Breast Cancer Research and Treatment (2019) 176:519–533
https://doi.org/10.1007/s10549-019-05271-3

REVIEW

Global prevalence of depression among breast cancer patients: a systematic review and meta-analysis

Motahare Pilevarzadeh[1] · Mehrbanoo Amirshahi[2] · Roghaiyeh Afsargharehbagh[3] · Hosein Rafiemanesh[4] · Seyed-Mehdi Hashemi[5] · Abbas Balouchi[6]

Received: 25 April 2019 / Accepted: 4 May 2019 / Published online: 13 May 2019

Abstract

Purpose Depression in patients with breast cancer imposes huge costs to patients, families, and healthcare systems. The present study aimed at evaluating the global prevalence depression among patients with breast cancer.

Methods In this meta-analysis, three electronic databases (PubMed, Web of Science, and Scopus) were searched from 1 January, 2000 until 30 March, 2019. The Hoy tool was used to evaluate the quality of the articles included in the meta-analysis. The search, screening, quality evaluation, and data extraction were carried out by two of the researchers.

Results Of 47,424 studies, 72 studies performed in 30 countries entered the final stage of analysis. The global prevalence of depression was 32.2%. Specifically, the prevalence of depression was highest in the Eastern Mediterranean region and twice as high in middle-income countries as compared to developed countries.

Conclusions Regarding the high prevalence of depression in patients with breast cancer, it is vital to carry out screening within standard time periods and offer the necessary emotional support.

Keywords Depression · Breast neoplasms · Systematic review · Meta-analysis

Introduction

Cancers are one of the most important challenges of health systems worldwide today. Breast cancer, the most common type of cancer among women, is the second most common type of cancer in the world. According to 2019 statistics, breast cancer has an incidence of 11.6% among all types of cancer, accounting for 6.5% of mortalities worldwide (626679) [1]. Also, as demonstrated by GLOBOCAN 2018, the incidence of breast cancer will increase from two million patients in 2018 to more than three million in 2046, showing a 46% increase [1, 2]. Owing to its untreatable nature and the long process of exposure to the disease, breast cancer imposes a great burden on patients as well as caregivers [3–5]. In addition, breast cancer involves huge costs for the healthcare system. Evidence suggests that the USA alone spends an annual sum of more than $16 million on breast cancer treatment [5]. Considering the different treatments of breast cancer and the long-term exposure to the disease, patients with psychological symptoms such as depression experience stress, which can reduce their quality of life [6, 7]. Depression is one of the most common psychiatric symptoms in patients with breast cancer. However, if breast cancer is diagnosed and treated in time, patients' quality of life and their disease prognosis can be improved [8, 9]. Individual studies show a high degree of depression in cancer patients [10, 11]. However, previous reviews have been performed on a specific type of breast cancer (metastatic

✉ Seyed-Mehdi Hashemi
hadismast@gmail.com

1 Department of Nursing Education, Nursing and Midwifery School, Jiroft University of Medical Sciences, Jiroft, Iran

2 Midwifery Department, Zabol University of Medical Sciences, Zabol, Iran

3 Department of Cardiology, Shohada Hospital, Urmia University of Medical Science, Urmia, Iran

4 Student Research Committee, Department of Epidemiology, School of Public Health and Safety, Shahid Beheshti University of Medical Sciences, Tehran, Iran

5 Clinical Immunology Research Center, Department of Internal Medicine, Hematology and Medical Oncology Ward, Ali-Ebne-Abitalelb Hospital, Zahedan University of Medical Sciences, Zahedan, Iran

6 Student Research Committee, Nursing and Midwifery School, Iran University of Medical Sciences, Tehran, Iran

breast cancer) [12], and there has been a lack of a global perspective. Determining the exact prevalence of depression in various parts of the world can help policymakers in each country design better preventive plans. Therefore, this study has been conducted to fill this epidemiological gap by investigating the prevalence of depression in patients with breast cancer around the world.

Methods

Eligibility criteria

The methods adopted for this systematic review are consistent with the guidelines of the Preferred Reporting Items for Systematic Reviews and Meta-Analyses and Cochrane Handbook [13]. The inclusion criteria were studies that (1) were performed on patients with known breast cancer, (2) used standard tools, and (3) were published in English. Exclusion criteria were studies that (1) were published in languages other than English, (2) took the form of reviews, letters to the editor, and brief communications, (3) were performed on patients with cancers other than breast cancer, (4) had a high risk of bias, and (5) lacked full text and for which the required information was not found in the abstracts.

Search strategy

Searches were conducted with the help of a librarian specializing in health academic resources. The search strategy was implemented using the MESH keywords and free words according to the PRESS standard. Keywords include (Prevalence OR Incidence OR frequency) AND (Breast cancer OR Breast neoplasm) AND (depression). Three databases included PubMed, Web of Science, and Scopus were searched from 1 January, 2000 until 30 March, 2019. The search strategy was finalized at PubMed and then modified to include other databases. The PROSPERO database was also searched for similar ongoing studies.

Selection of studies and data extraction

Two researchers independently screened the titles and abstracts for eligibility. The full text was then reviewed to confirm that eligibility criteria were met and for extraction of requisite information, which included basic information (first author, year of publication and country, questioner, design, participants, sampling method, region based on WHO classification (African, Americas, South-East Asia, European, Eastern Mediterranean (EMRO), and Western Pacific Region) [14], sociodemographic index (SDI) status based on world bank classification (low SDI, lower-middle SDI, upper-middle SDI, high SDI) [15], risk of bias, instrument, and age), and outcome measures (prevalence of depression).

