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Mental Health and Psychosomatic Medicine Correlations: Exploring Age-Sex Variations in a Cross-Sectional Study

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Abstract

The mental health status of many patients is intertwined with their physical symptoms, posing a challenge in primary care settings. This study investigates how the relationship between physical symptoms and mental health is influenced by sex and age. It also examines less-studied organs such as the eyes/ears and the genitourinary system in this context. A total of 258 patients first visiting a Psychosomatic Internal Medicine clinic in Japan were surveyed from September 2019 to July 2022. Mental health symptoms were analyzed using validated questionnaires including the General Health Questionnaire, State-Trait Anxiety Inventory, and Center for Epidemiologic Studies Depression Scale. Physical symptoms were analyzed using the Cornell Medical Index. Findings revealed sex-specific differences and found that the 40-59 years age group was more susceptible to mental health issues mainly affecting the respiratory, cardiovascular, digestive, and nervous systems. A relationship was identified between mental health and organs such as the eye/ear and the genitourinary system (which includes the organs of the genital and urinary systems). This study underscores the significant link between mental health and physical symptoms, highlighting organs most affected and variations by sex and age.

Key words: medically unexplained symptoms, psychosomatic medicine, mental health correlations, sex difference, age difference.

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Novelty and Significance

What is already known about the topic?

- Primary care serves a wide variety of patients, many of whom experience mental health complications.
- The influence of mental health on physical health, and vice versa, is not well understood.

What this paper adds?

- This paper adds to the body of knowledge on the impact of mental health symptoms on physical health including the organs, which have not been adequately studied, such as the eye/ear and genitourinary system.
- It provides insight into the differences regarding this relationship based on sex and across the lifespan.

Primary care units receive patients with a variety of symptoms. In some instances, these patients may need a referral to a specialized medical facility. According to Kroenke and Mangelsdorff (1989), around 33% of physical symptoms in primary care cannot be explained by organic pathology. These symptoms are known as medically unexplained symptoms (MUSs) or functional somatic symptoms (FSSs). Stress is believed to be related to the onset and worsening of FSSs (Basso *et alii*, 2022). Consequently, the quality of life for these patients is often low, as they frequently experience feelings of shame, guilt, and a sense of being misunderstood by physicians, leading them to question the legitimacy of their illness (Zijlema *et alii*, 2013).

It is crucial for primary care physicians and others examining physical symptoms to consider the link between mental health background and physical symptoms. This understanding enables the treating physician to more effectively identify the symptoms,

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and therefore the specific organs, requiring attention during patient examinations by exploring the relationship between physical symptoms and mental health. FSSs encompass a wide array of symptoms, but pain disorders are often seen as indicative of underlying psychosocial issues (Schröder, Rehfeld, Ørnbøl, Sharpe, Licht, & Fink, 2012). Mood disorders, which commonly affect patients with headaches, play a significant role in clinical outcomes (Baker, Sowers, & Hack, 2020). The relationship between anxiety, depression, and headaches, especially in studies focusing on tension-type headaches and migraines, has been well established (Wei, Jia, Wang, Zhou, Zuo, & Chu, 2016).

Although certain organs have traditionally been studied for their connection to the mind and body, others have received less attention. Indeed, patients with a wide variety of conditions seek treatment in primary care settings. The mechanisms through which psychological stress induces various physiological responses are still not fully understood (Kataoka, Shima, Nakajima, & Nakamura, 2020). Previous research has also identified minor sex- or gender-based differences in symptoms of anxiety and overall mental health when measured continuously, but other outcomes (continuous depression symptoms, dichotomous anxiety symptoms, depression symptoms, general mental health, and stress) have shown no significant difference based on sex or gender (Dal Santo *et alii*, 2022).

In this study, we aimed to explore the association between psychological symptoms and physical health. We focused on organs that are often ignored in mind-body research, highlighting the importance of examining the eyes/ears, and genitourinary system. We investigated the relationship between mental health conditions and common physical symptoms, including those impacting less studied organs like the eyes/ears and genitourinary system, and analyzed differences based on sex and age.

