Original article

Work Environment and Depressive Symptoms of Webtoon Writers

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ABSTRACT

Background: Webtoon, a digital form of comics created in the Republic of Korea, has spread widely with advantages that anyone can become a cartoonist and that autonomy of creation is guaranteed. The purpose of this study is to identify the working conditions of webtoon writers and analyze the relationship between these conditions and depressive symptoms.
Methods: A survey was carried out on webtoon writers and a survey data of 312 webtoon writers were analyzed. The questionnaire included basic socio-demographic characteristics, webtoon writers' contractual type, fields of activity (webtoon creator, story writer, illustrator), and working environment (labor discretion etc.). We investigated depressive symptoms and analyzed its relation to the work environment of webtoon writers.
Results: Webtoon writers were exposed to long working hours, high labor intensity, limited labor discretion, negative comments from readers, and had a high prevalence of depressive symptoms. Compared to story writers who contracted directly with platforms, story writers and the illustrators who contracted with content providers (CPs) were 9.51 times (OR = 9.51, 95% CI = 1.47 - 61.33) and 6.47 times (OR = 6.47, 95% CI = 1.08 − 38.75) more likely to have depressive symptoms, respectively.
Conclusions: This study emphasizes the urgent necessity to improve the overall working environment in the webtoon industry and implement measures to tackle the escalating mental health challenges faced by illustrators and story writers contracted with CPs, especially given the increasing popularity of novel comics.

1. Introduction

Originally, the term "Comics" referred to "printed comics" in the form of publications. However, with the widespread use of computers and the advent of the Internet, a new digital form of cartoons, known as "internet comics," emerged. One notable subtype, "webtoon," is a compound of "web" and "cartoon," representing a distinct style of comics tailored to the unique characteristics of the Internet. Coined in the Republic of Korea [1], webtoons initially gained popularity in the late 1990s as general internet users and amateur webtoon writers released them freely to the public through individual homepages or blogs. Recognizing the potential, major Internet portal companies began commercializing webtoons to drive substantial traffic and generate indirect revenue through advertising fees [2]. In this evolution, portal companies established dedicated spaces for webtoon writers and offered diverse content, laying the foundation for the growth of webtoon platforms [3]. In the early days of the webtoon industry, the process that granted

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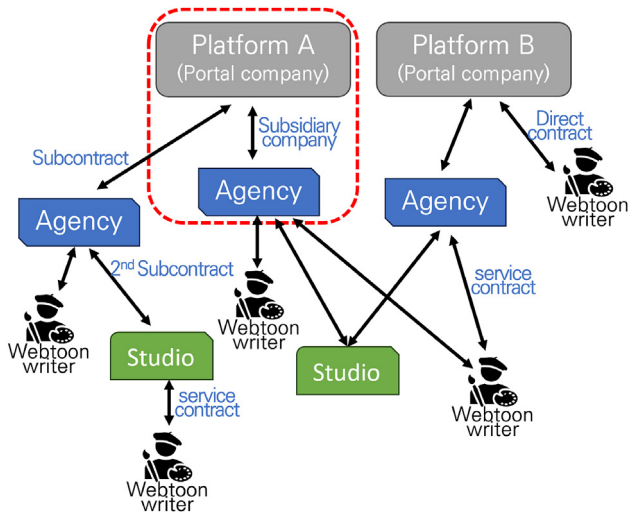E-mail address: cyclor@catholic.ac.kr (H.-R. Kim).

Fig. 1. Webtoon industry subcontracting structure.

individual autonomy was perceived as an advantage, differing from the collective approach of the traditional comic industry, which involved writers, assistants, and managers working collaboratively. However, as the webtoon industry expanded, collective relationships evolved into a structure distinct from the traditional comic industry, forming a portal platform with a company-intermediary company (agencies, studios)-user (customer)-supplier (webtoon writers) relationship [4]. Originally, studios functioned as collaborations among webtoon writers, and agencies served as intermediaries between webtoon writers and platforms. Over time, they transformed into subcontractors and intermediaries for large platforms (Fig. 1) [5]. The Korea Creative Content Agency's "Webtoon Business Survey" in 2022 categorized all webtoon businesses, excluding platforms, as content providers (CPs). The number of CPs supplying works to Republic of Korea's monopolistic platforms has tripled or quadrupled in the past four years [6]. The proliferation of CPs is linked to the novel comics boom, a term coined in Republic of Korea for webtoons based on web novels. Among the webtoons produced in 2021, 67.2% were purely creative for platforms, while CPs contributed to 31.9% [6]. CPs seek works among web novels, sign contracts, recruit webtoon writers, produce novel comics, and upload them to platforms. The expansion of the novel comics production model has led to increased demand for low-skilled workers, transforming the industry into more of a mass production enterprise than an original creation process. As webtoon production becomes increasingly platform-based and multi-level subcontracting, webtoon writers find themselves in a subordinate position with heightened labor intensity.