Quality assessment

To assess the risk of bias of included studies, Hoy critical appraisal checklist was used [16]. This 10-item checklist evaluates the quality of studies along two dimensions: external validity (items 1–4 assess target population, sampling frame, sampling method, and minimal non-response bias) and internal validity (items 5–9 assess data collection method, case definition, study instrument, and mode of data collection). Item 10 assesses bias related to the analysis. Each study was evaluated for risk of bias by two independent project researchers with disagreements resolved through consensus.

Data analysis

All the eligible studies were included in the synthesis after a systematic review. Data were combined with the forest plot. The prevalence of depression was evaluated by random-effects model. The heterogeneity of the preliminary studies was evaluated with I^2 Cochrane test. Sub-group analysis was conducted to determine heterogeneity based on the age, publication year and regions of WHO. Meta-analysis was performed using STATA 14 statistical software.

Results

Study selection

A total of 6140 articles were retrieved from the initial search in different databases. Out of 4022 non-duplicate studies in the title and abstract screening process, 3901 studies were excluded due to unrelated titles or abstracts. Of the remaining 121 studies, 72 met the eligibility criteria. Of the 49 excluded studies, 11 were review articles, 4 were letters to the editor, 3 did not have full text, 22 were published in non-English language, and 9 did not meet the quality requirements for inclusion in the study (Fig. 1).

Study characteristics

Seventy-two studies out of the 47,424 conducted in 30 countries during the 2000–2019 period entered the final stage of analysis. The mean age of participants was 52.5 years. Most studies were performed in the USA ($n=14$) and Iran ($n=6$). The sampling method in most studies was consecutive ($n=42$) or census ($n=14$). According to the WHO classification of regions, most studies were conducted in Europe ($n=26$) and the Americas ($n=17$). More than 94% of studies

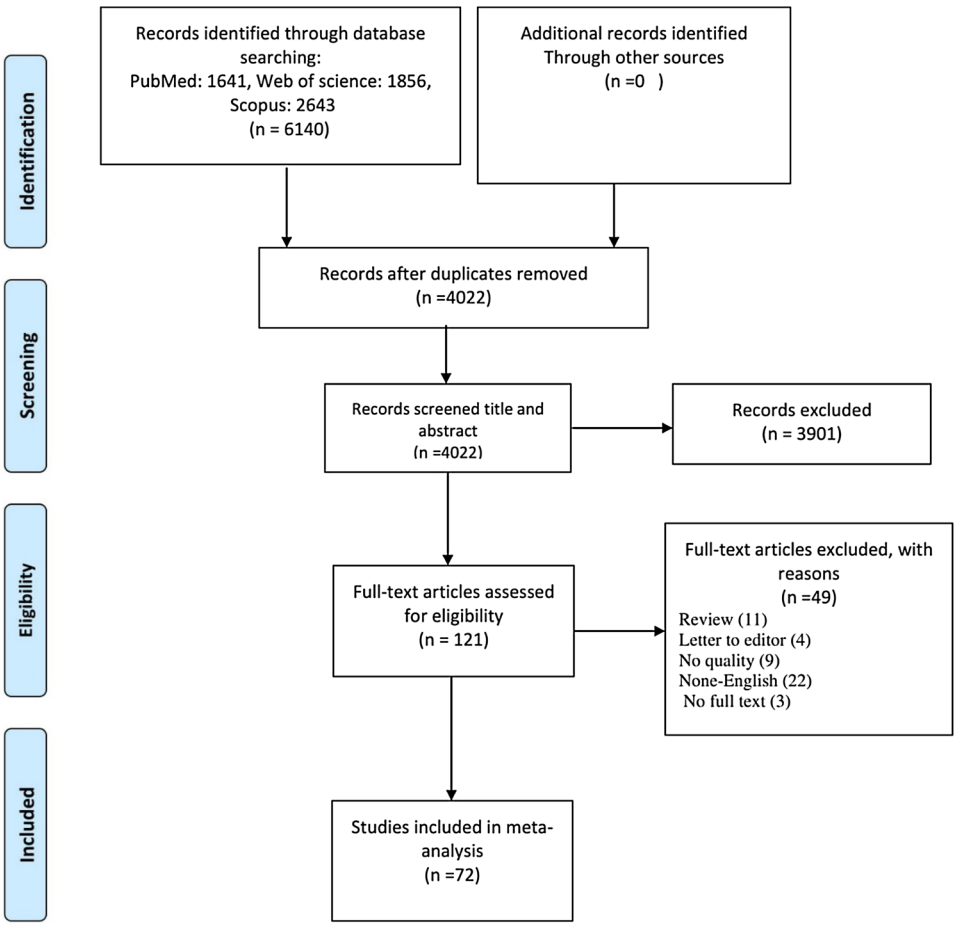

Fig. 1 PRISMA flow diagram

($n=68$) were conducted in middle to high-income countries in terms of SDI. With regard to instruments used, all the studies used standard questionnaires or interviews. All studies were descriptive in nature, and most ($n=66$) employed a cross-sectional design. The sample size was between 32 and 8461. Most studies ($n=71$) had a low risk of bias (Table 1).

Main results

Meta-analysis of depression

Seventy-two studies, using 16 assessment tools, reported on the prevalence of depression in patients with breast cancer. The overall prevalence of depression was assessed in 63 articles, with 7095 out of 44,075 patients reported to have depression (3.0–95.9%).

Based on the results of the random effects model, the global prevalence of depression was 32.2% (95% confidence interval (CI) 28.9, 35.4; $I^2=99.1\%$). Sub-group analysis based on WHO regions showed that the pooled prevalence of depression was the lowest in the Americas, Europe, and the Western Pacific and highest in the EMRO. The high prevalence of depression in the EMRO as compared with the Americas and Europe was statistically significant; the pooled prevalence of depression in the EMRO (51.5%; 95% CI 34.1, 68.9) was 2.1 times higher than the Americas (25.1%; 95% CI 20.3, 29.8) and 1.9 times higher than Europe (27.2%; 95% CI 23.3, 31.2) (Fig. 2).