METHOD

Participants and Design

The study included all patients who initially visited the Department of Psychosomatic Internal Medicine at our University hospital from September 2019 to July 2022. These participants, who were referred from various clinics, sought treatment at a psychosomatic department, distinguishing them from those with mental disorders typically referred to psychiatry departments. The criteria for inclusion were individuals aged 20 years or older and eligible for a psychological assessment. The exclusion criteria were being either unable or unwilling to undergo a psychological assessment or being at risk of the assessment worsening their mental health condition. Study details were made available online, allowing prospective participants to opt out before obtaining ethics board approval. Informed written consent was collected from all participants following this approval. We excluded patients who had incomplete data.

This cross-sectional study was approved by The Hospital's Human Subjects Institutional Review Board of the Nihon University Itabashi Hospital Clinical Research Judging Committee (Approval number RK-220510-8) and adhered to the principles of the Declaration of Helsinki.

Instruments and Measures

Data on patients' demographic characteristics and treatment protocols were collected retrospectively during the patients' initial visit via anonymous questionnaires including the Cornell Medical Index (CMI), State-Trait Anxiety Inventory (STAI), Center for

Epidemiologic Studies Depression Scale (CES-D), and General Health Questionnaire-30 (GHQ-30), which are described in detail below.

Cornell Medical Index (CMI; Pendleton *et alii*, 2004). All new patients were asked to complete a CMI questionnaire. The CMI assesses physical health status through concordant self-reports and structured clinical assessment featuring yes/no questions across 18 sections (A-R). Sections A-L denote physical health complaints and query physical symptoms, personal habits, and family health history. Sections M-R refer to psychological health complaints, focusing on emotional patterns and mood. The CMI is designed to quickly gather data on physical symptoms and is suitable for a broad demographic. By using the CMI to measure physical symptoms body-wide, a comprehensive overview of a patient's subjective health concerns can be achieved (Kataoka *et alii*, 2020). We prioritized the CMI questionnaire, specifically examining the eyes and ears, skin, and genitourinary system, to explore the relationship between physical symptoms and mental health.

State-Trait Anxiety Inventory (STAI; Albanidou-Farmaki, Poulopoulos, Epivatianos, Farmakis, Karamouzis, & Antoniades, 2008). All new patients were asked to complete a STAI questionnaire. The STAI, a self-administered Likert-scale questionnaire, measures anxiety on two scales: the State Anxiety Scale evaluates moment-specific responses, and the Trait Anxiety Scale gauges general feelings of anxiety. Scores range from 20 to 80, with ≥50 indicating extreme anxiety, 31 to 49 indicating moderate anxiety, and <30 indicating little to no anxiety (López Jornet, Camacho Alonso, & Sánchez Siles, 2014).

Center for Epidemiologic Studies Depression Scale (CES-D; Vilagut, Forero, Barbaglia, & Alonso, 2016). All new patients were asked to complete a CES-D questionnaire. The CES-D is used to measure symptoms associated with depression that have been experienced within one week. Each of the 20 items available in this instrument is measured using the Likert scale in the following way: 0= rarely or never (less than one day); 1= occasionally or in few cases (1 to 2 days); 2= occasionally or a moderate amount of time (3 to 4 days); and 3= most of the time or all the time (5 to 7 days) (Wang *et alii*, 2013). The total scores range from 0 to 60. Results were interpreted as participants having depression (16-60) or being normal (0-15) (Awano *et alii*, 2020). Higher scores indicate greater depressive symptomatology (Maass *et alii*, 2015). This scale is available and reliable in the Japanese context (Demura & Sato, 2003).