While previous studies on mental health in digital platform labor have primarily focused on locally based forms of labor, such as transportation, delivery, and housekeeping services, webtoon writers engaged in web-based platform labor also face mental stress due to extended working hours, isolation, financial instability, and criticism in the comment sections [7]. However, research on the relationship between the working environment of webtoon writers and health problems is lacking. Health effects may vary depending on whether the contractor is the original platform or a subcontractor, such as an agency or studio. Moreover, concerns exist that working conditions, environment, and health effects may differ for webtoon creators, story writers, or illustrators. This study aims to identify the working conditions of webtoon writers and analyze the relationship between these conditions and depressive symptoms.

2. Materials and methods

2.1. Study subjects

Study subjects were those who had an income of 500,000 won (KRW) or more per year as a webtoon writer for the past year at the time of the survey. Recruitment of research subjects was done through cooperation of labor union and the writer's communities. The survey was conducted online. The survey period was about 3 weeks from June 15 to July 8, 2022. Of 320 people who voluntarily responded to the survey, 8 people were excluded due to incomplete responses. Finally, we analyzed 312 people.

2.2. Measurements

The questionnaire included basic socio-demographic characteristics, fields of activity, career and working environment. It also included health behaviors, health, and disease states (including mental health). Regarding work characteristics, weekly working hours were analyzed by dividing them into 40 hours or less, 41 to 52 hours, 53 to 60 hours, and 61 hours or more. Income was queried about "total annual income for the last year" and analyzed by dividing it into less than 24 million won, more than 24 million won to less than 36 million won, more than 36 million won to less than 48 million won, and more than 48 million won. The period of working in webtoon business was divided into 2 years or less, 3~4 years, 5~6 years, and 7 years or more. The activities of webtoon writers are divided into three categories (Fig. 2). A story writer is a writer who creates webtoon stories or adapts web novels. An illustrator is a writer who does line drawing, coloring, and background work for webtoons. Sometimes, a single writer handles everything from story to drawing for a webtoon work. Such writers are referred to as webtoon creators in this study. Since each webtoon writer had a different role for each work, we asked them questions about the main field of activity. Among various contract types, direct contracts involve a direct agreement with major portal platforms in the Republic of Korea. On the other hand, indirect contracts occur when a webtoon writer collaborates with a portal platform through intermediaries known as content providers (CPs), such as studios or agencies. It's important to note that webtoons can only be published on these major portals, and writers who opt for indirect contracts through CPs may be subject to a double contract fee. "Number of cuts" refers to the number of cuts visible on the monitor. An "episode" is a single episode that contains a
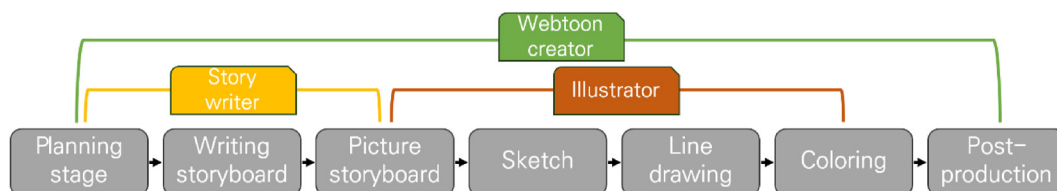

Fig. 2. Webtoon production process.

specific number of cuts. The number of cuts required per episode was divided into 50 cuts or less, 51−60 cuts, 61−70 cuts, 71−80 cuts, and 81 or more cuts. We inquired about labor discretion by posing the following questions: Can you take a vacation when you want? Do you have the authority to adjust the number of cuts as needed? Can you determine the serialization frequency on your own terms? The survey was divided into the following three parts: The right to pause (rest authorization), the right to adjust the number of cuts (cut authorization), and the right to adjust the serialization period (serial period authorization). Respondents were given the options of "always," "most of the time," "sometimes," "rarely," and "never" for each category. Labor intensity was measured using the Borg scale, where respondents were asked to select a number between 6 and 20 to indicate how hard their job was on a typical day: "Very comfortable" (6 points), "weak" (8 points), "moderate" (10 points), and "slightly hard" (12 points), "hard" (13 points), "a lot hard" (15 points), "very hard" (17 points), "maximally hard" (20 points).

