nature of disease

The results of the study showed that the higher the stage of the disease, the lower the level of psychology resilience with the trend of psychology resilience observed by Costanzo [17]. The reason may be that before receiving induction chemotherapy, the main symptoms of the patient were nausea, headache, nosebleed, hearing loss, and vomiting, and the fatigue was mild. The higher the disease stage, the larger the patient's tumour, the wider the spread, the poorer the treatment effect, and the adverse reactions increased. After the start of radiotherapy and chemotherapy, the patient's head, neck, and systemic reactions aggravated at the same time. Dysgeusia, loss of appetite, radiation dermatitis, etc. coexisted with fatigue and interacted with each other. By the end of radiotherapy, fatigue or distress had reached its peak. The uncertainty and fear brought about by the disease lower the patient's expectations for disease recovery and reduce treatment compliance. At the same time, in addition to facing the failure of treatment and the deterioration of the disease, patients with advanced stage also face the fear of death at any time, and their psychological state will also be poor. Therefore, clinical medical staff should pay attention to monitoring the mental state of patients in the middle and late stages, provide psychological counseling, and help patients relieve the pain caused by the disease.

4.5 Perceived social support

The results showed that perceived social support was positively correlated with psychological resilience. The result is consistent with that of Zhao Lihui et al. [18]. Perceived social support means that patients can feel the emotional experience and satisfaction degree of understanding, care, support, and encouragement from the outside world, which is an important factor affecting the quality of life [19]. In the face of great pressure or difficulties, patients need not only external social support, but also subjective feelings and acceptance of these support, and form their own motivation to play a huge role. When patients face illness, patients with a high level of perceived social support have higher self-efficacy [20], the easier it is for individuals to face adversity in a positive way, and is good at using social support to adjust their emotions and find ways to deal with them, so that patients' stress response and negative emotions decrease and their sense of despair about the disease decreases [21]. Therefore, family or community centers should focus on providing social support to patients and helping them establish a positive attitude.

4.6 Sleep quality

The results showed that the quality of sleep was negatively correlated with the level of psychological resilience. The reason may be that poor sleep quality will cause hypothalamic-pituitary-adrenal axis disorder and inflammatory reaction [22], which will delay the recovery and progress of the disease. At the same time, the human body usually takes glucose in the body during sleep. When sleep is insufficient, glucose intake decreases, and the prefrontal cortex energy is insufficient, which leads to the impairment of brain function, thus causing the patient's self-control ability to decline. Patients often look at things with negative thinking, and their ability to under-

stand, judge and deal with things decreases, which is more likely to produce negative expressions such as disgust and dissatisfaction [23] and negative emotions such as anxiety, depression and stress. Therefore, clinical medical staff should pay attention to improving patients' sleep quality, which is of great significance to reducing their stress levels and improving their coping ability and psychological resilience.

5. Conclusions

The results of this study showed that the level of psychological resilience of cancer patients undergoing radiotherapy and chemotherapy is low, and age, educational level, staging nature of the disease, perceived social support and sleep quality are the influencing factors. With the proposal and development of the Socio-Psycho-Biomedical model, the model advocates that human health is not only the absence of physical disease, but also physical health, mental balance, and good social adaptation. Therefore, in the management of patients' psychology resilience in the future, medical staff can focus on these influencing factors, and timely implement precise prevention and treatment programs for cancer patients undergoing chemotherapy and radiotherapy who are considered to have low psychology resilience, so as to further improve the prognosis of patients.

Author Contributions

Xu Liya: Data analysis and writing.
Dr. Lida C. Landicho: Formal analysis.
Dr. Elna R. Lopez: Validation.

Conflict of Interest

There is no conflict of interest.

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Statement

This research was reviewed by the Ethics Committee of North China University of Science and Technology, Ethical Review No. (2021062), and the research participants all signed the informed consent form.

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ARTICLE

Changes in Subjective Sleep, Physical Condition, and Mental Health during the COVID-19 Pandemic: A Nationwide Survey in Japan

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ABSTRACT

This study aimed to investigate how people's subjective health changed after the coronavirus disease 2019 (COVID-19) pandemic. This survey was conducted in May 2021 as a nationwide online self-reported survey in Japan. The respondents indicated how their sleep, physical condition, and mental state altered after the pandemic. Furthermore, they answered questionnaires about their intention to get vaccinated, the means of gathering information, etc. A logistic regression analysis was performed. Of the 2,573 responses, there was a decline of approximately 13.6%, 14.0%, and 23.8% in subjective sleep, physical condition, and mental health after the pandemic, respectively. The logistic regression analysis demonstrated that regarding sleep, the affected group was younger, got vaccinated against influenza annually, had lower income, experienced poor sleep quality in the past month, and had worse physical and psychiatric symptoms than before the pandemic. Concerning the physical condition, the affected group lived alone, witnessed deficient sleep quality in the past month, and had deteriorated mental health status than before the COVID-19 pandemic. In terms of mental status, the affected group was younger, females, had access to more sources of information, and experienced worse sleep and physical conditions than the unchanged or improved group ($p < 0.05$). Each group indicated an association with the background factors, confirming that the subjective sleep, physical condition, and mental state affected each other. From a preventive perspective, the results of this study suggested that factors such as youth, gender, sleep quality, pregnancy, reduced income, and greater access to information, may be necessary for physical and mental support. The above-mentioned factors should be considered in light of community life and approached accordingly.

Keywords: COVID-19; Pandemic; Mental health; Sleep quality; Physical health; Public health

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1. Introduction

The coronavirus disease 2019 (COVID-19) pandemic began in 2020 and rapidly spread worldwide, infecting more than 500 million people and causing over 6.3 million deaths by June 2022 [1]. However, the Japanese infection rate was lower than that of the Organization for Economic Co-operation and Development (OECD) countries. The Japanese government declared a state of emergency four times between April 2020 and July 2021 [2]. The Japanese emergency declaration was not a lockdown mandate as in other countries; however, a request for voluntary restraint by the citizens. Although most Japanese residents complied with the request, some did not, thus creating an atmosphere of mutual monitoring of each other's behavior in some areas.

The COVID-19 vaccination has proven to be highly effective in decreasing the disease's spread and severity, with a significant reduction in the risk of serious outcomes in vaccinated individuals [3]. The COVID-19 vaccine was approved by the World Health Organization for emergency use in December 2020 and in February 2021 in Japan, with the vaccination beginning immediately [4].

In Japan, the first state of emergency was declared nationwide in April and May 2020, with requests to refrain from leaving the house and restrictions on various activities. Examples include changes in daily life, such as school closures, online classes, working from home due to the development of telework, and limited opening hours for restaurants. It has been predicted that these restrictive and unforeseeable changes in social situations have had a significant impact on our physical and mental states. The psychosomatic effects of COVID-19 have been studied using data from 13,052,788 individuals from the United States (U.S.) Department of Veterans Affairs. The research reported that people with COVID-19 were at an increased risk of various psychiatric disorders (anxiety disorders, depression, adjustment disorder, opioid use disorder, non-opioid substance use disorder, neurocognitive impairment, sleep disturbances, etc.) [5]. A bidirectional relationship between psychiatric disorders and COVID-19 was also identified which may lead to adverse mental health events [6]. In a study involving 13,829 Australian adults examining the association between COVID-19 restrictions and depressive and anxiety symptoms, about one-quarter of the respondents reported mild to moderate symptoms [7]. In a review of 43 articles regarding the effects of COVID-19 on anxiety, depression, and other mental health effects, 77% (n = 33) and 56% (n = 26) showed a relationship between the COVID-19 pandemic with the anxiety symptoms and depression or depressive symptoms, respectively; moreover, seven papers demonstrated sleep changes, reporting that they found a relationship between the COVID-19 pandemic and the anxiety symptoms [8].