General Health Questionnaire-30 (GHQ-30; Goldberg & Williams, 1988). All new patients were asked to complete a GHQ-30 questionnaire. The GHQ, a self-administered Likert-scale questionnaire used to screen non-psychotic psychiatric illnesses, is used in both clinical and epidemiological research settings to examine the mental health of the general population. This self-reported questionnaire has versions with 12, 28, 30, and 60 items. The most popular version is the GHQ-30, an edited version of the GHQ-60 that includes an indispensable measure of general psychological problems. An important GHQ-30 characteristic is the inclusion of an equal number of positive and negative questions with close verbal anchors for answer categories (Stochl, Böhnke, Pickett, & Croudace, 2016). Each item includes four answer options scored either from 0 to 3, for a total score ranging from 0-84, or by an alternative binary method in which a threshold of 4 is set for "caseness" (or the presence of psychiatric distress). The GHQ includes "positive" items that represent an ability to carry out normal functions (e.g., "Have you recently been able to enjoy your normal day-to-day activities?"), and "negative" items that address distressing symptoms (e.g., "Have you recently felt constantly under strain?"). A person with a high GHQ score was considered to have a high level of psychological distress, including symptoms of somatization, sleep disturbance, anxiety and disphoria, social dysfunction, and suicidal depression. In addition, the total score was standardized including being normal and having neurosis. The Japanese version of the instrument has been previously validated (Nakagawa & Daibo, 1985, Goldverg, 1988) and many GHQ studies have recently been conducted in Japan (Hayasaka, Nakamura, Yamamoto, & Sasaki 2007).

Data Analysis

Data were analyzed by a statistician from the Japanese Institute of Statistical Technology (Tokyo, Japan) using SPSS Statistics 25 (IBM Corporation, Armonk, NY,

USA). Analyses included correlations between CES-D scores and CMI physical symptom scores, STAI scores and CMI physical symptom scores, and GHQ-30 scores and CMI physical symptom scores. Participant scores were categorized by sex and age (20-39, 40-59, and 60 and above) groups. Spearman's rank correlation coefficient was used for the analyses. A significance level of $p < .05$ was set. No adjustments for multiple comparisons were made since this study is exploratory research.

RESULTS

Valid data were analyzed from 258 out of 296 participants (153 women) and 38 participants were excluded because of incomplete answers to the questionnaires. The Mean age of the participants was 49.09 years (*SD*= 18.01). Table 1 shows the data of the participants on sex, age, and chief complaints.

Table 1. Participants' sex, age and chief complaints.

		n (%)
Sex Mean age (SD)	Male: 48.30 (17.76)	105 (40.7)
	Female: 49.53 (18.16)	153 (59.3)
	Total: 49.09 (18.01)	258
Age	20–39	90 (34.9)
	40–59	93 (36.0)
	60…	75 (29.1)
Chief complaints	depressive	45 (17.4)
	respiratory	33 (12.8)
	anxiety	30 (11.6)
	digestive	27 (10.5)
	vertigo/dizziness	25 (9.7)
	sleep disorder	22 (8.5)
	headache	20 (7.8)
	chronic pain	8 (3.1)
	skin	5 (1.9)
	orthostatic disorder	5 (1.9)
	other	38 (14)

Using Spearman's rank correlation coefficient, we analyzed the correlations between CES-D and STAI scores and the CMI physical symptom score, alongside the relationship between the increase in CES-D and STAI scores and the corresponding increase in each CMI score. A significant association was found across all CMI scores with both CES-D and STAI (see Table 2). As shown in Table 2, both the CES-D and STAI scores were significantly associated with the CMI physical symptom scores. Further analysis using Spearman's rank correlation coefficient revealed a significant relationship between the GHQ-30 total scores and CMI physical symptom scales.

Notably, among the GHQ-30 subscales (see Table 3), only anxiety and dysphoria, and somatic symptoms demonstrated significant correlations with the CMI eyes and ears subscale. The CMI musculoskeletal system subscale showed significant associations with the somatic symptoms, anxiety and dysphoria subscales of GHQ-30. The skin subscale of the CMI correlated significantly with the somatic symptoms, anxiety and dysphoria, and suicidal depression GHQ-30 subscales. The genitourinary system subscale of the CMI was notably linked with all GHQ-30 subscales, excluding sleep disturbance and social dysfunction. As shown in Table 3, the associations between GHQ total and subscale scores and the CMI physical symptom scores differed significantly based on organ: eyes & ears, musculoskeletal system, skin, and the genitourinary system showed different correlations depending on the GHQ-30 subscale items.