In the mental health-related questionnaire, we used the Patient Health Questionnaire-9 (PHQ-9), which is a depression screening tool. It is a self-report test designed to simply screen for depression and assess its severity. PHQ is a tool reported by Spitzer et al. [8]. PHQ-9 consists of 9 items corresponding to criteria for major depressive episodes in the Diagnostic and Statistical Manual of Mental Disorders, fourth edition. Each item is answered by a frequency scale, such as "not at all" (0 points), "many days" (1 point), "more than a week" (2 points), or "almost every day" (3 points) in the past 2 weeks. The sum of scores ranges from 0 to 27, with 0 to 4 categorized as not depressed, 5 to 9 as mildly depressed, 10 to 14 as moderately depressed, 15 to 19 as moderately depressed, and 20 to 27 as highly depressed [9]. Lee et al. [10] have reported that a total score of 5 or 6 or more, depending on the purpose of PHQ-9 use, could be selected as a depressive disorder, and that a score of 10 or more is highly likely to correspond to major depressive disorder. In this study, a PHQ-9 total score of 0 to 9 was considered to barely have depressive symptoms. Those with a score of 10 or more were considered to have depressive symptoms. We inquired about the influence of comments from readers by posing the following questions: To what extent are you influenced by comments from readers? Respondents were given the options of "It doesn't affect me at all," "It bothers me somewhat," "It bothers me a lot," "It bothers me to the point of anxiety," "It makes my daily life difficult because of my anxiety".

2.3. Statistical analysis

Frequency analysis, chi-square test and Fisher's exact test were performed for basic information. Multiple logistic regression analysis was used to examine the effect of occupational characteristics on depressive symptoms. It was also used to examine the effect of the contract type and field of activity (6 groups) on depressive symptoms. All statistical analyses were carried out using IBM SPSS Statistics 21 program. The study protocol was reviewed and approved by the Institutional Review Board of Hanyang University (HYUIRB-202205-005-01).

3. Results

3.1. Sociodemographic characteristics and health behavior characteristics by contract type of research subjects

Regarding sex distribution of 312 study subjects, there were 230 (73.7%) females and 82 (26.3%) males (Table 1). The mean age was 33.1 ± 6.11 years. The group that contracted with CPs was older (34.1 ± 6.50) than the group that contracted directly with platforms

(32.1 ± 5.52), showing a statistically significant ($p = 0.013$) difference.

3.2. Occupational characteristics of research subjects

In terms of occupational characteristics of research subjects, the average weekly working hours was 57.2 ± 20.71 (Table 2). Those who contracted directly with platforms worked 59.7 hours, which was about 5 hours more than those who contracted with CPs. In terms of activity, webtoon creators were the largest at 60.7% of the webtoon writers who signed directly with platforms, while illustrators were the largest at 37.8% of the writers who signed with CPs. The average number of cuts required per episode was 66.0 ± 31.08. The group that directly contracted with the platform received 67.2 cuts more than 64.8 cuts requested by the group that contracted with CPs. In all three cases of labor discretion, webtoon writers who signed a contract with CPs tended to have fewer rights than those who signed a contract directly with the platform, but this was not statistically significant. We found that webtoon writers who contracted with CPs were more affected by comments from readers than those who contracted directly with the platform. Those who contracted with CPs were more depressed at 7.1 compared to 5.9 for those who contracted directly with the platform, which was statistically significant ($p = 0.016$). The results of analyzing the occupational characteristics of this group, divided into six categories based on contact type and field of activity, are presented in Supplementary Table 1.

3.3. Depressive symptoms of research subjects

Study subjects were analyzed according to their depressive symptoms (Table 3). In terms of working hours, it was found that the group with depressive symptoms worked an average of 60.9 hours per week, about 5 hours more than the group without depressive symptoms. The proportion of people contracting CPs was higher in the group with depressive symptoms times (OR: 3.01, 95% CI: 1.19−7.60). The rate of being influenced by comments and public reactions was higher in the group with depressive symptoms times (OR: 4.86, 95% CI: 1.71−13.85).

3.4. Depressive symptom by contract type and roles

Logistic regression analysis was conducted to examine factors related to depressive symptoms of study subjects (Table 4). Age, sex, marital status, education level, smoking, drinking, exercise, BMI, weekly working hours, annual salary, duration of webtoon work, labor discretion, number of required cuts, Borg score, and negative comment impact were adjusted. The group of story writers who signed a direct contract with the platform had the lowest depression complaint rate. Compared to story writers who contracted directly with platforms, story writers who contracted with CPs were 9.51 times (OR: 9.51, 95% CI: 1.47−61.33) and illustrator group contracted with the CPs were 6.47 times (OR: 6.47, 95% CI: 1.08−38.75) more likely to have higher depressive symptoms.

4. Discussion

This study investigated the working conditions of webtoon writers, focusing on the type of contract, and analyzed the relationship between working conditions and depressive symptoms. Webtoon writers were exposed to long working hours, high labor intensity, limited labor discretion, negative comments from readers, and had a high prevalence of depressive symptoms.