In addition, Alimoradi et al.'s meta-analysis of previous studies regarding the effect of COVID-19 on sleep reported 31%, 18%, and 57% prevalence of sleep problems among health professionals, the general population, and COVID-19 patients, respectively, indicating that sleep problems were positively associated with the depressive and anxiety symptoms among the three groups [9]. Chew et al. examined the relationship between COVID-19 and physical symptoms in health care workers [10]. In their research, the most reported physical symptom during the COVID-19 outbreak was headache at 31.9%. Those with physical symptoms also had higher rates of depression, anxiety, stress, and post-traumatic stress disorder (PTSD); furthermore, the study suggested that physical symptoms and psychological outcomes may be bidirectional [10]. COVID-19 and its vaccine produced considerable misinformation and conspiracy theories. However, a recent study suggested that social media is responsible for spreading misinformation [11]. The means of gathering information on COVID-19 has been found to influence subsequent health care [12-18]. This research summarized the variables identified as factors in previous studies and investigated what factors affected the mental state, sleep, and physical health. By examining these aspects, we would be able to identify the factors of those whose multiple mental and physical conditions deteriorated, and thus, identify the characteristics of

those who need greater attention due to mental and physical deterioration and those who need more intervention and support. This is significant because it could recognize the aspects of intervention and support. The analysis was conducted on a group of people who experienced a more extensive deterioration in any one of the following areas: sleep, physical condition, and mental state. In addition, we examined a group of individuals with severe exacerbations in which all these three areas had deteriorated.

We conducted a national survey with the aim to investigate how the COVID-19-related restrictive situation affected people's subjective sleep, physical condition, and mental state during the pandemic in Japan. Furthermore, we assessed the factors related to those states.

2. Methods

2.1 Study design and samples

This web-based, self-reported questionnaire survey was conducted in May 2021 using a large Internet survey agency (GMO RESEARCH, Inc., Tokyo, Japan: https://gmo-research.com/) that had approximately 20 million registered panelists; further, the study was a stratified random sample of 2.2 million active users by age and gender. The company distributed and collected the questionnaires online and sent the results. All the data were anonymized. This study was approved by the Ethics Committee of Aichi Toho University. Online written informed consent was obtained from all potential participants.

Our final sample consisted of 2,573 compensated Japanese-speaking adults aged 20 years and residing in Japan. The sample was collected according to the prefectural population and age distribution.

2.2 Survey items

The questionnaire items collected the following data:

Demographic information: age, gender (male or female), residential area (Hokkaido, Tohoku, Kanto, Chubu, Kansai, Chugoku, Shikoku, and Kyushu), marital status, living condition (alone/with children/with adults/with elderly aged 65 years or older/with a medical worker), education (high school or less/college, university, graduate university), job (agriculture, forestry, fisheries/service industry/administrative position/employee (full-time)/civil servant/medical workers/students/part-time job/unemployed, housewife/others), income before the COVID-19 pandemic (million yen; < 1.99, 2.00-3.99, 4.00-5.99, 6.00-7.99, 8.00-9.99, 10.00-11.99, > 12.00), decrease in income after the COVID-19 pandemic (yes/no: y/n), having a specific political party affiliation (y/n), gathering information from the traditional media such as newspaper, television (y/n), good sleep for the past one month (y/n), pre-existing diseases (pulmonary diseases, heart diseases, diabetes, severe obesity, chronic renal failure, liver disease, and immunodeficiency diseases) (y/n), currently smoking (y/n), and currently pregnant (y/n).

In addition to these were the subjective status changes before and after the COVID-19 expansion: sleep (improved/no change/worsened), physical condition (improved/no change/worsened), and mental health state (improved/no change/worsened).

The respondents were requested to answer all the above-mentioned items and indicate how that condition had changed after the COVID-19 pandemic.

2.3 Statistical analyses

First, we conducted a descriptive analysis to report the demographic characteristics. Second, we calculated the proportion of the people who answered "worsened" regarding their subjective sleep, physical, and mental state. Third, we performed a logistic regression analysis. In terms of the modifications in the three areas, each was divided into two groups: "worsened" and "improved/no change", which were employed as dependent variables. A chi-square test was utilized to assess the associations between "worsened" and each independent variable (χ^2). The variables with $p < 0.2$ in the χ^2 test were used as covariates for binominal logistic regression analysis. A logistic regression analysis using the variable increase method with the likelihood ratio was

performed.

In addition, a logistic regression analysis was performed to examine not only the stand-alone worsening factors for sleep, physical condition, and mental status, but also for those who had multiple deteriorating physical and mental conditions due to COVID-19. All the data were analyzed using SPSS version 25. The significance level was alpha < 0.05.

3. Results

3.1 Demographic characteristics

The participants' characteristics are shown in **Table 1**. Of the 2,573 participants, 1,203 (46.8%) and 1,370 (53.2%) were males and females, respectively. The mean age (± standard deviation) was 52.2 ± 16.8 years.

Table 1. Sample characteristics. (n = 2,573).

Characteristics		**N (mean)**	**% (SD)**
Female		1370	53.2
Male		1203	46.8
Age (in years)	20-29	323	12.6
	30-39	379	14.7
	40-49	456	17.7
	50-59	398	15.5
	60-69	436	16.9
	70-79	581	22.6
Japan Region	Hokkaido (North Island)	98	3.8
	Tohoku (North of Honshu*)	215	8.4
	Kanto (Mideast of Honshu*)	770	29.9
	Chubu (Mid of Honshu*)	447	17.4
	Kansai (Midwest of Honshu*)	437	17.0
	Chugoku (West of Honshu*)	167	6.5
	Shikoku (Southwest Island)	111	4.3
	Kyusyu (South Island)	328	12.7
Married		1552	60.3
Living	Alone	420	16.3
	With children	464	18.0
	With adults	1295	50.3
	With elderly people (aged > 65 years)	1059	41.2
	With a medical worker	82	3.2
Education	High school or less	905	35.2
	College/University/Graduate university	1668	64.8

Table 1 continued

Characteristics		**N (mean)**	**% (SD)**
Job	Agriculture, Forestry, Fisheries	19	0.7
	Service industry	128	5.0
	Freelance	91	3.5
	Administrative position	125	4.9
	Employee (full-time)	507	19.7
	Civil servant	49	1.9
	Medical workers	51	2.0
	Students	57	2.2
	Part-time job	312	12.1
	Unemployed/housewife	1072	41.7
	Others	162	6.3
Income before the COVID-19 pandemic (million yen)	< 1.99	251	9.8
	2.00-3.99	668	26.0
	4.00-5.99	573	22.3
	6.00-7.99	340	13.2
	8.00-9.99	204	7.9
	10.00-11.99	89	3.5
	> 12.00	113	4.4
	Declined to answer	155	6.0
	Unknown	180	7.0
Decrease in income after the COVID-19 pandemic		118	4.6
Having a specific political party affiliation		1028	40.0
Intention of the COVID-19 vaccine	Yes	1809	70.3
	No	377	14.7
	Undecided/unknown	387	15.0
Getting vaccinated against influenza annually (almost)		1144	44.5
Number of information collecting ways about COVID-19		(2.9)	(1.34)
Gathering information from the old media: newspaper and television		1919	74.6
Good sleep for the past one month		1643	63.9
Pre-existing diseases (pulmonary diseases, heart diseases, diabetes, severe obesity, chronic renal failure, liver disease, and immunodeficiency diseases)		415	16.1
Smoking		377	14.7
Pregnant		33	1.3

Note: Abbreviation: SD, standard deviation.

*Honshu: Main and Biggest Island of Japan.

3.2 The proportion of the samples worsened in the subjective sleep, physical, and mental state

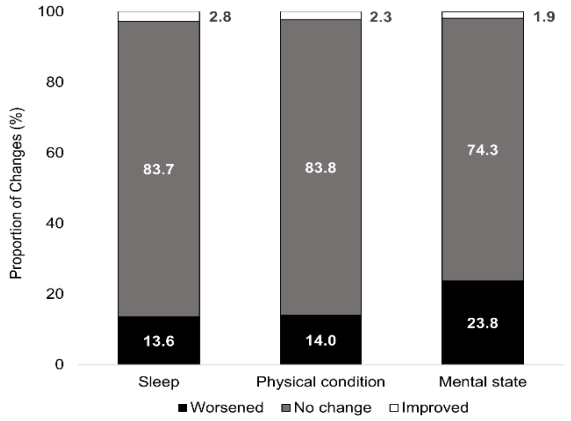

Figure 1 shows the proportion of the participants who answered "worsened" regarding their sleep, physical condition, and mental state before and after the COVID-19 outbreak. Specifically, 349 (13.6%), 359 (14.0%), and 612 (23.8%) individuals reported deterioration in their sleep, physical condition, and mental state, respectively.

Figure 1. The proportion of the participants who answered "worsened", "no change", or "improved".