In 23 studies, depression was categorized into two or three types (mild, moderate, or major) with six different tools. Mild or moderate depression was reported in 1524 out of 7176 patients, and the prevalence was between 8.1 and 89.2%. Major depression was reported in 807 out of 7176 patients, and the prevalence was between 1.8 and 69.4%. Globally, the pooled prevalence of mild or moderate depression was 28.9% (95% CI 21.9, 35.9; $I^2=98.2\%$) and major depression was 13.2% (95% CI 10.1, 16.3; $I^2=95.4\%$). Also, the high prevalence of major depression in the EMRO compared with the Americas was statistically significant; the pooled prevalence in the EMRO (26.3%; 95% CI 13.0, 39.6) was 12.5 times higher than the Americas (2.5%; 95% CI 1.0, 4.0) (Table 2).

Sixty-three studies conducted in 29 countries reported on the prevalence of depression of varying levels of severity. There was more than one study conducted in 12 countries. Sub-group analysis based on these 12 countries showed that

Table 1 Demographic characteristics of the Included Studies

ID	Author	Year	Country	Sampling method	WHO Region	SDI status	Instrument	Design	Participants	Risk of bias
1	Ahmed, A. E. [17]	2018	Saudi Arabia	Convenience	EMRO	High SDI	DASS-21	Cross-sectional	125	Low
2	Akel, R. [18]	2017	Lebanon	Census	EMRO	Upper-middle SDI	HADS	Cross-sectional	150	Low
3	Alacacioglu, A. [19]	2009	Turkey	Census	European	Upper-middle SDI	BDI-21	Cross-sectional	55	Low
4	Alacacioglu, A. [20]	2014	Turkey	Census	European	Upper-middle SDI	HADS	Cross-sectional	100	Low
5	Ardebil, M. D. [21]	2013	Iran	Consecutive	EMRO	Upper-middle SDI	BDI-21	Cross-sectional	60	Low
6	Aukst-Margetic, B. [22]	2005	Croatia	Census	European	High SDI	CES-D-20	Cross-sectional	115	Low
7	Bener, A. [23]	2017	Qatar	Census	EMRO	High SDI	BDI-21	Cross-sectional	678	Low
8	Brunault, P. [8]	2016	France	Census	European	High SDI	MINI	Cross-sectional	120	Low
9	Carlson, L. E. [24]	2007	Canada	Consecutive	Americas	High SDI	CES-D-20	Cross-sectional	33	Low
10	Chang, H. A. [25]	2019	USA	Consecutive	Americas	High SDI	BSI-18	Cross-sectional	110	Low
11	Chang, H. Y. [26]	2015	South Korea	Census	Western Pacific	High SDI	PHQ 9	Cross-sectional	2244	Low
12	Chen, X. [27]	2009	China	Consecutive	Western Pacific	Upper-middle SDI	CES-D-20	Cross-sectional	1400	Low
13	Christensen, S. [28]	2009	Denmark	Consecutive	European	High SDI	BDI-21	Prospective cohort	3321	Low
14	Christie, K. M. [29]	2010	USA	Consecutive	Americas	High SDI	CES-D-10	Longitudinal study	677	Low
15	Couillet, A. [30]	2015	France	Consecutive	European	High SDI	BDI-21	Cross-sectional	70	Low
16	Cvetković, J. [31]	2016	Serbia	Consecutive	European	Upper-middle SDI	BDI-21	Cross-sectional	84	Low
17	De Medeiros, M. C. L. [32]	2010	Brazil	Consecutive	Americas	Upper-middle SDI	BDI-21	Cross-sectional	75	Low
18	De Souza, B. F. [33]	2014	Brazil	Convenience	Americas	Upper-middle SDI	BDI-21	Cross-sectional	112	Low
19	Dujmović, A. [34]	2017	Croatia	Convenience	European	High SDI	BDI-21	Cross-sectional	100	Low
20	Eskelinen, M. [35]	2011	Finland	Consecutive	European	High SDI	BDI-21	Cross-sectional	34	Low
21	Fafouti, M. [36]	2010	Greece	Simple random	European	High SDI	MADRS	Cross-sectional	109	Low
22	Galloway, S. K. [37]	2012	USA	Consecutive	Americas	High SDI	CES-D-10	Cross-sectional	60	Low
23	Geyikci, R. [38]	2018	Turkey	Consecutive	European	Upper-middle SDI	BDI-21	Cross-sectional	94	Low
24	Hegel, M. T. [39]	2006	USA	Census	Americas	High SDI	PHQ-9	Cross-sectional	236	Low
25	Hill, J. [40]	2011	United Kingdom	Convenience	European	High SDI	other	Cross-sectional	260	Low
26	Ho, S. S. [41]	2013	China	UK	Western Pacific	Upper-middle SDI	HADS	Cross-sectional	417	Low
27	Hopwood, P. [42]	2010	United Kingdom	Consecutive	European	High SDI	HADS	Cross-sectional	2208	Low
28	Huang, C. Y. [43]	2010	Taiwan	Census	South-East Asia	High SDI	CES-D-20	Cross-sectional	150	Low
29	Jang, J. E. [44]	2013	South Korea	Consecutive	Western Pacific	High SDI	HADS	Cross-sectional	284	Low
30	Jimenez-Fonseca, P. [45]	2018	Spain	Consecutive	European	High SDI	BSI-18	Cross-sectional	202	Low
31	Jones, S. M. [46]	2015	USA	Consecutive	Americas	High SDI	CESD-SF-6	Cross-sectional	6949	Low
32	Kalender, M. [47]	2014	Turkey	Consecutive	European	Upper-middle SDI	HADS	Cross-sectional	122	Low
33	Karakoyun-Celik, O. [48]	2010	Turkey	Census	European	Upper-middle SDI	BDI-21	Cross-sectional	120	Low
34	Kim, S. Y. [49]	2012	South Korea	Consecutive	Western Pacific	High SDI	MINI	Cross-sectional	335	Low
35	Kovács, Z. [50]	2011	india	Convenience	South-East Asia	Lower-middle SDI	PHQ-9	Cross-sectional	267	Low