Table 2. Results of analyzing the association of the degree of each physical symptom on the CMI with CES-D and STAI (*n*= 252).

CMI	CES-D *p* *r*	STAI-state *p* *r*	STAI-trait *p* *r*
Eyes & ears	.001 0.205	.000 0.253	.000 0.245
Respiratory system	.000 0.330	.000 0.261	.00 0.36
Cardiovascular system	.000 0.287	.000 0.290	.000 0.251
Digestive system	.000 0.334	.000 0.320	.000 0.310
Musculo skeletal system	.002 0.192	.002 0.196	.020 0.148
Skin	.001 0.212	.001 0.204	.002 0.200
Nervous system	.000 0.370	.000 0.407	.000 0.346
Genitourinary system	.000 0.223	.004 0.184	.002 0.200
Fatigability	.000 0.585	.000 0.447	.000 0.541

Notes: CES-D= Center for Epidemiologic Studies Depression Scale; CMI= Cornell Medical Index; *p*= *p*-value; *r*= correlation coefficient; STAI= State-Trait Anxiety Inventory.

Table 3. Results of analyzing the association of the degree of each physical symptom on the CMI with the GHQ-30 (*n*= 252).

	CMI								
	E/E *p* *r*	Respi. *p* *r*	Cardio. *p* *r*	Diges. *p* *r*	Muscul. *p* *r*	Skin *p* *r*	Nerv *p* *r*	Gen-urin. *p* *r*	Fatig. *p* *r*
GHQ-Total	.007 0.172	.000 0.317	000 0.280	.000 0.301	.008 0.170	.002 0.200	.000 0.402	.004 0.184	.000 0.530
GHQ-A/GI	.293 0.067	.000 0.227	.017 0.152	.006 0.174	.097 0.106	.239 0.076	.000 0.234	.036 0.134	.000 0.415
GHQ-B/SS	.000 0.224	.000 0.329	.000 0.321	.000 0.267	.000 0.242	.000 0.345	.000 0.448	.002 0.194	.000 0.305
GHQ-C/SD	.228 0.077	.001 0.203	.005 0.179	.001 0.207	.001 0.210	.181 0.086	.000 0.231	.164 0.089	.002 0.197
GHQ-D/SDy	.140 0.094	.004 0.184	.034 0.135	.008 0.168	.827 0.014	.353 0.060	.000 0.251	.089 0.109	.000 0.354
GHQ-E/A-D	.013 0.158	.000 0.264	.000 0.266	.001 0.212	.035 0.135	.004 0.185	.000 0.309	.010 0.165	.000 0.466
GHQ-F/SDe	.039 0.131	.000 0.237	.000 0.251	.000 0.318	.207 0.081	.002 0.193	.000 0.302	.009 0.166	.000 0.507

Notes: Cardio= Cardiovascular system; CMI= Cornell Medical Index; Diges= Digestive system; E/E= Eyes & ears; Fatig= Fatigability; Gen-uri= Genitourinary system; GHQ= General Health Questionnaire-30 (A/GI= General Illness; B/SS= Somatic Symptom; C/SD= Sleep Disturbance; D/SDy= Social Dysfunction; E/A-D= Anxiety and Dysphoria; F/SDe= Suicidal Depression; Total= Total score); Muscul= Musculo skeletal system; Nerv= Nervous system; Respi= Respiratory system.

Further examination of sex/gender-based differences using Spearman's rank correlation coefficient highlighted distinct associations between physical symptoms and GHQ-30 scores (see Table 4). For instance, while no significant correlation was observed in the genitourinary system among men, a significant link was found among women, except for sleep disturbance. Women exhibited a stronger correlation between skin symptoms and anxiety/disphoria and suicidal depression compared with men. Moreover, among men, more GHQ-30 subscale items were significantly related to the eyes and ears CMI subscale than among women, who showed no significant associations. As shown in Table 4, for the physical symptoms on the CMI regarding the genitourinary system, eyes and ears, and skin, there was a significant difference between the GHQ total score and subscales assessed using the CMI between men and women.