Among the 2,573 participants, the proportion who answered "worsened" before and after the COVID-19 (black bar) were 13.6% (n = 349) for sleep quality, 14.0% (n = 359) for physical condition, and 23.8% (n = 612) for mental state. The proportion who answered "no change" (gray bar) was 83.7% (n = 2153) for sleep quality, 83.8% (n = 2155) for physical condition, and 74.3% (n = 1912) for mental state. The proportion who answered "improved" (white bar) were 2.8% (n = 71) for sleep quality, 2.3% (n = 59) for physical condition, and 1.9% (n = 49) for mental state.

3.3 Factors related to the subjective sleep, physical condition, and mental state after the COVID-19 outbreak

The association of the potential factors and the subjective sleep, physical condition, and mental state has been displayed in **Table 2**. In the logistic regression model comparing the "worsened" and "improved/no change" groups regarding subjective sleep, the following independent variables were found to be significantly associated: age (OR = 0.987; 95% CI 0.977-0.997), not vaccinated against influenza annually (OR = 0.58; 95% CI 0.41-0.80), income decreased after the COVID-19 outbreak (OR = 2.85; 95% CI 1.55-5.22), poor sleep quality in the past month (OR = 6.04; 95% CI 4.27-8.54), worsened physical condition due to the COVID-19 outbreak (OR = 10.56; 95% CI 7.32-15.23), and deteriorated mental state (OR = 4.82; 95% CI 3.38-6.88) ($p < 0.05$).

On comparing the "worsened" and the "improved/no change" groups for physical condition, the following independent variables were found to be significantly associated: living alone (OR = 1.56; 95% CI 1.03-2.36), poor sleep quality in the past month (OR = 1.53; 95% CI 1.08-2.16), pre-existing diseases (OR = 1.86; 95% CI 1.24-2.79), worsened subjective sleep after the COVID-19 outbreak (OR = 10.35; 95% CI 7.19-14.91), and deteriorated mental state after the COVID-19 outbreak (OR = 11.94; 95% CI 8.49-16.80) ($p < 0.05$).

Similarly, regarding the mental state after the COVID-19 pandemic, the following independent variables were significantly associated with the "worsened" group ($p < 0.05$): age (OR = 0.990; 95% CI 0.983-0.997), female (OR = 1.67; 95 CI 1.30-2.13), number of information collection methods regarding COVID-19 (OR = 1.23; 95% CI 1.13-1.35), poor sleep quality in the past month (OR = 1.31; 95% CI 1.01-1.70), worsened sleep after the COVID-19 outbreak (OR = 4.46; 95% CI 3.12-6.37), and poorer physical condition after the COVID-19 outbreak (OR = 10.86; 95% CI 7.72-15.28).

Regarding the group with the worsening of either sleep, physical condition, or mental health in Additional Analysis 1 (**Table 3**), the following groups were also included: younger (OR = 0.99; 95% CI 0.98-0.99), female (OR = 1.54; 95% CI 1.26-1.88), decreased income after the COVID-19 outbreak (OR = 1.94; 95% CI 1.27-2.96), poor sleep quality in the past month (OR = 3.25; 95% CI 2.66-3.96), possible pregnancy (OR = 2.58; 95% CI 1.21-5.50), and the number of information sources on COVID-19 (OR = 1.34; 95% CI 1.24-1.44) ($p < 0.05$). For the

group with deteriorated sleep, physical health status, and mental health in Additional Analysis 2 (**Table 3**), the following groups were affected: younger (OR = 0.98; 95% CI 0.97-0.99), female (OR = 1.54; 95% CI 1.08-2.20), decreased income after the COVID-19 outbreak (OR = 3.40; 95% CI 1.73-6.70), poor sleep quality in the past month (OR = 10.10; 95% CI 6.74-15.14), and more means of gathering information about COVID-19 (OR = 1.43; 95% CI 1.26-1.61) ($p < 0.05$).

Table 2. Logistic regression analysis of the change in the subjective sleep, physical condition, and mental state. (n=2,573).

Variables	**B**	**OR (95%CI)**	**p-value**
Change in the subjective sleep †			
Age	–0.01	0.987 (0.977-0.997)	0.009
Not taking influenza vaccine annually	–0.55	0.58 (0.41-0.80)	0.001
Decreased income during the pandemic	1.05	2.85 (1.55-5.22)	< 0.001
Deterioration in the quality of sleep in the past month	1.80	6.03 (4.26-8.53)	< 0.001
Deterioration of the physical condition	2.36	10.56 (7.32-15.23)	< 0.001
Deterioration of the mental state	1.57	4.82 (3.38-6.88)	< 0.001
Change in the subjective physical condition††			
Living alone	0.44	1.56 (1.03-2.36)	0.035
Deterioration in the quality of sleep in the past month	0.42	1.53 (1.08-2.16)	0.017
Deterioration of the subjective sleep condition	2.34	10.35 (7.19-14.91)	< 0.001
Deterioration of the mental state	2.48	11.94 (8.49-16.80)	< 0.001
Pre-existing diseases	0.62	1.86 (1.24-2.79)	0.003
Change in the subjective mental state †††			
Age	–0.01	0.990 (0.983-0.997)	0.009
Female	0.51	1.67 (1.30-2.13)	< 0.001
Number of information collection methods regarding COVID-19	0.21	1.23 (1.13-1.35)	< 0.001
Deterioration in the quality of sleep in the past month	0.27	1.31 (1.01-1.70)	0.041
Deterioration of the subjective sleep condition	1.49	4.46 (3.12-6.37)	< 0.001
Deterioration of the physical condition	2.39	10.86 (7.72-15.28)	< 0.001

Note: Other variables were not significant in the model.

† female, married, intention of taking the COVID-19 vaccine, income before the COVID-19 pandemic, old media, number of information methods, pre-existing diseases, pregnant;

†† age, female, married, COVID-19 vaccine, influenza, income before COVID-19, decrease in the income after the COVID-19 outbreak, number of methods of collecting information;

††† married, income before the COVID-19 pandemic, decrease in the income after the COVID-19 outbreak, old media, pregnant;

Abbreviation: OR, odds ratio; CI, confidence interval.

Table 3. Logistic regression analysis of the groups in which all as well as any one of the three conditions, namely, sleep, physical condition, and mental health, worsened.

Variables	**B**	**OR (95%CI)**	**p-value**
Change in the subjective sleep, physical condition, and mental state †			
Age	–0.02	0.98 (0.97-0.99)	0.001
Female	0.43	1.54 (1.08-2.20)	0.018
Decreased income during the pandemic	1.23	3.40 (1.73-6.70)	< 0.001
Deterioration in the quality of sleep in the past month	2.31	10.10 (6.74-15.14)	< 0.001
Number of information collecting methods about COVID-19	0.36	1.43 (1.26-1.61)	< 0.001

Table 3 continued

Variables	B	OR (95%CI)	p-value
Change in any one of the following: subjective sleep, physical condition, and mental state†††			
Age	–0.01	0.99 (0.98-0.99)	< 0.001
Female	0.43	1.54 (1.26-1.98)	< 0.001
Decreased income during pandemic	0.66	1.94 (1.27-2.96)	0.002
Deterioration in the quality of sleep in the past month	1.18	3.25 (2.66-3.96)	< 0.001
Pregnant	0.95	2.58 (1.21-5.50)	0.01
Number of information collecting methods about COVID-19	0.29	1.34 (1.24-1.44)	< 0.001

Note: Other variables were not significant in the model.

† living with children, married, education, income before the COVID-19 pandemic, old media, pre-existing diseases;

†† living with children, married, COVID-19 vaccine, getting vaccinated against influenza annually (almost), income before COVID-19;

Abbreviation: OR, odds ratio; CI, confidence interval.

4. Discussion

This study was conducted in Japan when the COVID-19 vaccination had just begun, and most people had not been vaccinated. It was assumed that many people were both concerned about the continuing pandemic and hopeful regarding the vaccine at the time. After the COVID-19 outbreak, our results demonstrated a deterioration of subjective sleep, physical condition, and mental health perceptions by 13.6%, 14.0%, and 23.8%, respectively. The number of COVID-19-infected people in Japan was limited compared to the other OECD countries. Nevertheless, it was found that a limited number of people experienced physical and mental deterioration in an unstable situation.

Each group indicated an association with the background factors, confirming that subjective sleep, physical condition, and mental state affected each other. As for the relationship between sleep with the COVID-19 pandemic, a dose-response relationship was found between anxiety, depression, and sleep [19]; moreover, sleep timing was delayed and the quality of sleep deteriorated during the lockdown [20]. Our findings reported that younger people whose physical and mental states deteriorated after the pandemic experienced poorer sleep.