Table 1 (continued)

ID	Author	Year	Country	Sampling method	WHO Region	SDI status	Instrument	Design	Participants	Risk of bias
36	Kyranou, M. [51]	2013	USA	Consecutive	Americas	High SDI	CES-D-20	Cross-sectional	390	Low
37	Lee, M. K. [52]	2011	South Korea	Simple random	Western Pacific	High SDI	SDS	Prospective cohort	286	Low
38	Linden, W. [53]	2012	Canada	Consecutive	Americas	High SDI	other	Cross-sectional	2250	Moderate
39	Lueboonthavatchai, P. [54]	2007	Thailand	Consecutive	South-East Asia	Upper-middle SDI	HADS	Cross-sectional	300	Low
40	Marijanovic, I. [55]	2017	Croatia	Consecutive	European	High SDI	HDRS	Cross-sectional	403	Low
41	Mashhadi, M. A. [56]	2013	Iran	Census	EMRO	Upper-middle SDI	BDI-21	Cross-sectional	42	Low
42	Mhaidat, N. M. [57]	2009	Jordan	Simple random	EMRO	Upper-middle SDI	HADS	Cross-sectional	41	Low
43	Milbury, K. [58]	2013	USA	Consecutive	Americas	High SDI	CES-D-20	Cross-sectional	201	Low
44	Miura, K. [59]	2016	Japan	Consecutive	Western Pacific	High SDI	SRQ-D	Cross-sectional	93	Low
45	Montazeri, A. [60]	2001	Iran	Consecutive	EMRO	Upper-middle SDI	HADS	Cross-sectional	56	Low
46	Montazeri, A. [61]	2000	Iran	Census	EMRO	Upper-middle SDI	HADS	Cross-sectional	151	Low
47	Montazeri, A. [62]	2005	Iran	Consecutive	EMRO	Upper-middle SDI	HADS	Cross-sectional	177	Low
48	Ng, G. C. [63]	2017	Malaysia	Consecutive	South-East Asia	Upper-middle SDI	HADS	Cross-sectional	114	Low
49	Ollonen, P. [64]	2005	Finland	Census	European	High SDI	BDI-21	Cross-sectional	34	Low
50	Park, B. [65]	2017	South Korea	Consecutive	Western Pacific	High SDI	ICD-10	Cross-sectional	3120	Low
51	Park, E. M. [66]	2018	USA	Consecutive	Americas	High SDI	HADS	Prospective cohort	54	Low
52	Popoola, A. O. [67]	2012	Nigeria	Systematic Random	African	Lower-middle SDI	MINI	Cross-sectional	124	Moderate
53	Puigpinos-Riera, R. [68]	2018	Spain	Convenience	European	High SDI	HADS	Cohort	2235	Low
54	Purkayastha, D. [69]	2017	India	Convenience	South-East Asia	Lower-middle SDI	PHQ-9	Cross-sectional	267	Low
55	Reece, J. C. [70]	2013	USA	Consecutive	Americas	High SDI	PHQ-9	Cross-sectional	32	Low
56	Reuter, K. [71]	2006	Germany	Convenience	European	High SDI	HADS	Cross-sectional	353	Low
57	Saboonchi, F. [72]	2014	Sweden	Consecutive	European	High SDI	HADS	Prospective cohort	715	Low
58	Schleife, H. [73]	2014	Germany	Consecutive	European	High SDI	HADS	Cross-sectional	107	Low
59	Shakeri, J. [74]	2016	Iran	Available	EMRO	Upper-middle SDI	BDI-21	Cross-sectional	98	Low
60	Sharma, A. [75]	2015	Nepal	Available	South-East Asia	Low SDI	HADS	Cross-sectional	120	Low
61	Sheppard, V. B. [76]	2013	USA	Consecutive	Americas	High SDI	BDI-13	Cross-sectional	76	Low
62	Slovacek, L. [77]	2009	Czech Republic	Convenience	European	High SDI	ZSDS	Cross-sectional	41	Low
63	So, W. K. [78]	2010	China	Consecutive	Western Pacific	Upper-middle SDI	HADS	Cross-sectional	218	Low
64	Stafford, L. [79]	2013	Australia	Consecutive	Western Pacific	High SDI	CES-D-20	Cross-sectional	101	Low
65	Stanton, A. L. [80]	2015	USA	Consecutive	Americas	High SDI	CES-D-20	Cross-sectional	309	Low
66	Steiner, J. L. [81]	2014	USA	Census	Americas	High SDI	CES-D-20	Cross-sectional	54	Low
67	Su, J. A. [82]	2017	Taiwan	Consecutive	South-East Asia	High SDI	MINI	Cross-sectional	300	Low
68	Tsaras, K. [83]	2018	Greece	Simple random	European	High SDI	PHQ-2	Cross-sectional	152	Low
69	Vin-Raviv, N. [84]	2015	USA	Simple random	Americas	High SDI	ICD-10	Cross-sectional	4164	Low
70	Walker, J. [85]	2014	United Kingdom	Convenience	European	High SDI	HADS	Cross-sectional	8461	Low