Table 4. Results of Analyzing Sex-Based Differences in the Association of the Degree of Each Physical Symptom on the CMI with the GHQ-30 (n= 258).

		CMI								
		E/E	Respi.	Cardio.	Diges.	Muscul.	Skin	Nerv	Gen-urin.	Fatig.
		p	*p*	*p*	*p*	*p*	*p*	*p*	*p*	*p*
		r	*r*	*r*	*r*	*r*	*r*	*r*	*r*	*r*
Males	GHQ-Total	.002	.000	.001	.004	.007	.128	.000	.851	.000
		0.309	0.355	0.319	0.289	0.267	0.154	0.392	0.019	0.591
	GHQ-A/GI	.005	.003	.025	.021	.011	.763	.001	.385	.000
		0.281	0.293	0.225	0.230	0.254	0.031	0.320	0.088	0.520
	GHQ-B/SS	.001	.002	.075	.031	.008	.001	.000	.471	.042
		0.338	0.302	0.179	0.216	0.265	0.319	0.345	-0.073	0.204
	GHQ-C/SD	.012	.001	.001	.003	.007	.465	.002	.466	.007
		0.251	0.319	0.327	0.291	0.267	0.074	0.306	0.074	0.270
	GHQ-D/SDy	.102	.052	.123	.070	.391	.316	.023	.811	.000
		0.165	0.195	0.155	0.182	0.084	0.102	0.226	0.024	0.442
	GHQ-E/A-D	.015	.015	.019	0.083	.103	.590	.011	.896	.000
		0.243	0.244	0.234	0.174	0.164	0.055	0.252	-0.013	0.490
	GHQ-F/SDe	.044	.008	.001	.007	.086	.200	.004	.600	.000
		0.202	0.263	0.329	0.266	0.173	0.130	0.284	0.053	0.561
Females	GHQ-Total	.325	.000	.001	.000	.189	.002	.000	.000	.000
		0.082	0.299	0.280	0.314	0.110	0.252	0.414	0.329	0.491
	GHQ-A/GI	.459	.033	.097	.082	.843	.094	.018	.010	.000
		-0.061	0.176	0.137	0.144	0.017	0.139	0.193	0.213	0.353
	GHQ-B/SS	.071	.000	.000	.000	.006	.000	.000	.000	.000
		0.150	0.351	0.415	0.304	0.228	0.366	0.518	0.363	0.380
	GHQ-C/SD	.723	.123	.153	.074	.029	.163	.017	.106	.069
		-0.029	0.128	0.118	0.148	0.181	0.116	0.197	0.134	0.151
	GHQ-D/SDy	.452	.030	.083	.050	.719	.596	.001	.012	.000
		0.062	0.179	0.144	0.163	-0.030	0.044	0.271	0.208	0.451
	GHQ-E/A-D	.223	.000	.000	.003	.154	.001	.000	.000	.000
		0.101	0.285	0.299	0.244	0.199	0.284	0.343	0.306	0.451
	GHQ-F/SDe	.335	.006	.007	.000	.901	.002	.000	.001	.000
		0.080	0.225	0.226	0.359	0.010	0.259	0.319	0.274	0.474

Notes: Cardio= Cardiovascular system; CMI= Cornell Medical Index; Diges= Digestive system; E/E= Eyes & ears; Fatig= Fatigability; Gen-uri= Genitourinary system; GHQ= General Health Questionnaire-30 (A/GI= General Illness; B/SS= Somatic Symptom; C/SD= Sleep Disturbance; D/SDy= Social Dysfunction; E/A-D= Anxiety and Dysphoria; F/SDe= Suicidal Depression; Total= Total score); Muscul= Musculo skeletal system; Nerv= Nervous system; Respi= Respiratory system.