As for physical condition, people who lived alone and those with pre-existing medical diseases were more likely to experience health deterioration. A reason for this was that many of them refrained from seeing a doctor or seeking consultation with someone during the COVID-19 pandemic. An online survey of 1,879 participants by Michael et al. also showed that those with poor physical health states during the COVID-19 disaster experienced significantly more stress, anxiety, and depression symptoms than those who did not [21].

Several reports have been on the relationship between the COVID-19 pandemic and mental health. A study in the U.S. reported that mental distress and isolation increased with the former [22]. Moreover, there were international reports of anxiety, depression, PTSD, and stress regarding the coronavirus [23-25]. Risk factors associated with mental distress, mental health, anxiety, and depression during the COVID-19 pandemic were found to be more prevalent among women, young people, chronically/mentally ill individuals, unemployed people, students, and those with high exposure to COVID information [23-25]. In our research, females, young people, and those with more sources of information on COVID-19 had poorer mental health, which is consistent with the aforementioned international reports.

By 2020, an increase in suicides among women and young people was noted (Ministry of Health, Labor, and Welfare, Japan) [26]. Furthermore, Horita et al. also demonstrated a surge in suicides in Japan, especially among young women, during the COVID-19 pandemic [27]. These circumstances necessitate urgent measures to be implemented for vulnerable populations.

We found that the more sources of information people had about COVID-19, the poorer their mental health. In Japan, Internet traffic has increased sharply from the previous year after 2020 (COVID-19 pandemic) [28]. This has been believed to be due to a rise in stay-at-home hours. Trust in televisions (TV), newspapers, and other media has been declining [29,30]. In particular, it has become clear that there is considerable misinformation on the social networking service (SNS) [31]. Prior research has shown that exposure to misinformation is detrimental to mental and physical health [12-18]. During the COVID-19 pandemic, it was found that the reasons for the health effects of the SNS were that its users skipped lunch and had fewer conversations [32]. It is possible that information-gathering while staying at home is not merely limited to the SNS and the Internet. Given these findings, it is probable that in this study's results, those who used various information-gathering methods to collect data about COVID-19 were affected by these factors and their mental and physical health worsened. Furthermore, in addition to the SNS, a study in Japan showed that people who received information about the COVID-19 infections from TV news and Internet articles tended to have higher levels of coronavirus anxiety [33]. The study also reported that reducing the amount of time spent watching TV and reading Internet articles may have a positive impact on mental health. Specifically, seeking more information to reduce anxiety may increase exposure to false, misleading, or negative information, consequently increasing anxiety. A study by Machida et al. including Japanese participants also indicated that those who were more diligent in gathering information about the COVID-19 vaccination were more likely to refrain from receiving it [34].

Furthermore, this study's analyses suggested the possibility that a careful approach to pregnant women is needed from a preventive perspective concerning the deterioration of mental and physical conditions caused by the COVID-19 disaster.

Reports from Belgium, China, and Canada have presented elevated depressive and anxiety symptoms among pregnant women during the COVID-19 pandemic [35-37]. Among Japan, Matsushima and Horiguchi showed that the percentage of mothers with depressive symptoms was remarkably higher than that found in normal circumstances in Japan. They reported that given that the experience of pregnancy/becoming a mother can itself be considered a stressful event, the risk of postpartum depression was intensified with additional stressors caused by the COVID-19 pandemic, including voluntary social isolation and economic uncertainty [38]. Furthermore, Davenport et al. found that one in seven women in the perinatal period were affected by depression and anxiety and that these were associated with an increased risk of preterm delivery, a decreased maternal-child bonding, and a delayed cognitive aptitude and emotional development in infants, effects that may continue into childhood [39]. Therefore, similar to previous studies, this research's results indicated that support and care may be essential for those who are pregnant and of childbearing potential, as they are likely to present some kind of disorder. However, this study's results alone should be interpreted with caution since it is not possible to mention whether sleep or physical discomfort was exacerbated by pregnancy or whether COVID-19 had an effect.

Based on this research's findings, we believed that the variables (i.e., younger, female, decreased income after the COVID-19 outbreak, poor sleep quality in the past month, possible pregnancy, and the number of information sources on COVID-19) that were suggested to have an impact on the deterioration of all or any of the psychosomatic state variables (i.e., sleep, physical condition, and mental state) are especially important for the prevention of the physical health. According to an article, the COVID-19 pandemic has spurred the development of health monitoring through wearable devices [40]. The article also reported that the pandemic requires not only individual but also collective behavior change in the community. Therefore, we believe that it is crucial to recognize physical and mental health problems earlier by monitoring health through wearable devices and to approach not only individuals but the whole community. In particular, the odds ratio of

sleep quality was more extensive in the model with the group in which any one of the physical and mental conditions worsened as the dependent variable, as compared to that in which all physical and mental conditions deteriorated as the dependent variable. Thus, it is suggested that sleep quality may have a greater critical impact on the widespread worsening of the psychosomatic states due to COVID-19. A meta-analysis by Alimoradi et al. also showed an association between sleep and psychological distress (depressive and anxiety symptoms) [9]. The limitations of their study included that most papers employed in the meta-analysis were Chinese and Italian and were conducted only among young people. This study's results provided new evidence of an association between sleep and physical and psychological complaints among diverse ages in Japan. From a preventive perspective, treatment and intervention for sleep disorders may be meaningful in improving the deterioration of mental and physical conditions. By using wearable devices, sleep quality can be easily monitored, making it possible to recognize sleep disorders earlier. The early recognition of sleep disturbances can lead to their early treatment and intervention which may eventually help address the deterioration in mental and physical conditions. However, this research's analyses also suggested that various aspects other than sleep may be confounding factors in this deterioration. Therefore, it is essential to note that sleep treatment alone may not be beneficial.

5. Conclusions

In this study, it became clear that the COVID-19 pandemic and the self-restraint lifestyle affected both body and mind; furthermore, sleep, physical condition, and mental state affected each other. Additionally, it was evident that socially vulnerable groups such as women, young people, and those with underlying diseases were more susceptible to the pandemic. Based on these findings, it is necessary to consider appropriate intervention support methods.

The limitations of this study are as follows. It was a web-based survey; hence, those who did not have access to Internet devices were excluded. And people with poor Internet access may be equally affected causing bias. Such people cannot receive appropriate information and support. In addition, this study is a small sample size. Furthermore, all the questionnaires employed in this study were not objective indexes; however, subjective and not validated ones. Nevertheless, health itself is an inherently subjective concept; thus, this survey is certainly meaningful.

Author Contributions

T.F., M.K., and M.Y. designed the study. All authors conducted the survey, analyzed the data, and wrote the paper. All authors read and approved the final manuscript.

Conflict of Interest

The authors declare that they have no conflicts of interest to report regarding the present study.

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Appendix A

Table A1. Comparison of the demographic characteristics of the participants included and excluded in the analysis.

Characteristics	Model 1					Model 2				
	Deterioration in the subjective sleep, physical condition, and mental state group		All unchanged/ good group		*p* value	Deterioration in any one of the following group: Subjective sleep, physical condition, or mental state		All unchanged/ good group		*p* value
	n = 192		n = 1831			n = 741		n = 1831		
	Mean (n)	SD (%)	Mean (n)	SD (%)		Mean (n)	SD (%)	Mean (n)	SD (%)	
Age (in years)	48.7	15.4	53.1	16.7	< 0.001	49.8	16.7	53.1	16.7	<0.001
Number of information collecting ways about COVID-19	3.3	1.5	2.8	1.3	< 0.001	3.2	1.3	2.8	1.3	<0.001
Sex										
Man	71	37	919	50.2	< 0.001	284	38.3	919	50.2	<0.001
Female	121	63	912	49.8		457	61.7	912	49.8	
Age group (in years)										
20-29	30	15.6	215	11.7	0.003	107	14.4	215	11.7	<0.001
30-39	31	16.1	243	13.3		136	18.4	243	13.3	
40-49	34	17.7	326	17.8		130	17.5	326	17.8	
50-59	42	21.9	279	15.2		119	16.1	279	15.2	
60-69	31	16.1	330	18		106	14.3	330	18	
70-79	24	12.5	438	23.9		143	19.3	438	23.9	