Table 1 (continued)

ID	Author	Year	Country	Sampling method	WHO Region	SDI status	Instrument	Design	Participants	Risk of bias
71	Wu, S. M. [86]	2014	USA	Convenience	Americas	High SDI	CES-D-20	Cross-sectional	227	Low
72	Zhang, J. [87]	2018	China	Convenience	Western Pacific	Upper-middle SDI	SDS	Cross-sectional	82	Low

NR none report, *DASS-21* Depression Anxiety and Stress Scales, *HADS* hospital anxiety and depression scale, *BDI-21* Beck Depression Inventor, *CES-D-20* Center for Epidemiologic Studies Depression Scale, *MINI* Mini International Neuropsychiatric Interview, *BSI-18* Brief Symptom Inventory, *PHQ 9* Patient Health Questionnaire-9, *MADRS* The Montgomery–Åsberg Depression Rating Scale, *SDS* Self-Rating Depression Scale (SDS), *SRQ-D* Self-Rating Questionnaire for Depression, *ZSDS* Zung Self-Rating Depression Scale

the pooled prevalence of depression of any severity level was the lowest in the UK (8.9%; 95% CI 3.6, 14.3) and highest in Iran (57.1%; 95% CI 31.6, 82.6) Fig. 3.

Of all the included studies, 46 were conducted in high-SDI countries, 23 in upper-middle SDI countries, three in lower-middle SDI countries, and one in a low-SDI country based on GDP. Sub-group analysis based on SDI showed that the pooled prevalence of depression in middle-SDI countries (42.4% 95% CI 32.2, 52.6) was 1.8 times higher than in high-SDI countries (24.1% 95% CI 21.5, 26.7), and this difference was significant.

Meta-analysis based on depression mean score

Depression mean score was reported in 11 tools of them, HADS, CESD-20 and BDI-21 have used in more than one study. Depression mean score in 7 studies with HADS assessment tools was reported between 3.6 and 11.3. Pooled mean score for HADS in 905 patients based on random effects model was 6.1 (95%CI 3.8, 8.3). Depression mean score in 8 studies with CESD-20 assessment tools was reported between 6.1 and 15.6. Pooled mean score for CESD-20 in 1216 patients based on random effects model was 12.1 (95%CI 8.4, 15.8). Depression mean score in 7 studies with BDI-21 assessment tools was reported between 4.0 and 25.1. Pooled mean score for BDI-21 in 4394 patients based on random effects model was 11.9 (95%CI 4.8, 19.1) (Table 3).

Meta-regression finding

The results of meta-regression analyses showed publication year of study variable not significantly contributed to heterogeneity of any severity depression prevalence by WHO regions. However, the trend of prevalence in Americas and Western pacific regions was negative and for other regions was positive (Fig. 4). But there was a marginally significant to explain any severity depression prevalence variation by age mean in the world (Coef. = − 1.0% (95% CI: 2.1, 0.08), Adj R-squared = 5.93%, *P* value = 0.069). As the age increases, the prevalence of depression decreases (Fig. 5).

Discussion

Today, psychiatric symptoms impose a high caregiving burden and result in high healthcare costs. Depression is one of the most common mental disorders among patients with breast cancer. Accordingly, this systematic review and meta-analysis was conducted to determine the global prevalence of depression among patients with breast cancer. A total of 72 out of 47424 studies conducted in 30 countries between January 1, 2000 and March 30, 2019 entered the