Webtoon writers reported working for long hours, with an average weekly working time of 57.2 hours. According to the sixth

Korean Working Conditions Survey, the average weekly working hours of Korean workers was 41.4 hours [11]. 12.1% of respondents worked more than 57 hours, which is the average weekly working time for webtoon writers. According to the "Webtoon Business Survey" announced by the Korea Creative Content Agency in 2022, webtoon writers averaged 10.5 hours per day, working 5.8 days a week. Labor intensity, measured by the Borg scale, was high, with an average score of 14.5, signifying a significant level of exertion. The prevalence of such intense labor is attributed to the deepening monopolization of a few platforms, forcing writers to become more economically dependent on these platforms to publish their works [12]. Responses regarding labor discretion consistently indicated low levels. The proportion of negative responses of "rarely" and "never" was 47.7% for the right to pause, 58.5% for the right to adjust the number of cuts, and 67.4% for the right to adjust the serialization period. The Survey on the Human Rights Situation of Platform Labor Workers, which addressed autonomy, work evaluation and control, revealed that professional freelancers (designers, programmers, marketers, translators, interpreters, business consulting, etc.) scored the highest in terms of autonomy. However, webtoon writers and web novel writers scored below the average [13]. The researcher concluded, "It may be that their pride and expectations as creative workers were undermined by various orders from platform companies and management companies, leading to lower subjective evaluations."

Regarding the impact of negative comments from readers, 13.8% of respondents reported being significantly affected, stating that it bothered them to the point of anxiety and made their daily life difficult. Regarding the existence of a service user evaluation system, 86.4% of respondents from the webtoon and web novel occupation reported its presence [13]. On platforms that publish webtoons/web novels, user evaluations are often publicized online, directly influencing the work, pay, and overall concerns of the writers. The researcher said, "Not only can writers directly know their own evaluations, but also those who want to use the service can make their choice based on the published evaluations, so evaluation is directly related to work or pay, and they are very concerned about the ratings of service users." The webtoon platform allows readers to evaluate webtoons every week and actively utilizes their evaluations [14]. Unfortunately, the webtoon platform's active use of reader evaluations has led to a reduction in writers' control over their working conditions. The working conditions for webtoon writers have become more challenging with long working hours becoming the "standard." Some contracts even specify the minimum number of cuts, citing reader preferences as justification, resulting in long working hours becoming the norm in the webtoon industry.

We checked whether there were differences in the working conditions of webtoon writers depending on their contractual type. Webtoon writers who contracted directly with platforms received

Table 1
General characteristics of the study subjects by contract

Characteristics	Total		Direct contract[‖]		Indirect contract[¶]		p*
	n	(%)	n	(%)	n	(%)	
Sex							
Female	230	(73.7)	93	(79.5)	84	(68.9)	0.061
Male	82	(26.3)	24	(20.5)	38	(31.1)	
Age (years)							
Mean	33.1 ± 6.11		32.1 ± 5.52		34.1 ± 6.50		0.013
≦ 29	83	(26.6)	39	(33.3)	27	(22.1)	0.122
30−39	179	(57.4)	64	(54.7)	74	(60.7)	
≧ 40	50	(16.0)	14	(12.0)	21	(17.2)	
Education level							
≦ High school	30	(12.6)	13	(11.1)	17	(13.9)	0.510
≧ College	209	(87.4)	104	(88.9)	105	(86.1)	
Marital status							
Married	55	(23.0)	21	(17.9)	34	(27.9)	0.069
Others[†]	184	(77.0)	96	(82.1)	88	(72.1)	
Body mass index (kg/m²)							
< 25	187	(78.2)	92	(78.6)	95	(77.9)	0.886
≧ 25	52	(21.8)	25	(21.4)	27	(22.1)	
Smoking							
None or ex	208	(87.0)	106	(90.6)	102	(83.6)	0.108
Current	31	(13.0)	11	(9.4)	20	(16.4)	
Alcohol consumption[‡]							
Social drinker	179	(74.9)	87	(74.4)	92	(75.4)	0.851
Binge drinker	60	(25.1)	30	(25.6)	30	(24.6)	
Regular exercise[§]							
Yes	78	(32.6)	41	(35.0)	37	(30.3)	0.437
No	161	(67.4)	76	(65.0)	85	(69.7)	

Values are mean ± standard deviation or number (%).
* By Chi-square test.
† Single, Unmarried, Widowed, Divorced.
‡ Alcohol consumption: Binge drinker = Consume alcohol at least once a month & at least 7 cups.
§ Regular exercise: At least 150 minutes of moderate-intensity physical activity per week or 75 minutes or more of vigorous physical activity.
‖ Direct contract: Webtoon writer who signed a direct contract with Republic of Korea's largest portal platform.
¶ Indirect contract: Webtoon writer contracted with content providers (studios and agencies, etc.) other than portal platform.