Table A1 continued

Japan Region										
Hokkaido (North Island)	8	4.2	66	3.6		32	4.3	66	3.6	
Tohoku (North of Honshu*)	11	5.7	161	8.8		54	7.3	161	8.8	
Kanto (Mideast of Honshu*)	57	29.7	551	30.1		219	29.6	551	30.1	
Chubu (Mid of Honshu*)	24	12.5	336	18.4	0.09	111	15	336	18.4	0.236
Kansai (Midwest of Honshu*)	32	16.7	305	16.7		132	17.8	305	16.7	
Chugoku (West of Honshu*)	18	9.4	114	6.2		53	7.2	114	6.2	
Shikoku (Southwest Island)	13	6.8	73	4		38	5.1	73	4	
Kyusyu (South Island)	29	15.1	225	12.3		102	13.8	225	12.3	
Married	106	55.2	1136	62	0.064	416	56.1	1136	62	0.006
Living										
Alone	32	16.7	299	16.3	0.904	120	16.2	299	16.3	0.933
With children	41	21.4	317	17.3	0.163	147	19.8	317	17.3	0.131
With adults	101	52.6	921	50.3	0.544	374	50.5	921	50.3	0.937
With elderly people (>65 years old)	76	39.6	745	40.7	0.767	314	42.4	745	40.7	0.431
With a medical worker	7	3.6	62	3.4	0.85	20	2.7	62	3.4	0.369
Education										
High school or less	58	30.2	651	35.6	0.14	253	34.1	651	35.6	0.497
College/University/ Graduate university	134	69.8	1180	64.4		488	65.9	1180	64.4	
Job										
Agriculture, Forestry, Fisheries	3	1.6	11	0.6		8	1.1	11	0.6	
Service industry	7	3.6	102	5.6		26	3.5	102	5.6	
Freelance	9	4.7	62	3.4		29	3.9	62	3.4	
Administrative position	10	5.2	97	5.3		28	3.8	97	5.3	
Employee (full-time)	36	18.8	361	19.7		146	19.7	361	19.7	
Civil servant	3	1.6	38	2.1	0.11	11	1.5	38	2.1	0.035
Medical workers	3	1.6	44	2.4		7	0.9	44	2.4	
Students	1	0.5	35	1.9		21	2.8	35	1.9	
Part-time job	26	13.5	214	11.7		98	13.2	214	11.7	
Unemployed/housewife	72	37.5	755	41.2		317	42.8	755	41.2	
Others	22	11.5	112	6.1		50	6.7	112	6.1	
Income before the COVID-19 pandemic (million yen)										
<1.99	29	17.7	171	10.7		79	12.4	171	10.7	
2.00-3.99	44	26.8	500	31.2		168	26.4	500	31.2	
4.00-5.99	36	22	392	24.5		181	28.5	392	24.5	
6.00-7.99	21	12.8	248	15.5	0.13	92	14.5	248	15.5	0.093
8.00-9.99	15	9.1	138	8.6		66	10.4	138	8.6	
10.00-11.99	10	6.1	66	4.1		23	3.6	66	4.1	
12.00<	9	5.5	86	5.4		27	4.2	86	5.4	

Table A1 continued

Decrease of income after the COVID-19 pandemic	17	8.9	68	3.7	< 0.001	50	6.7	68	3.7	<0.001
Having a specific political party affiliation	77	40.1	733	40	0.985	295	39.8	733	40	0.917
Intention of the COVID-19 vaccine										
Yes	139	72.4	1263	69	0.238	546	73.7	1263	69	0.033
No	22	11.5	295	16.1		92	12.4	295	16.1	
Undecided/unknown	31	16.1	273	14.9		103	13.9	273	14.9	
Having the annual influenza vaccine (almost)	90	46.9	788	43	0.307	355	47.9	788	43	0.024
Gathering information from old media: newspaper and television	134	69.8	1373	75	0.116	546	73.7	1373	75	0.492
Good sleep for the past one month	40	20.8	1325	72.4	<0.001	318	42.9	1325	72.4	<0.001
Pre-existing diseases (pulmonary diseases, heart diseases, diabetes, severe obesity, chronic renal failure, liver disease, and immunodeficiency)	39	20.3	289	15.8	0.105	126	17	289	15.8	0.446
Smoking	31	16.1	266	14.5	0.547	111	15	266	14.5	0.769
Pregnant	3	1.6	17	0.9	0.398	16	2.2	17	0.9	0.012

Note: Abbreviation: SD, standard deviation.

*Honshu: Main and Biggest Island of Japan.

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EDITORIAL

Cognitive Advancements across the Globe: Intelligence Research and Piagetian Psychology in Comparison

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1. Two approaches to studying intelligence and cognition

It is widely accepted that there are two main approaches to studying "intelligence" and "cognition", psychometric intelligence research and Piagetian developmental psychology. While the psychometric approach measures intelligence without having a true theory of intelligence, ascribing different scores to test persons according to their respective mastering of tests, thus measuring abilities regarding abstractive and logical capabilities, the Piagetian approach comprises a complete theory of human development, a comprehensive theory of stage developments from infancy over adolescence to adulthood, including a detailed description of the development of psyche, consciousness, personality, and understanding of logic, physics, social affairs, law, religion, politics, morals, and arts. While intelligence research gages and assigns numbers (the average number is 100) to test persons, the Piagetian approach identifies their test person's belonging to certain developmental stages.

2. Historical advancements in intelligence

Some scholars of both approaches have recognized already early that people's performance on tests depends on historical, social, and cultural conditions. Test performance is not simply a biological phenomenon but is germane to divergent social settings and environmental influences. Especially the immigration office at Ellis Island, New York, recognized huge ethnic differences concerning IQ, when administering intelligence tests to immigrating people, already very early in the 20th century. Immigrants from Asia or from Eastern and Southern Europe scored much weaker than those coming from Western and Northern Europe. Later on, it was found

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that already the first generation born in the USA, descending from the Eastern and Southern Europeans, tended to achieve the same scores as those descending from Western and Northern Europeans [1]. Chinese and Japanese living in the US scored likewise weaker than the Whites during the 1960s and 1970s, while since the 1980s Americans from these groups usually have been scoring better than Americans with European background [2].

It was a general discovery that ethnicities living in traditional, preindustrial, or premodern societies score lower than ethnicities of industrial and modern societies. This result was confirmed right across the whole world irrespective of race, culture, and region. People living in developing nations scored weakly in comparison to people raised in modern, industrial societies. Whenever agrarian societies changed to industrial societies, their national intelligence increased over time. Whenever people from developing nations or traditional societies immigrated to modern, industrial societies, their children, exposed to modern environments, surpassed scores of their parents, coming close to scores prevailing in the new environment [3,4].

As intelligence research had almost forgotten this cultural context of intelligence development, James Flynn surprised the research community with something they should and could have known for long. He showed that industrial nations such as those of Europe but also the USA, Russia and Japan had increased their scores by about 25 points in the time span from about 1914 to about 1980. The increase in school education, job enrichment, and cultural modernization were discovered as the main factors in climbing intelligence scores. Accordingly, it was found that modernization and industrialization in developing nations were likewise accompanied by rising scores. The vaunted Flynn effect is, more or less, a worldwide phenomenon, with from time to time changing forerunners and backbenchers. On the whole, racial-biological factors play obviously no part, while culture and environment shape the intelligence level of people decisively.

3. Historical advancements in stage development

Flynn was insecure about whether these test results take root in conventions or real intelligence differences over decades. As he met with my Piagetian research, he finally found that neither measurement problems nor conventions but real differences in intelligence account for the divergent scores [3]. Child or developmental psychologists knew from the beginning of their discipline that stages typical for children may be shared by adults living in the past or in premodern respectively traditional societies. H. Werner wrote in 1926 the first great monograph to show the resemblances and C. Hallpike [5] wrote the second important one, albeit the hint at these correspondences was omnipresent in literature beforehand.

Jean Piaget delved into this tradition and became a child psychologist in order to find a tool to reconstruct the history of mind, culture, philosophy, and sciences. He described parallels between ancients and children concerning a wide range of psychological patterns, however mostly dispersed and interlaced in some short sections of his books only. Only his book on the history of sciences was completely devoted to the description of the parallels [6]. Nonetheless, Piaget swayed between a biological clock work model and a historical model of his stage theory during his lifetime. His position related was unequivocally contradictious. Accordingly, he never understood the relevance and the findings of that branch of research that has been called Piagetian Cross-Cultural Psychology.