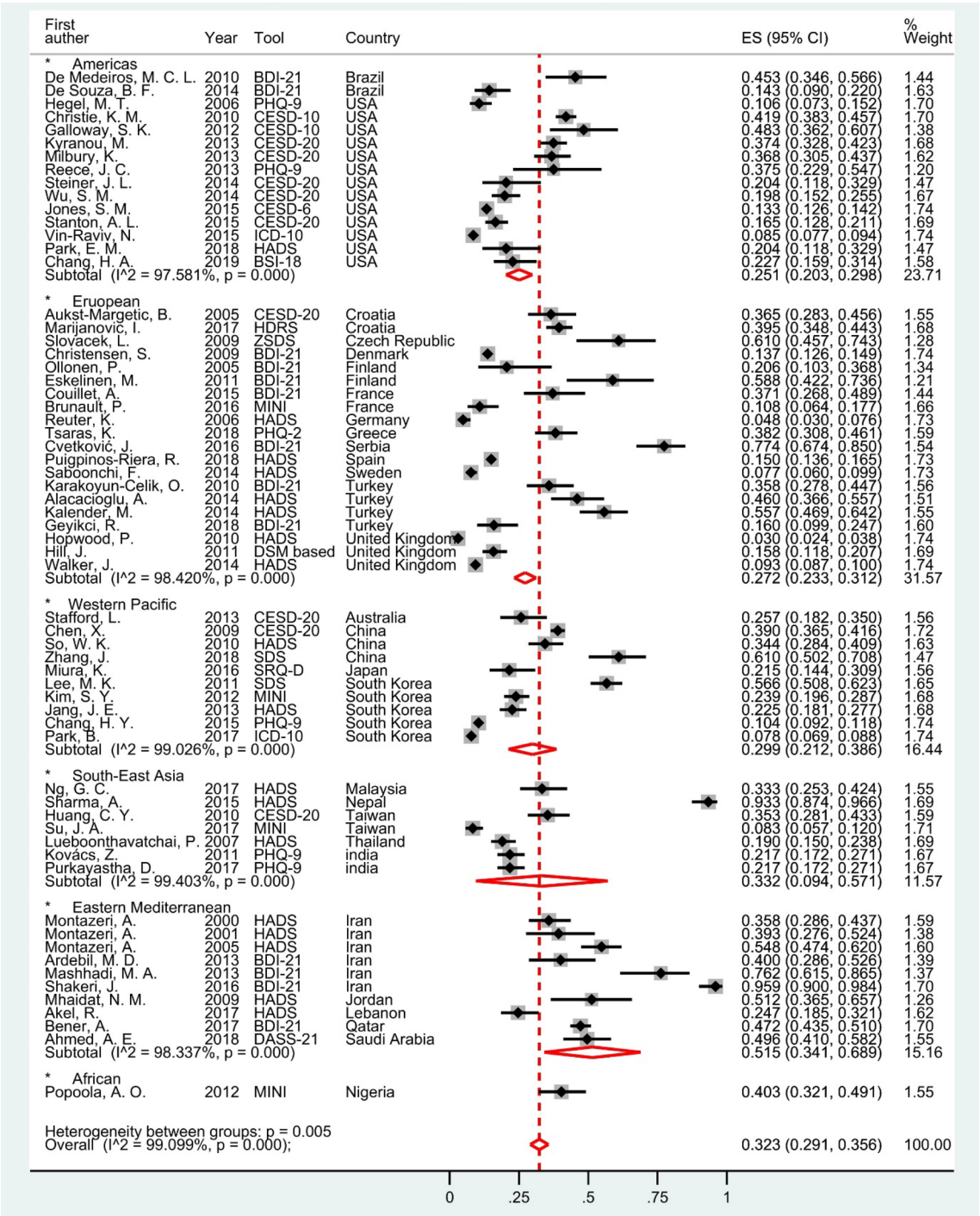

Fig. 2 Global prevalence of depression based-on random effects model among breast cancer patients based on WHO regions

final stage of the meta-analysis. All studies were conducted using standard instruments. While a 2014 review, which included 43 studies conducted on a total of 11,182 people by 2011 [88], reported a global depression prevalence of 32.2% (1.8–89.2%) in patients with breast cancer, consistent with Hotopf's study, which indicated a 29% increase in depression among cancer patients [89], it was inconsistent with previous two studies carried out in different years 2014 and 2011, which showed a depression prevalence of 11–20%, [90], and 14.1% [88] in patients with breast cancer, which indicates an increase in the depression level in recent years [91].

Previous studies have shown the overall prevalence of depression in patients with a variety of cancers to be 13%

Table 2 Global prevalence of different level of severity of depression among breast cancer patients based on the WHO regions

WHO regions First author (year)	Country	Assessment tools	Mild depression	Moderate depression	Mild or moderate depression	Major depression
Americas						
De Souza, B.F. (2014) [33]	Brazil	BDI-21		12.5 (7.6, 19.9)	12.5 (7.6, 19.9)	1.8 (0.5, 6.3)
De Medeiros, M.C.L. (2010) [32]	Brazil	BDI-21	24.0 (15.8, 34.8)	16.0 (9.4, 25.9)	40.0 (29.7, 51.3)	5.3 (2.1, 12.9)
Hegel, M.T. (2006) [39]	USA	PHQ-9	4.2 (2.3, 7.6)	3.8 (2.0, 7.1)	8.1 (5.2, 12.2)	2.5 (1.2, 5.4)
Sub-group random pooled ES			5.5 (3.1, 8.0)	10.1 (2.1, 18.1)	19.1 (5.3, 32.9)	2.5 (1.0, 4.0)
European						
Puigpinos-Riera, R. (2018) [68]	Spain	HADS		9.2 (8.1, 10.5)	9.2 (8.1, 10.5)	5.8 (4.9, 6.8)
Marijanovic, I. (2017) [55]	Croatia	HDRS	25.8 (21.8, 18.4)	6.7 (4.6, 9.6)	32.5 (28.1, 37.2)	6.9 (4.9, 9.9)
Cvetković, J. (2016) [31]	Serbia	BDI-21	7.1 (3.3, 14.7)	67.9 (57.3, 76.9)	75.0 (64.8, 83.0)	2.4 (0.7, 8.3)
Couillet, A. (2015) [30]	France	BDI-21		20.0 (12.3, 30.8)	20.0 (12.3, 30.8)	17.1 (10.1, 27.6)
Kalender, M. (2014) [47]	Turkey	HADS		30.3 (22.9, 39.0)	30.3 (22.9, 39.0)	25.4 (18.5, 33.8)
Eskelinen, M. (2011) [35]	Finland	BDI-21	32.4 (19.1, 49.2)	11.8 (4.7, 26.6)	44.1 (28.9, 60.5)	14.7 (6.4, 30.1)
Karakoyun-Celik, O. (2010) [48]	Turkey	BDI-21		16.7 (11.1, 24.3)	16.7 (11.1, 24.3)	19.2 (13.1, 27.1)
Aukst-Margetic, B. (2005) [22]	Croatia	CESD-20	11.3 (6.7, 18.4)	7.8 (4.2, 14.2)	19.1 (13.0, 27.3)	17.4 (11.5, 25.3)
Sub-group random pooled ES			18.0 (7.1, 28.9)	20.3 (13.0, 27.5)	30.4 (17.3, 43.6)	12.2 (8.1, 16.2)
Western pacific						
Zhang, J. (2018) [87]	China	SDS	42.7 (32.5, 53.5)	14.6 (8.6,23.9)	57.3 (46.5, 67.5)	3.7 (1.3, 10.2)
Chen, X. (2009) [27]	China	CESD-20		26.0 (23.8, 28.4)	26.0 (23.8, 28.4)	13.0 (11.3, 14.9)
Sub-group random pooled ES				25.1 (22.9, 27.3)	27.4 (25.1, 29.6)	11.5 (9.9, 13.1)
South-East Asia						
Purkayastha, D. (2017) [69]	India	PHQ-9	6.4 (4.0, 10.0)	7.1 (4.6, 10.8)	13.5 (9.9, 18.1)	8.2 (5.5, 12.2)
Sharma, A. (2015) [75]	Nepal	HADS	29.2 (21.8, 37.8)	60.0 (51.1, 68.3)	89.2 (82.3, 93.6)	4.2 (1.8, 9.4)
Kovács, Z. (2011) [50]	India	PHQ-9	6.4 (4.0, 10.0)	14.6 (10.9, 19.3)	17.6 (13.5, 22.6)	4.1 (2.3, 7.2)
Sub-group random pooled ES			12.7 (4.3, 21.2)	26.7 (5.3, 48.2)	40.0 (0.0, 83.9)	5.4 (2.8, 8.0)
Eastern Mediterranean						
Bener, A. (2017) [23]	Qatar	BDI-21		27.7 (24.5, 31.2)	27.7 (24.5, 31.2)	19.5 (16.7, 22.6)
Akel, R. (2017) [18]	Lebanon	HADS	13.3 (8.8, 19.7)	6.7 (3.7, 11.8)	20.0 (14.4, 27.1)	4.7 (2.3, 9.3)
Shakeri, J. (2016) [74]	Iran	BDI-21	8.2 (4.2, 15.3)	18.4 (11.9, 27.2)	26.5 (18.8, 36.0)	69.4 (59.7, 77.6)
Montazeri, A. (2005) [62]	Iran	HADS		25.4 (19.6, 32.3)	25.4 (19.6, 32.3)	29.4 (23.2, 36.5)
Montazeri, A. (2001) [60]	Iran	HADS		25.0 (15.5, 37.7)	25.0 (15.5, 37.7)	14.3 (7.4, 25.7)
Montazeri, A. (2000) [61]	Iran	HADS		13.2 (8.7, 19.6)	13.2 (8.7, 19.6)	22.5 (16.6, 29.8)
Sub-group random pooled ES			10.7 (6.9, 14.6)	19.2 (10.8, 27.6)	22.8 (17.5, 28.1)	**26.3 (13.0, 39.6)**
African						
Popoola, A. O. (2012) [67]	Nigeria	MINI		23.4 (16.8, 31.6)	23.4 (21.9, 35.9)	16.9 (11.4, 24.5)
Overall random pooled ES			16.2 (10.9, 21.5)	19.6 (15.2, 24.0)	28.9 (21.9, 35.9)	13.2 (10.1, 16.3)