Lastly, an analysis based on age groups, using Spearman's rank correlation coefficient, assessed the relationship between GHQ scores and CMI physical symptom scores, including the impact of GHQ score increases on CMI score changes across different age categories (see Table 5). As shown in Table 5, significant differences were found in the physical symptoms on the CMI related to the genitourinary system, eyes and ears, and skin in terms of both the GHQ-30 total score and subscales; variations were also observed in the physical symptoms on the CMI across different age groups. The relationship between physical symptoms, as measured by the CMI, and mental health, as assessed by the GHQ-30, varied across age groups. Individuals in the 40–59 age group exhibited a higher number of significant correlations in the respiratory, circulatory, digestive, musculoskeletal, and genitourinary systems compared with those in other age brackets. However, a significant association between the eyes and ears subscale of the CMI and GHQ-30 total/subscales (i.e., somatic symptoms, anxiety and dysphoria) was uniquely identified within the 20-39 age group. By contrast, the relationship between skin and GHQ-30 items was consistent across the 20-39 and 40-59 age groups. Among participants aged 60 and above, a noticeable decline was observed in the number of items showing significant relationships. To sum it up, there were significant relationships between CES-D/STAI scores and each CMI physical symptom scores. In addition, the degrees of GHQ-30 total, and subscales were significantly associated with CMI physical scores and the associations differed according to sex and age.

Table 5. Results of analyzing age-based differences in the association of the degree of each physical symptom on the CMI with the GHQ-30 (*n*= 258).

		CMI								
		E/E	Respi.	Cardio.	Diges.	Muscul.	Skin	Nerv	Gen-urin.	Fatig.
		p *r*	*p* *r*	*p* *r*	*p* *r*	*p* *r*	*p* *r*	*p* *r*	*p* *r*	*p* *r*
GHQ-20-39 (*n*= 90)	Total	.033 0.230	.132 0.164	.152 0.156	.258 0.123	.165 0.151	.149 0.158	.001 0.357	.460 0.081	.000 0.543
	A/GI	.536 0.067	.118 0.169	.843 0.022	.668 -0.047	.533 0.068	.830 0.024	.159 0.152	.923 -0.010	.001 0.345
	B/SS	.000 0.385	.001 0.348	.003 0.320	.185 0.143	.005 0.299	.005 0.302	.002 0.332	.065 0.199	.032 0.230
	C/SD	.183 0.144	.076 0.192	.063 0.201	.051 0.210	.048 0.213	.101 0.178	.000 0.386	.653 0.049	.000 0.369
	D/SDy	.971 -0.004	.897 -0.014	.464 -0.080	.512 -0.071	.311 -0.110	.585 0.060	.111 0.172	.462 -0.080	.045 0.215
	E/A-D	.007 0.288	.092 0.182	.203 0.138	.625 0.053	.830 0.023	.658 0.048	.043 0.217	.174 0.147	.000 0.419
	F/SDe	.342 0.103	.517 0.070	.189 0.142	.016 0.258	.204 0.137	.284 0.117	.057 0.205	.586 0.059	.000 0.528
GHQ-40-59 (*n*= 93)	Total	.358 0.099	.001 0.336	.001 0.336	.001 0.348	.006 0.291	.314 0.108	.001 0.347	.045 0.213	.000 0.479
	A/GI	.956 0.006	.069 0.194	.108 0.171	.029 0.231	.130 0.162	.981 -0.002	.119 0.166	.066 0.196	.001 0.357
	B/SS	.318 0.107	.018 0.251	.014 0.259	.013 0.263	.000 0.377	.003 0.308	.000 0.435	.384 0.093	.032 0.228
	C/SD	.398 0.091	.014 0.261	.034 0.225	.036 0.223	.022 0.243	.814 0.025	.028 0.233	.499 0.208	.039 0.219
	D/SDy	.259 0.121	.015 0.258	.021 0.244	.011 0.269	.271 0.118	.929 0.010	.029 0.232	.029 0.231	.000 0.405
	E/A-D	.469 0.078	.008 0.278	.003 0.310	.012 0.265	.016 0.254	.513 0.070	.033 0.226	.073 0.191	.000 0.395
	F/SDe	.355 0.099	.010 0.273	.003 0.309	.000 0.374	.093 0.179	.070 0.193	.003 0.307	.265 0.119	.000 0.497
GHQ-60… (*n*= 75)	Total	.127 0.183	.051 0.233	.006 0.325	.039 0.247	.368 0.109	.135 0.181	.002 0.369	.435 0.095	.001 0.391
	A/GI	.163 0.167	.049 0.235	.053 0.231	.084 0.208	.342 0.115	.392 0.104	.010 0.304	.251 0.139	.000 0.499
	B/SS	.251 0.138	.106 0.193	.004 0.341	.194 0.157	.331 0.118	.025 0.268	.001 0.404	.652 0.055	.067 0.220
	C/SD	.793 -0.032	.118 0.187	.227 0.145	.020 0.277	.178 0.163	.236 0.144	.059 0.227	.492 0.084	.658 0.054
	D/SDy	.145 0.175	.141 0.177	.116 0.188	.103 0.196	.865 0.021	.963 -0.006	.013 0.294	.473 0.087	.010 0.305
	E/A-D	.723 0.043	.480 0.085	.022 0.273	.304 0.125	.154 0.172	.018 0.282	.014 0.292	.990 -0.002	.001 0.402
	F/SDe	.102 0.196	.404 0.101	.025 0.266	.096 0.200	.820 -0.028	.414 0..099	.165 0.168	.471 0.088	.044 0.241