This branch conducted empirical research right across continents, cultures, and milieus, carrying out thousands of surveys during the past 80 years. It evidenced that assumption the founders of child psychology had already imputed in the 19th century. People living in premodern or traditional societies stay on the preoperational or concrete-operational stage, and do not develop the stage of formal operations that teenagers living in modern, industrial societies attain during the second decade of life. This

result comprises an understanding of logic, physics, social affairs, law, morals, etc. It was likewise shown that not hereditary but educational and cultural factors account for these differences. People from whichever origin can attain the formal operational stage when exposed to modern education and culture early in life, while people of premodern culture, from whichever race or region, do usually not surmount the preoperational or concrete operational stages [7,4,8].

4. Conclusions

Intelligence scores below 75 exhibit the same "developmental age" or "intelligence age" as stages below the formal operational stage. Conversely, higher intelligence scores match the formal operational stage. Piagetian psychology and intelligence research have come to conclusions that support each other. It becomes now possible to accomplish the task Piaget had envisaged all his lifetime but has only groped for. There does not exist any better scientific tool to reconstruct the history of humankind than that stage theory provides. Accordingly, S. Gablik has reconstructed the history of the fine arts by using stage theory, D. LePan the history of British literature, C. Radding the history of the Middle Ages, L. Ibarra the history of Pre-Columbian cultures in America, C. Hallpike the history of morals, and Oesterdiekhoff the history of society, worldview, mind, logic, sciences, philosophy, morals, politics, law, and arts (references also concerning the other authors mentioned to find in Oesterdiekhoff.

Conflict of Interests

There are no conflicts to report.

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ARTICLE

Social Determinants of Social Zapping: Exploring Predictors of Planned Scheduled Social Events with Others

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ABSTRACT

Social zapping has gained popularity as a term that refers to canceling plans or appointments at the last minute to attend other, supposedly more appealing events. This behavior resembles rapidly switching channels on a television, as individuals frequently jump between different social engagements. The present study examined potential behavioral trait predictors of social zapping, such as belongingness, self-esteem, sense of control, and meaningful existence among community residents ranging from 40 to 75 years of age (n = 48). The study utilized *simple linear regressions* to identify potential predictors of social zapping, exploring how the four fundamental needs (belongingness, self-esteem, sense of control, and meaningful existence) might be linked. Results indicated that belongingness and self-esteem are significant predictors of social zapping tendencies. Additionally, an *independent samples t-test* was conducted to determine the relationship both older and younger adults have with the four fundamental needs as well as the role age plays in social zapping tendencies. Older adults exhibited a significant and more positive association with self-esteem, sense of control, and meaningful existence compared to individuals aged 39 and younger. Social zapping frequency was nonsignificant for both older adults and younger adults. Furthermore, a separate set of *linear regression analyses* were completed to determine how social desirability affects social zapping across age groups. Social desirability significantly predicted both self-esteem and meaningful existence. Overall, the present study builds on what is currently a new phenomenon in research and will provide new information on the relationship between age, social zapping, and behavioral traits.

Keywords: Social zapping; Four fundamental needs; Communicating online; Older adult populations; Social desirability

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1. Introduction

As Generation Z transitions into adulthood, social media has become their primary method of communication and relationship-building [1]. There is no shortage of electronic use to perform everyday tasks that normally would be carried out in person, and this abundance of technology has only been amplified during the time of the COVID-19 pandemic [2]. Current research has explored the relationship between social media habits and personality traits among Generation Z [3]. However, little is known about social zapping tendencies in middle-aged to older adults, a significant portion of the population using social media [4]. Our study examined the predictors of social media-related behaviors in a community sample of adults aged 40-75.

1.1 Social zapping: Defined, but minimally assessed

Limited research exists on social zapping and its predictive behavioral constructs. Müller et al. [3] defined social zapping as canceling or switching plans with others through instant messaging at the last minute. Their work linked social zapping to personality traits such as narcissism and Machiavellianism in the "Dark Triad" [5]. However, research on social zapping in middle-aged and older adults is nonexistent. Findings from Pew Research Center [4] provide evidence that older adults' (65+) social media usage jumped from 3% in 2005 to 45% in 2021. This subgroup is not the only set of older adults to experience a significant rise in social media usage; participants aged 50-64 displayed a nearly 70% increase in social media usage in those same years [4]. With social media usage on the rise among populations of older adults, there should be more research dedicated to exploring a larger age range of adults' social zapping habits. Knowledge on underlying personality factors in the context of a different generation pushes for a more representative and inclusive understanding of social zapping.

1.2 Four core social psychological constructs

Previous research on social zapping focused on negative traits such as the "Dark Triad", (i.e., narcissism, Machiavellianism, and psychopathy) without considering positive or neutral traits [5]. *Belongingness*, *self-esteem*, *desire for control,* and *meaningful existence* are all components worth examining to determine the behavioral characteristics held by social zappers, and they provide a new perspective on traits more applicable to the general population. Each of these social behavior concepts will be examined and reflected to a person's tendency for social zapping.

Belongingness: A root aspect of social zapping

Belongingness, encompassing companionship, affiliation, and connectedness, is crucial for promoting social bonds and reducing feelings of isolation [6]. Individuals who experience exclusion or rejection may feel a lack of belongingness, leading to depressive symptoms and increased social isolation [6]. As social zapping involves canceling plans, it may be associated with low belongingness and depressive symptoms. Older adults, in particular, show an association between low belongingness and depression, which further contributes to feelings of loneliness and social isolation. Thus, this study predicts an inverse correlation between belongingness and social zapping in older adults.

Self-esteem: An emotional connection to social zapping

Research suggests that self-esteem, along with a sense of belonging, may play a significant role in predicting social zapping tendencies. Self-esteem is defined as the satisfaction one feels toward oneself, influenced by the distance between self-image and ideal self [7]. Because the research on social zapping is slim, it may be helpful to view self-esteem regarding Müller and colleagues' [5] paper connecting "Dark Triad" traits and social zapping. The study revealed that individuals exhibiting Machiavellianism and narcissism were more likely to engage in social zapping, while psychopathy showed a weaker but still significant correlation. Further research into "Dark Triad" traits and self-esteem found that there is a significant, inverse relationship between the two. Based on this foundation, exploring the link between self-esteem and "Dark Triad" traits may help develop hypotheses regarding social zapping.

Pathological narcissism, obstructing personality development, is associated with an inability to regulate self-esteem and self-cohesion [8]. Previous studies have found a negative correlation between narcissism and self-esteem, and since Müller et al. [5] established a correlation between narcissism and social zapping, it can be inferred that low self-esteem, indicating high narcissism, leads to increased social zapping.

Psychopathy, characterized by low empathy and emotional control, has two types: Factor 1 and Factor 2 [9,10]. Factor 2 psychopathy, involving impulsive behaviors and risk-taking, has been linked to low self-esteem and aggression [10]. Considering that impulsive individuals engage in social zapping more frequently, the evidence suggests that low self-esteem, an indicator of Factor 2 psychopathy, leads to higher levels of social zapping.

Machiavellianism, the use of manipulation and cunningness to gain power, is negatively correlated with self-esteem [11]. Given the significant correlation between Machiavellianism and social zapping, along with the negative correlation between self-esteem and Machiavellianism, it can be inferred that low self-esteem is associated with Machiavellianism and, consequently, higher levels of social zapping.

Furthermore, "Dark Triad" traits are more prevalent among adolescents than older adults [12,13]. However, as self-esteem tends to increase throughout adulthood and peaks around age 60, older adults may have higher self-esteem and lower "Dark Triad" traits [14]. Consequently, the current study expected that higher self-esteem among older adults would predict lower levels of social zapping, and vice versa.

Sense of control: Social zapping as a conscious choice

Sense of control refers to one's ability to make choices, take responsibility, and maintain consistency in their actions [15]. It is associated with personal beliefs and decision-making, facilitating the pursuit of desired life events [16]. Sense of control is linked to emotional well-being and perceived social support, both negatively correlated with depression. Considering the connection between depressive symptoms, isolation, and social zapping, it is hypothesized that self-control would also be negatively correlated with social zapping. Older adults, who experience increased isolation and reduced belongingness, may exhibit higher levels of social zapping when they have a lower sense of control [17]. Therefore, in this study, it was anticipated that a diminished sense of control would predict a greater tendency for social zapping among older adults.