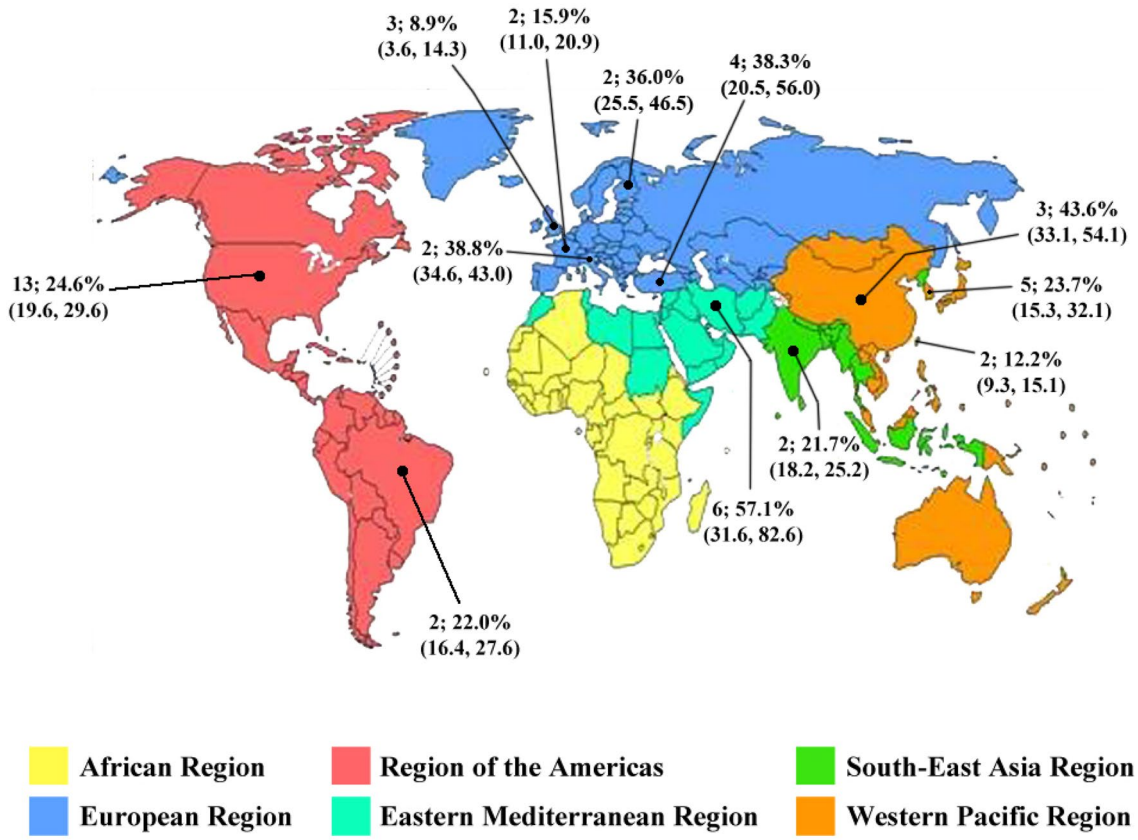

Fig. 3 Number of studies conducted and pooled prevalence of depression (95% CI) among breast cancer patients by countries based on WHO regions

[90], 16% [92]. Possible reasons for the difference from the present study may be the variations in the characteristics of the studies included and the fact that only those published by 2001 had been included in previous analyses, whereas the present analysis included about 47 new studies. In previous studies, databases other than the ones searched in the present study were also used. Another reason can be the type of instruments used to measure depression in two studies. Massie's (2014) study showed a depression prevalence of 1-46%, which was higher than the current study [93]; such a difference could have been due to differences in methodology.