Table 2
Occupational characteristics and depression of the study subjects by contract

Characteristics	Total		Direct contract**		Indirect contract††		p*
	N	(%)	n	(%)	n	(%)	
Weekly working hours							
Mean	57.2 ± 20.71		59.7 ± 18.86		54.7 ± 22.14		0.066
≦40	55	(23.0)	18	(15.4)	37	(30.3)	0.004
41−52	47	(19.7)	20	(17.1)	27	(22.1)	
53−60	44	(18.4)	30	(25.6)	14	(11.5)	
≧61	93	(38.9)	49	(41.9)	44	(36.1)	
Annual income (×1,000,000 KRW)							
Mean	36.76 ± 6671.3		41.95 ± 933.81		31.79 ± 1853.4		0.240
Less than 24	72	(30.1)	42	(35.9)	30	(24.6)	0.022
24 to less than 36	88	(36.8)	38	(32.5)	50	(41.0)	
36 to less than 48	37	(15.5)	12	(10.3)	25	(20.5)	
48 or more	42	(17.6)	25	(21.4)	17	(13.9)	
Work duration (year)							
Mean	4.1 ± 3.05		3.8 ± 2.63		4.3 ± 3.40		0.240
≦2	76	(31.8)	42	(35.9)	34	(27.9)	0.536
3−4	81	(33.9)	39	(33.3)	42	(34.4)	
5−6	45	(18.8)	19	(16.3)	26	(21.3)	
≧7	37	(15.5)	17	(14.5)	20	(16.4)	
Field of activity							
Webtoon creator†	109	(45.6)	71	(60.7)	38	(31.1)	<0.001
Story writer	66	(27.6)	28	(23.9)	38	(31.1)	
Illustrator	64	(26.8)	18	(15.4)	46	(37.8)	
Number of cuts per episode							
Mean	66.0 ± 31.08		67.2 ± 24.80		64.8 ± 36.12		0.552
≦ 50	61	(25.6)	21	(18.1)	40	(32.8)	0.025
51−60	40	(16.8)	25	(21.6)	15	(12.3)	
61−70	63	(26.5)	33	(28.4)	30	(24.6)	
71−80	31	(13.0)	19	(16.4)	12	(9.8)	
≧81	43	(18.1)	18	(15.5)	25	(20.5)	
Labor discretion† (rest authorization)							
Yes	125	(52.3)	65	(55.6)	60	(49.2)	0.324
No	114	(47.7)	52	(44.4)	62	(50.8)	
Labor discretion† (cut authorization)							
Yes	99	(41.4)	53	(45.3)	46	(37.7)	0.233
No	140	(58.6)	64	(54.7)	76	(62.3)	
Labor discretion† (serial period authorization)							
Yes	85	(35.6)	47	(40.2)	38	(31.1)	0.145
No	154	(64.4)	70	(59.8)	84	(68.9)	
Labor intensity (Borg RPE) §							
Mean	14.5 ± 2.83		14.6 ± 2.59		14.4 ± 3.05		0.515
RPE <15	115	(48.1)	50	(42.7)	65	(53.3)	0.103
RPE ≧ 15	124	(51.9)	67	(57.3)	57	(46.7)	
Negative comment impact‖							
Low	206	(86.2)	106	(90.6)	100	(82.0)	0.053
High	33	(13.8)	11	(9.4)	22	(18.0)	
Depressive symptom (PHQ-9 ≧ 10) ¶							
Mean	6.8 ± 5.10		5.9 ± 5.10		7.1 ± 4.98		0.016
No	154	(75.1)	84	(82.4)	70	(68.0)	0.017
Yes	51	(24.9)	18	(17.6)	33	(32.0)	

Values are mean ± standard deviation or number (%).
* By Chi-square test.
† A single writer handles everything from story to drawing for a webtoon work.
‡ Yes: Always, Often, Sometimes/No: Rarely, Never.
§ RPE: Rating of Perceived Exertion.
‖ Low: "It doesn't affect me at all", "It bothers me somewhat", "It bothers me a lot"/High: "It bothers me to the point of anxiety", "It makes my daily life difficult because of my anxiety".
¶ Depressive symptom (PHQ-9: Patient Health Questionnaire-9 ≧ 10).
** Direct contract: Webtoon writer who signed a direct contract with Republic of Korea's largest portal platform.
†† Indirect contract: Webtoon writer contracted with content providers (studios and agencies, etc.) other than portal platform.