Meaningful existence: An overall worldview related to social zapping

Meaningful existence, defined as a sense of value and life purpose, plays a crucial role in distinguishing humans from animals by providing a sense of efficacy and purpose [18,19]. Self-esteem acts as a quasi-buffer for achieving meaningful existence by bridging the gap between the perceived self and the ideal self. Research suggests a positive correlation between meaningful existence, well-being, and self-esteem [20,21]. Furthermore, low well-being is associated with an increased risk of depression and isolation, which may contribute to higher levels of social zapping [22]. Considering the link between self-esteem, meaningful existence, and social zapping, it is expected that low meaningful existence would lead to higher levels of social zapping. Older adults tend to experience higher levels of meaningful existence, and thus, meaningful existence may serve as a predictor of lower social zapping among this age group [23]. By considering the relationship between self-esteem and meaningful existence, we can gain insights into the connection between meaningful existence and social zapping.

1.3 The present study

The literature regarding social zapping is scarce, with only two known published articles [3,5]. Both of these published studies included university students and young emerging adults. Although there is research to support a link with each of the core social psychological variables discussed, no known study assessed their link connecting to social zapping, especially with older adults from community samples.

It is proposed that understanding the fundamental social factors linked to social zapping will provide important information about the concept of social zapping.

Therefore, the present study assessed Therefore, the present study examined the interplay between social zapping and the four social constructs (*belongingness, control, self-esteem, and meaningful existence*) within a community sample. Utilizing existing data on older adults is proposed to assess predictors of social zapping through reliable and valid self-report measures. We used existing (archival) data collected online from a community sample of older adults (through Prolific Academic) including all four behavioral social psychological core variables (i.e., belongingness, control, self-esteem, and meaningful existence), as well as measures on social zapping and social desirability (to control for social appearance tendencies), with each construct measured through reliable and valid Likert-type psychometric scales.

2. Method

2.1 Participants

Data for both proposed studies were collected from a U.S. adult sample of 315 participants (D. Patel, June 2021). To have a complete data set, responses from 18 individuals were removed who did not complete all measures, leaving a final total sample size of 297 participants. The sample was then split into two age groups, older adults (n = 48; aged 40-75) and younger adults (n = 249; aged 18-39). This population consisted of approximately 46% females (n = 138) and 49% males (n = 147). The mean age of participants was 30.9 years old (SD = 10.88). The majority of participants, 68.6%, self-identified as White/Caucasian (n = 216), 13.7% of participants identified as Asian or Pacific Islander (n = 43), 9.8% as Black or African American (n = 31), 8.6% as Hispanic/Latinx (n = 27), 0.9% as American Indian or Alaskan Native, and less than 1% (n = 1) identified as Middle Eastern or Northern African. Most participants held a Bachelor's Degree (n = 112, 35.6%), while 17.8% held a Master's Degree (n = 56), and 17.8% attended some college (n = 56). Participants primarily claimed to be single (n = 143, 45.4%) or married (n = 98, 31.1%).

2.2 Psychometric scales

Various psychometric scales were used to measure different constructs in the study. The *Need to Belong Scale* developed by Leary et al. [24] assessed participants' integration within their environment, showing strong internal consistency (α = 0.81). The *Self-Esteem Scale* by Rosenberg [25] measured positive and negative feelings about self-worth, demonstrating strong reliability (α = 0.81). The *Desire for Control Scale* by Burger and Cooper [26] evaluated the urge to control events, with good internal consistency (α = 0.80). The *Meaning in Life Questionnaire* by Steger et al. [27] measured identification with life's purpose, displaying strong internal consistency (α = 0.86). To assess social desirability, Reynolds's [28] shortened version of the *Marlowe-Crowne Social Desirability Scale* (α = 0.76) was used. Social zapping tendencies were measured using Müller et al.'s [3] Social Zapping Scale (α = 0.77). Demographic information, including gender, age, relationship status, education level, ethnicity, and state of residence, was also collected.

2.3 Procedure

An adult data sample was collected for 4 days during June of 2021, using an online survey through Prolific Academic, an online crowd source program where participants are paid for their time. Previous research indicated that the use of this source program is reliable and valid [29]. Participants were asked to complete a consent form prior to moving on in the survey. Participants were paid US $3.50 for approximately 30-40 minutes of time. Those individuals who did not meet the eligibility criteria were prompted out. The body of the survey contained four blocks: One block was qualitative, asking for thoughts and actions on clutter behavior; three other blocks contained the psychometric scales discussed above for a set of quantitative measures. All measures were pre-

sented in counterbalanced order, to control fatigue effects, and took most participants 30 minutes or less to complete. The payment was provided online after all survey items were completed. The fifth and last block included demographic questions such as age, gender, relationship status, highest education completed, ethnicity, and residing state.

3. Results

3.1 Preliminary analyses

Table 1 provides descriptive statistics for the measures used in the present study. The zero-order correlation matrix, the mean sum scores, and their standard deviations for all study variables are presented in **Table 1**. As noted from the table, social desirability was found to be significantly, and positively correlated at the 0.01 level with self-esteem and meaningful existence. Meaningful existence and control were also significantly, positively correlated at the 0.01 level. In contrast with the current literature, self-esteem and belongingness were negatively correlated, significant at the 0.01 level.

3.2 Primary analyses

Hypothesis I – Individuals displaying a low sense of any four of the fundamental needs (belongingness, sense of control, self-esteem, and meaningful existence) would predict higher social zapping tendencies.

Table 1. Mean sum scores and zero order correlations between all self-reported variables.

Variable	*M*	1	2	3	4	5	6
1. Belonging	27.67 (7.07)	[0.813]					
2. Self-esteem	30.36 (6.30)	–0.434**	[0.920]				
3. Control	46.46 (5.40)	–0.175	0.302*	[0.195]			
4. Meaning	47.40 (8.50)	–0.193	0.639**	0.472**	[0.685]		
5. Social Desirability	18.90 (1.70)	–0.236	0.465**	0.194	0.394**	[–0.038]	
6. Social Zapping	12.74 (5.41)	0.329*	–0.282	–0.135	0.028	–0.234	[0.810]

$n = 297$, *$p < 0.05$, **$p < 0.01$

Note: Values in parentheses are standard deviation and values in brackets are coefficient alpha.

To evaluate the first hypothesis, four *linear regression analyses* were conducted using belongingness, sense of control, self-esteem, and meaningful existence as four separate predictor variables and social zapping as the outcome variable. Simple linear regression was used to test if any one of the four predictor variables significantly predicted social zapping. The results indicated that the regression was significant for belonging, $\beta = 0.329$, $p = 0.029$, while self-esteem approached significance, $\beta = –0.241$, $p = 0.057$. The fitted regression model for sense of belonging was social zapping score = 6.389 + 0.227*(belonging). Self-esteem scores accounted for 8.0% of the variance in social zapping ($R^2 = 0.080$, $F(1, 42) = 3.809$, $p = 0.029$), and belonging accounted for 10.8% of the variance in social zapping ($R^2 = 0.108$, $F(1, 44) = 5.106$, $p = 0.057$). Meaningful existence was not significant, $\beta = 0.028$, $p = 0.852$, nor was control, $\beta = –0.135$, $p = 0.365$.

Results indicated that belongingness and self-esteem were significant predictors for social zapping. Belongingness was found to be the strongest predictor of social zapping. Control and meaningful existence were not found to be significant predictors of

social zapping.

Hypothesis II – Older adults take part in social zapping tendencies less than younger participants (aged 39 and younger) because of their more positive relationship with belongingness, sense of control, self-esteem, and meaningful existence.

To evaluate the second hypothesis, an *independent samples t-test* was conducted to determine whether older adults had a better relationship with belongingness, sense of control, self-esteem, and meaningful existence than that of younger adults in the sample. The difference in belonging between older adults (M = 27.67, SD = 7.07) and younger adults (M = 30.76, SD = 7.50) was significant, t (275) = –2.554; p = 0.011. Cohen's d indicated a medium effect size (d = 0.42). The difference in self-esteem between older adults (M = 30.36, SD = 6.30) and younger adults (M = 27.48, SD = 6.51) was significant as well, t (282) = 2.785; p = 0.003. Again, Cohen's d indicated a medium effect size (d = –0.45) Further, a sense of control between older adults (M = 46.46, SD = 5.39) and younger adults (M = 42.84, SD = 6.21) was significantly different, t (288) = 3.761; p < 0.001. A medium effect size was found for a sense of control (d = –0.59). Finally, meaningful existence between older adults (M = 23.66, SD = 8.25) and younger adults (M = 20.94, SD = 8.03) was significantly different, t (292) = 2.122; p = 0.017. A small effect size was found for meaningful existence (d = –0.34).