Notes: Cardio= Cardiovascular system; CMI= Cornell Medical Index; Diges= Digestive system; E/E= Eyes & ears; Fatig= Fatigability; Gen-uri= Genitourinary system; GHQ= General Health Questionnaire-30 (A/GI= General Illness; B/SS= Somatic Symptom; C/SD= Sleep Disturbance; D/SDy= Social Dysfunction; E/A-D= Anxiety and Dysphoria; F/SDe= Suicidal Depression; Total= Total score); Muscul= Musculo skeletal system; Nerv= Nervous system; Respi= Respiratory system.

DISCUSSION

Our findings confirmed that psychological factors play a crucial role in influencing various physical symptoms, the results show a significant correlation between CES-D and STAI scores with the CMI physical symptom scores. Specifically, as depression levels (indicated by CES-D scores) increased, all categories of physical symptoms showed a significant uptick. Similarly, heightened levels of both state and trait anxiety led to significant increases across all physical symptom categories.

When examining the total GHQ score, which offers a more comprehensive assessment of mental health, and its subscales, we found significant correlations with the respiratory, cardiovascular, digestive, and nervous system scores across all GHQ-30 subscales. This finding aligns with previous research (Asamoah & Dei-Asamoa, 2022; Person & Keefer, 2021; Tegethoff, Stalujanis, Belardi, & Meinlschmidt, 2016),

underscoring the significant role played by these symptoms in somatization and the development of anxiety and dysphoria. Further, sleep disturbances were notably linked to musculoskeletal issues, while suicidal depression was significantly associated with symptoms affecting the eyes/ears, skin, and genitourinary systems.

The connection between musculoskeletal disorders and sleep disturbances has been specifically observed in nurses (Hämmig, 2020). Yu *et alii* (2022) demonstrated that eyeball stimulation in rats could alleviate symptoms of depression and dementia, suggesting that transcorneal electrical stimulation, aimed at enhancing visual function, might also have antidepressant effects and reduce stress hormones, thereby mitigating depression. In the realm of the urogenital system, a link has been established between testosterone levels and depression in men, with 56% of individuals who exhibited borderline testosterone levels also showing signs of depression or depressive symptoms (Westley, Amdur, & Irwig, 2015). Moreover, stress-induced sympathetic activation of cardiovascular functions, a common mammalian stress response, underscores the intricate relationship between stress, mental health, and physical symptoms (Kataoka *et alii*, 2020).

Our findings underscored notable sex- and gender-based differences in the correlations within the skin, genitourinary systems, and eyes and ears CMI subscales. Basso *et alii* (2022) discovered that the highest incidences of comorbid psychological conditions occur in cases of skin diseases (13.39%), digestive diseases (20.71%), and musculoskeletal diseases (21.43%) among women. This pattern suggests a potential link to sex hormones, a theory supported by Luo, Wang, Liang, Hu, Li, and Jin (2013), who posited that sex hormones commonly explain behavioral and physiological differences. Additionally, Piérard, Charlier, Delvenne, Humbert, and Piérard-Franchimont (2014) highlighted that the biological distinctions between male and female skin are influenced by both hormonal differences and the varied social roles and statuses assigned to each sex. There is a consensus in the current literature that female life stages, as delineated by hormonal status, significantly impact disease risk, skin physiology, and overall quality of life (Piérard *et alii*, 2014).