Table 3

Occupational characteristics of the study subjects by depressive symptom & logistic regression model of depressive symptom according to occupational characteristics

Characteristics	NO		Depressive symptom			Crude OR[**] (95% CI[††])	Adjusted OR[**] (95% CI[††])
			Yes		p		
	n	(%)	n	(%)			
Weekly working hours					0.060		
Mean	55.2 ± 19.3		60.9 ± 26.7				
≦40	44	(24.3)	20	(27.8)		1.00	1.00
41–52	39	(21.5)	8	(11.1)		0.45 (0.17–1.14)	0.39 (0.10–1.52)
53–60	31	(17.2)	10	(13.9)		0.71 (0.29–1.72)	1.64 (0.45–5.89)
≧61	67	(37.0)	34	(47.2)		1.11 (0.57–2.18)	1.61 (0.52–5.01)
Annual income (×1,000,000 KRW)					0.029		
Mean	30.51 ± 1727.0		38.84 ± 4320.7				
Less than 24	52	(28.7)	22	(31.0)		1.00	1.00
24 to less than 36	77	(42.5)	23	(32.4)		0.70 (0.35–1.39)	0.60 (0.21–1.70)
36 to less than 48	28	(15.5)	11	(15.5)		0.92 (0.39–2.18)	0.76 (0.18–3.20)
48 or more	24	(13.3)	15	(21.1)		1.47 (0.65–3.33)	1.60 (0.46–5.49)
Work duration (year)					0.090		
Mean	3.9 ± 2.74		4.6 ± 3.51				
≦2	55	(30.4)	16	(22.2)		1.00	1.00
3–4	68	(37.6)	27	(37.5)		1.36 (0.66–2.78)	2.04 (0.65–6.32)
5–6	35	(19.3)	15	(20.8)		1.47 (0.64–3.35)	1.72 (0.47–6.19)
≧7	23	(12.7)	14	(19.4)		2.09 (0.87–4.97)	1.10 (0.21–5.54)
Field of activity							
Webtoon creator[*]	77	(42.5)	34	(47.2)		1.00	1.00
Story writer	62	(34.3)	20	(27.8)		0.73 (0.38–1.39)	0.79 (0.28–2.18)
Illustrator	42	(23.2)	18	(25.0)		0.97 (0.49–1.92)	0.57 (0.20–1.63)
Contract type[†]							
Direct	84	(54.5)	18	(35.3)		1.00	1.00
Indirect	70	(45.5)	33	(64.7)		2.20 (1.14–4.24)	3.01 (1.19–7.60)
Number of cuts per episode					0.557		
Mean	69.3 ± 36.0		72.4 ± 44.2				
≦50	48	(26.8)	17	(23.6)		1.00	1.00
51–60	26	(14.5)	11	(15.3)		1.19 (0.48–2.92)	2.28 (0.60–8.65)
61–70	35	(19.6)	23	(31.9)		1.85 (0.86–3.98)	1.84 (0.53–6.36)
71–80	24	(13.4)	7	(9.7)		0.82 (0.30–2.25)	1.74 (0.41–7.26)
≧81	46	(25.7)	14	(19.4)		0.85 (0.38–1.94)	0.73 (0.23–2.69)
labor discretion[‡] (Rest Authorization)							
Yes	95	(52.5)	41	(56.9)		1.00	1.00
No	86	(47.5)	31	(43.1)		0.83 (0.48–1.44)	0.95 (0.37–2.42)
labor discretion[‡] (Cut Authorization)							
Yes	77	(42.5)	27	(37.5)		1.00	1.00
No	104	(57.5)	45	(62.5)		1.23 (0.70–2.16)	1.14 (0.45–2.87)
labor discretion[‡] (Serial period Authorization)							
Yes	68	(37.6)	23	(31.9)		1.00	1.00
No	113	(62.4)	49	(68.1)		1.28 (0.71–2.28)	1.18 (0.44–3.16)

Table 3 (*continued*)

Characteristics	Depressive symptom¶						
	NO		Yes		p	Crude OR** (95% CI††)	Adjusted OR** (95% CI††)
	n	(%)	n	(%)			
Negative comment impact§							
Low	167	(92.3)	51	(70.8)		1.00	1.00
High	14	(7.7)	21	(29.2)		4.91 (2.33–10.35)	4.86 (1.71–13.85)
Labor intensity (Borg RPE) ‖							
Mean	14.3 ± 2.63		14.7 ± 3.08		0.269		
RPE <15	92	(50.8)	35	(48.6)		1.00	1.00
RPE ≧15	59	(49.2)	37	(51.4)		1.09 (0.63–1.88)	0.63 (0.24–1.61)

The model was adjusted for age, sex, marital status, education level, smoking, alcohol consumption, regular exercise, BMI, weekly working hours, annual income, work duration, Field of activity, contract type, number of cuts per episode, labor discretion, comment impact, Borg scale.