Results indicated that the older adult sample did have higher levels of self-esteem, sense of control, and meaningful existence than the younger adult sample. However, older adults did display a lower sense of belongingness than participants in the younger adult sample. The same independent samples t-test found that social zapping was nonsignificant (p = 0.159) for both older adults and younger adults. **Table 2** presents the statistical results.

Table 2. Mean sum scores between older and younger adult participants with independent samples t-tests.

Measure	**Older adults (n = 48)**		**Younger adults (n = 249)**		
	M	*SD*	*M*	*SD*	
Belonging	27.67	7.07	30.76	7.50	0.011*
Self-esteem	30.36	6.30	27.48	6.51	0.003**
Control	46.46	5.39	42.84	6.21	0.001**
Meaning	23.66	8.25	20.94	8.03	0.017**

n = 297, $^{**}p < 0.01$, $^{*}p < 0.05$.

1) How does social desirability affect social zapping tendencies in middle- to older-aged adults and what is its relationship with the four fundamental needs?

To evaluate the first research question, five additional *simple linear regression* analyses were conducted using social desirability as the predictor variable and social zapping, belongingness, self-esteem, sense of control, and meaningful existence as the outcome variables. Simple linear regression was used to determine if social desirability significantly predicted any of the four fundamental needs and/or social zapping tendencies. The results indicated that the regression was significant for self-esteem, β = 0.465, p = 0.001, and for meaningful existence, β = 0.394, p = 0.006. The fitted regression model for social desirability and self-esteem was self-esteem = –2.512 + 1.736*(social desirability). The fitted regression model for social desirability and meaningful existence was meaningful existence = –13.547 + 1.976*(meaningful existence). Social desirability scores accounted for 21.6% of the variance in self-esteem (R^2 = 0.216, F(1, 45) = 12.383, p = 0.001), and accounted for 15.5% of the variance in meaningful existence (R^2 = 0.155, F(1, 45) =8.282, p = 0.006). Belonging was not significant, β = –0.236, p = 0.118, nor was control, β = 0.194, p = 0.186. Social desirability was not found to be a predictor of social zapping, β = –0.741, p = 0.114.

Results indicated that social desirability was a significant predictor of self-esteem and meaningful existence. Participants scoring high in social desir-

ability scored lower for both self-esteem and meaningful existence. Social desirability was not found to be a significant predictor of belonging, control, or social zapping.

2) Is there a perceived difference in social zapping levels between age groups (middle- to older-aged adults and younger adults)?

To evaluate the second research question, a *Mann-Whitney U* test was performed to evaluate whether perceived difference in social zapping levels differed by age (younger adults and older adults). The results indicated that there was no significant difference between the perceived difference in social zapping levels of younger adults vs older adults, $z = -1.479$, $p = 0.139$.

4. Discussion

The first hypothesis predicted that scoring low on any of the four behavioral traits (sense of belonging, self-esteem, sense of control, and meaningful existence) would predict higher social zapping scores. This hypothesis was significant only for belongingness. While self-esteem was approaching significance as a predictor of social zapping, it was negatively correlated, meaning individuals who felt a high sense of self-esteem engaged in less social zapping. Belongingness was found to be the strongest predictor of social zapping among the four characteristics. Participants who scored high in belongingness also displayed higher social zapping scores. These results are in line with the current literature, Müller et al. [3] found low self-esteem to be linked with "maximizing in selecting friends", a similar process to social zapping. A high sense of belonging promotes the need to seek out relationships and inclusion which provides individuals with multiple sources of activities and plans [30]. It may not be uncommon to agree to a couple of different plans in order to ensure that one has something to do, thus raising the rate of social zapping when they end up cancelling the plans they do not attend. It is important to note that the relationship between self-esteem and belonging was found to be negatively correlated in this study, going against the current literature on the relationship between these two traits [31-33]. Although belonging and self-esteem are almost always seen as having a positive relationship with one another, the distinct difference of using an older adult community sample may have changed the norm. Older adults are commonly known to have self-esteem that peaks around the age 60, the age of most of our sample, but older adults also report lower levels of belongingness [34,35]. This may account for the difference in correlation found at the beginning of the study.

The second hypothesis determines the difference in social zapping tendencies between younger and older adults through their relationship with the four behavioral characteristics (belongingness, self-esteem, sense of control, and meaningful existence). Social zapping tendencies were not found to be statistically significant among older and younger adults, however, the study still found that older adults had a higher level of self-esteem, meaningful existence, and sense of control than younger adults. Younger adults experienced higher belongingness than older adults, contributing further evidence to the current literature [36].

The first research question examined the relationship between social desirability and the four fundamental needs alongside social zapping. Social desirability was not found to be a predictor of social zapping; however, it was found to be a significant predictor of both meaningful existence and self-esteem. It should be noted that self-esteem had a significant relationship in nearly all of the hypotheses and research questions it was included in. Results indicated that self-esteem is deemed as a primary indicator of social zapping, a significant outcome of social desirability, and was determined to play a significant role in both older and younger adults (older adults had higher self-esteem). These findings support the current literature surrounding self-esteem and the critical role it serves among nearly every demographic group [37-40].

The second research question examined perceived differences in social zapping levels between young adult participants (aged 39 and younger) and older adult participants (aged 40 to 75). Although the

results did not show a significant difference, future research should take a more thorough look at the relationship between age and social zapping. Given the presence of social media and technology in all age groups, it would be beneficial to compare and contrast predictors of social zapping across age.

5. Conclusions

5.1 Social implications

Because there is little published research focused on social zapping [3,5], any new research determining the social implications seems warranted. The results in the current study suggested that there are behavioral traits that might predict social zapping tendencies; however, chronological age does not seem to be such a factor. Müller and colleagues' [3] research suggested that there are "negative" behavioral traits, such as the "Dark Triad", associated with social zapping. The current study explored both "positive" or "neutral" self-reported traits, such as self-esteem and sense of belonging. These variables add to a wider array of behavioral traits to the literature. Consequently, there is now evidence that certain personality traits are linked with social zapping and that these are not necessarily fixed traits.

One may experience more social zapping throughout various points in their lifetime, because of the variation in self-esteem and belongingness. Given that there is minimal research exploring social zapping tendencies, it is difficult to determine implications surrounding relationships, sense of self, perceived isolation, emotion disorders, etc. when an individual is partaking in social zapping. It is challenging to say that programs and treatment plans aimed at raising self-esteem and belongingness should be created to lower social zapping tendencies given the inverse relationship between belonging and social zapping. Further research should target more potential predictors of social zapping to gain a clearer understanding of how to limit social zapping.

5.2 Limitations of the current study

Of course, the current study is not without limitations, especially considering the novelty of research on social zapping. Both the control scale and the social desirability scales had low coefficient alphas, and our sample size used was too low. With only 48 participants, it is difficult to determine if this study is applicable to the general population (of both older adults and younger adults). Social zapping may have been significant for either population, and a larger participant pool was included. In addition, it is difficult to provide context for social zapping given there was little research done prior to this study.

Also, all data were collected during the COVID-19 pandemic and may not be representative of social zapping happening outside of the pandemic. Given how fearful the population was to interact with one another in person, social zapping may have occurred because individuals did not want to contract the virus. High levels of isolation may have also played a role in social zapping as individuals sought community and attempted to maintain relationships but were hesitant to meet up.

5.3 Future directions for research

Despite the limitations from the present exploratory study, there is no limit to the amount of future research that is possible on social zapping. Until the current study, research was only on potential behavioral traits influencing social zapping tendencies [3,5]. Future research might explore other predictors of social zapping, including personality factors associated with social zapping behavior not listed in the current literature. Future research also might examine the effects social zapping has on relationships and individuals partaking in it. Additionally, circumstances and environments prompting the use of social zapping tendencies should be studied. For example, it might be interesting to determine the relationship between COVID-19 and social zapping, as well as the relationship between social zapping and online spaces.

Social zapping is an underrepresented and underdeveloped concept that is now impacting people of all ages. The present study details the importance of determining predictors leading to social zapping, including the four fundamental needs (belongingness, self-esteem, sense of control, and meaningful existence). Additionally, the present study offers a look into how age plays a role in social zapping, and how technology is utilized across all age groups. Continuing with this research could potentially lead to a better understanding of behavior and provide insight as to how individuals can better their lives through communication and time spent with loved ones.

Conflict of Interest

There is no conflict of interest.

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