Further, a previous report (Smith, Murack, & Ismail, 2023) described that the development and function of genitourinary organs were related to sex hormones, leading to the expectation that the items deemed significant on the GHQ subscales would differ between men and women because of the varied influence of sex hormones on mental health.

In terms of the GHQ subscales, all but the social dysfunction subscale was found to be significant for the eyes and ears subscales in men, whereas in women, no GHQ subscales showed a significant correlation. Within the CMI, the eyes and ears are grouped into a single subscale. Focusing on hearing, Nordvik, Heggdal, Brännström, and Aarstad (2021) reported that hearing loss could have severe psychological repercussions, though the exact mechanisms behind this remain unclear. Earlier studies have indicated sex-based differences in coping mechanisms for hearing loss (Nordvik *et alii*, 2021). Barker, Leighton, and Ferguson (2017) proposed that serious psychological issues can lead to hearing loss, with men potentially more vulnerable to psychological impacts on their auditory and visual systems. Carrim, Ahmed, and Taguri (2006) found a connection between stress and eye health in patients with acute uveitis, hinting at the possibility that stress affects male eyes differently.

The susceptibility to psychological issues varied across age groups, with the 40s to 50s age bracket showing more susceptibility compared with other groups. A marginal significant relationship was observed between GHQ outcomes and physical symptoms

among individuals aged 60 and above. This indicates that psychological difficulties may manifest as somatization more prominently in certain age groups.

Age-related differences in resilience and social support, as discussed by Zhang *et alii* (2022), suggest that middle-aged (26-44 years) and younger adults (18-25 years) exhibit lower resilience and perceived social support compared with the older age group (45 years and above). Ungar and Theron (2020) highlighted that an individual's psychological stress is influenced by their emotions, thoughts, and cultural resources.

These findings point to a complex interplay between a range of physical symptoms and mental health, with variations observed based on sex and age. Stress levels differ among individuals, and it is crucial to identify modifiable and common risk factors for sex-specific comorbidity patterns to enhance clinical care and prevention (Basso *et alii*, 2022). Moreover, there is a need for a transition from the prevalent disease-focused approach to a more personalized, patient-centered methodology (Luijks, Loeffen, Lagro-Janssen, van Weel, Lucassen, & Schermer 2012; van der Heide *et alii*, 2018; Van Weel & Schellevis, 2006; Zulman, Asch, Martins, Kerr, Hoffman, & Goldstein 2014). Such a patient-centered strategy for managing multi-comorbidity should incorporate a holistic, biopsychosocial perspective (Van Weel & Schellevis, 2006). In diagnosing diseases in primary care settings, a variety of factors must be considered.

This study faced several limitations, including the use of a self-constructed questionnaire administered at a single-center university hospital. Additionally, the participants were recruited from only one clinic. Consequently, the generalizability of our results should be interpreted with caution.

The findings of this study are exploratory and will serve as the basis for future confirmatory studies. We recommend that clinics conduct a comprehensive range of psychological assessments. Future studies should investigate different aspects of mental health using both quantitative and qualitative methods for a more nuanced understanding of mental health issues.

This study underscores the susceptibility of the respiratory, cardiovascular, digestive, and nervous systems to mental health complications. Additionally, we identified a significant linkage between mental health and the genitourinary system among women. The correlation between skin conditions and anxiety/suicidal depression emerges distinctly among women, attributed to psychological factors such as anxiety and depression. This research analyzed the connection between the total score of each CMI category and mental health.

Future investigations should concentrate on the interplay between mental health and physical symptoms. These studies should aim to determine whether physical symptoms vary in accordance with changes in mental health status during treatment or to conduct surveys that assess the modifications brought about by therapeutic intervention.

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