Values are mean ± standard deviation or number (%).

* A single writer handles everything from story to drawing for a webtoon work.
† Direct: Webtoon writer who signed a direct contract with Republic of Korea's largest portal platform/Indirect: Webtoon writer contracted with content providers (studios and agencies, etc.) other than portal platform.
‡ Yes: Always, Often, Sometimes/No: Rarely, Never.
§ Low: "It doesn't affect me at all", "It bothers me somewhat", "It bothers me a lot"/High: "It bothers me to the point of anxiety", "It makes my daily life difficult because of my anxiety".
‖ RPE: Rating of Perceived Exertion.
¶ Depressive symptom (PHQ-9: Patient Health Questionnaire-9 ≧ 10).
** OR: Odds ratio.
†† CI: Confidence interval.

higher wages, but worked longer hours and were required to make more cuts per episode than those who contracted with CPs. Although not statistically significant, the mean score for subjective labor intensity was also higher for webtoon writers who contracted directly with platforms. When analyzing labor discretion by contractual relationship, webtoon writers who contracted with CPs tended to have lower rights than those who contracted directly with platforms. However, when labor discretion was analyzed by both contractual relationship and field of activity, story writers had higher rights in all three areas, and webtoon creators had higher the right to pause and the right to adjust the number of cuts than directly contracted webtoon writers. On the other hand, illustrators contracted with CPs had lower labor discretion than those who contracted directly with the platform in all three areas (Supplementary Table 1). CPs have become subcontractors and intermediaries for platform giants. They are in charge of all contracts, management, and disputes with artists that platforms have to deal with [15]. The recent increase in contracting through agencies and studios has been criticized as unfair, low-paying, low labor discretion, and double-commissioning. In this study, it was not possible to conclude that the working conditions of webtoon writers contracted with CPs were worse. However, it was found that the labor discretion of illustrators contracted with CPs was significantly low. This subcontracting system in the webtoon industry, accelerated with the advent of novel comics, appears to have restricted the labor discretion of illustrators contracted with CPs more than that of those who contracted with platforms.

Among the webtoon writers participating in the study, 24.9% scored more than 10 points on PHQ-9 (Table 2). The prevalence of depressive symptoms using PHQ-9 was 26.5% in women and 20.7% in men. According to the 2020 Korea National Health and Nutrition Examination Survey, the prevalence of depressive symptoms using PHQ-9 was 6.7% in women and 4.8% in men [16]. The prevalence of depressive symptoms among webtoon writers using PHQ-9 was approximately four times higher than that of the general population for both men and women. Although statistical significance was not found, there was a difference among webtoon writers in that the group with depressive symptoms who worked about 5 hours more than the group without depressive symptoms (p = 0.060). Many other studies have found that long working hours could negatively affect mental health, including depression and anxiety. A

Table 4

Logistic regression model of depressive symptom according to contract type & field of activity

Contract & field of activity	Depressive symptom*			
	Crude OR† (95% CI‡)		Adjusted OR† (95% CI‡)	
Direct§ & Story writer	1.00		1.00	
Indirect‖ & Story writer	3.96	(0.77−20.32)	9.51	(1.47−61.33)
Direct & Webtoon creator¶	3.27	(0.68−15.68)	4.81	(0.83−27.65)
Indirect & Webtoon creator	4.58	(0.90−23.26)	5.62	(0.91−34.46)
Direct & Illustrator	1.46	(0.18−11.58)	1.76	(0.17−18.12)
Indirect & Illustrator	7.33	(1.48−36.23)	6.47	(1.08−38.75)

The model was adjusted for age, sex, marital status, education level, smoking, alcohol consumption, regular exercise, BMI, weekly working hours, annual income, work duration, field of activity, contract type, number of cuts per episode, labor discretion, negative comment impact, Borg scale.

* Depressive symptom (PHQ-9: Patient Health Questionnaire-9 ≧ 10).
† OR: Odds ratio.
‡ CI: Confidence interval.
§ Direct contract: Webtoon writer who signed a direct contract with Republic of Korea's largest portal platform.
‖ Indirect contract: Webtoon writer contracted with content providers (studios and agencies, etc.) other than portal platform.
¶ A single writer handles everything from story to drawing for a webtoon work.

large sample study of about 10,000 people has reported that long hours of work can increase symptoms such as depression and anxiety from 1.44 to 1.67 times [17]. In a study of full-time workers aged 44 to 66 years, compared to those who worked 35 to 40 hours per week, those who worked more than 55 hours per week reported a 1.66-fold increase in depressive symptoms and a 1.74-fold increase in anxiety symptoms [18]. In a study that analyzed 4,662 full-time workers among the results of Korea National Health and Nutrition Examination Survey between 2007 and 2009, the risk of depressive symptoms increased 1.62 times for those who worked more than 60 hours per week compared to those who worked less than 52 hours per week [19].

Many studies have found that platform labor itself increases depression. Previous studies have focused on the mental health of digital platform labor, mostly in the form of locally based work. In a study on the development of an occupational health system to protect the health of platform workers, the PHQ-9 survey was administered to 168 housekeepers (mean age 60), 186 designated drivers (mean age 56), and 175 food delivery workers (mean age 36). The mean (standard deviation) PHQ-9 score by occupation was 4.1 ± 4.7 for housekeepers, 7.4 ± 7.0 for designated drivers, and 3.7 ± 5.1 for food delivery workers [20]. Another study found that 36.1% of designated drivers experienced physical violence and assault that interfered with safe driving for a year and that 80.4% of total respondents experienced verbal abuse [21]. The working environment of these drivers, where verbal abuse and assault have become routine, might have contributed to their severe depression. Webtoon writers also suffer from indiscriminate comments. They are exposed to verbal abuse from platforms and CPs [7]. In our study, it was also found that those who were highly influenced by comments were 4.86 times higher levels of depressive symptoms than those who were not (Table 3). A study of 223 rideshare drivers in China has found high levels of isolation due to frequent turnover and lack of experience [22]. A study of 359 workers on Amazon's Mechanical Turk (a platform that allows individuals to perform tasks on Amazon) in the U.S. has found that the way they are paid has a significant impact on their working conditions, with platform workers who are paid by the task reporting adverse mental health outcomes related to job satisfaction [23]. The ILO has pointed out dangers of platform labor reducing the quality of employment and increasing low-wage, unstable jobs. These unstable jobs have negative consequences for workers' health, causing serious mental disorders such as depression [24].

When analyzing the depressive symptom by contract type, it was higher among webtoon writers who contracted with CPs (Table 2). When analyzed by the field of activity, the rate of depressive symptoms was higher among webtoon writers contracted with CPs than those contracted directly with platforms, regardless of field of activity (Supplementary Table 1). It was expected that webtoon writers who contracted with CPs would have less authority in terms of labor discretion. However, different results were found depending on the field of activity. Among webtoon writers who contracted with CPs, only illustrators had lower labor discretion than webtoon writers who contracted directly with platforms. In the logistic regression analysis, depression symptoms were 6.47 times higher in the illustrators contracted with CPs than in story writers contracted directly with the platform (Table 4). The fact that CP-contracted illustrators had significantly lower labor discretion than webtoon writers who contracted directly may have contributed to their depressive symptoms. Several studies have described subcontracted workers as being at higher risk for mental health problems such as depression and anxiety due to increased exposure to hazardous work environments, low work autonomy, relatively low compensation levels, job insecurity, and low self-esteem [25,26].

Our study has some limitations. First, because the recruitment of research subjects was carried out through cooperation between labor unions and the writer community, generalizability of results may be affected. Future studies should consider collecting data from multiple sources. Second, because the data were cross-sectional, the causal relationship between work environment and mental health could not be determined. A longitudinal study is needed to shed light on the causal relationship. Third, since the subjects of the study were webtoon writers with an annual income of more than 500,000 won, it is possible that there were some subjects who had difficulty making a living as webtoon writers. They may have had other jobs to make a living which should have been considered as a confounding factor to contribute to their depressive symptoms. Although we adjusted for wages in logistic analysis, it is a limitation that we were unable to account for the effect of other jobs. Therefore, we conducted a sensitivity analysis by excluding low-income respondents and confirmed similar trends as when analyzing the entire sample. (Supplementary table 2). Finally, the "healthy worker effect" is a type of bias that cannot be ignored, where healthier writers tend to stay active in the webtoon market. This effect may have attenuated the prospective association between work environment and mental health as those with the highest depressive symptom levels might have already left the profession. Nevertheless, this study was significant in that it identified the working environment of webtoon writers and investigated mental health conditions for the first time.

This study examined the working conditions of webtoon writers and investigated their correlation with depressive symptoms. Webtoon writers reported prolonged working hours, high labor intensity, limited job discretion, and a notable prevalence of depressive symptoms. The research findings indicated that illustrators and story writers contracted with content providers (CPs) experienced the most severe depressive symptoms within the current novel comics production landscape. This study emphasizes the urgent necessity to improve the overall working environment in the webtoon industry and implement measures to tackle the escalating mental health challenges faced by illustrators and story writers contracted with CPs, especially given the increasing popularity of novel comics.

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Conflicts of interest

The authors have no conflict of interest to declare.

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Appendix A. Supplementary data

Supplementary data to this article can be found online at https://doi.org/10.1016/j.shaw.2024.03.003.

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