Similar to the current study, although there was a similar type of cancer, there was a wide variance in the prevalence of depression, which could have been due to the different disease stages and treatment strategies. There is also evidence that the depression rate in caregivers of cancer patients, including those with breast cancer, is 42.5% that is higher, which can be due to the high caregiving burden of families as the main source of support for patients. Also, the time and effort invested by caregivers, which draws on their financial, spiritual, and emotional resources, can reduce their quality of life and increase their level of depression [94, 95]. Evidence also suggests that the prevalence of depression is as follows in other cancers: prostate cancer (17.27%) [96], ovarian cancer (25.34%) [97], and lung cancer (13.1%) [98], all of which are lower than the prevalence of depression in patients with breast cancer in the present study. This may be owing to the psychological complications caused by breast cancer, the greater psychological impact of breast cancer on women, and their impaired body image [99–101].

The prevalence of major depression in the present study was 13.2%, higher than the global study in 2014 [102]. The prevalence of depression in the EMRO was higher than in other parts of the world. The results also showed that depression in middle-income countries is higher than higher-income countries, which is consistent with previous evidence suggesting the impact of socioeconomic factors on the treatment and improvement of psychological symptoms in cancer patients [102–105].

Determining the exact clinical prevalence of depression is very important since self-report instruments often show higher than actual depression rates owing to exaggerations by patients; in the case of structured interviews, if the interviewers are not adequately skilled, the reported rates can be lower than actual rates, increasing the incidence of depression left undiagnosed in patients [92]. The evidence also

Table 3 Meta-analysis of depression mean score in breast cancer patients in the World by assessment tools

Assessment tools First author (year)	Country	Mean (SD)	95% CI for effect size
HADS			
Park, E. M. (2018) [66]	USA	4.4 (3.5)	3.4, 5.4
Sharma, A. (2015) [75]	Nepal	11.3 (2.8)	10.8, 11.8
Schleife, H. (2014) [73]	Germany	4.4 (3.7)	3.7, 5.1
Ho, S. S. (2013) [41]	China	6.0 (4.0)	5.5, 6.5
Ho, S. S. (2013) [41]	China	3.6 (3.4)	3.1, 4.1
Montazeri, A. (2001) [60]	Iran	6.5 (3.8)	5.5, 7.5
Montazeri, A. (2000) [61]	Iran	6.2 (4.9)	5.4, 7.0
Overall random pooled ES		6.1	3.8, 8.3
CESD-20			
Steiner, J. L. (2014) [81]	USA	10.2 (6.9)	8.3, 12.0
Wu, S. M. (2014) [86]	USA	6.1 (3.7)	5.6, 6.6
Kyranou, M. (2013) [51]	USA	13.7 (9.7)	12.7, 14.7
Milbury, K. (2013) [58]	USA	14.5 (9.6)	13.2, 15.8
Stafford, L. (2013) [79]	Australia	13.8 (9.6)	11.9, 15.7
Huang, C. Y. (2010) [43]	Taiwan	15.6 (13.4)	13.4, 17.7
Carlson, L. E. (2007) [24]	Canada	11.2 (10.4)	7.6, 14.7
Overall random pooled ES		12.1	8.4, 15.8
BDI-21			
Geyikci, R. (2018) [38]	Turkey	10.6 (5.6)	9.5, 11.7
Bener, A. (2017) [23]	Qatar	25.1 (7.7)	24.5, 25.7
Dujmović, A. (2017) [34]	Croatia	10.1 (7.2)	8.7, 11.5
Couillet, A. (2015) [30]	France	4.0 (4.3)	3.0, 5.0
Alacacioglu, A. (2009) [19]	Turkey	13.0 (9.3)	10.5, 15.5
Christensen, S. (2009) [28]	Denmark	8.9 (7.4)	8.6, 9.1
Overall random pooled ES		11.9	4.8, 19.1
BSI-18			
Jimenez-Fonseca, P. (2018) [45]	Spain	63.2 (7.8)	62.1, 64.3
PHQ-2			
Tsaras, K. (2018) [83]	Greece	2.05 (1.7)	1.8, 2.3
SDS			
Lee, M. K. (2011) [52]	South Korea	41.4 (0.57)	41.3, 41.7
PHQ-9			
Reece, J. C. (2013) [70]	USA	6.5 (5.2)	4.7, 8.3
BDI-13			
Sheppard, V. B. (2013) [76]	USA	11.5 (5.0)	10.4, 12.6
CESD-10			
Galloway, S. K. (2012) [37]	USA	10.3 (5.8)	8.8, 11.7
Psychosocial Screen			
Linden, W. (2012) [53]	Germany	7.4 (3.3)	7.3, 7.5
MADRS			
Fafouti, M. (2010) [36]	Greece	13.4 (10.3)	11.6, 15.2

suggests that routine screening can be effective in detecting depression and other psychiatric disorders in patients with breast cancer [90, 92].

The limitations of this systematic review and meta-analysis were as follows: (1) All studies were descriptive that have their specific methodological limitations. (2) Most studies were conducted in high-income countries that limits the interpretation of results and generalization specific to low-income countries. (3) Only studies published in English were included. (4) Patients with breast cancer entered at various stages and the impact of the disease on depression was not considered. (5) Some studies did not provide the necessary

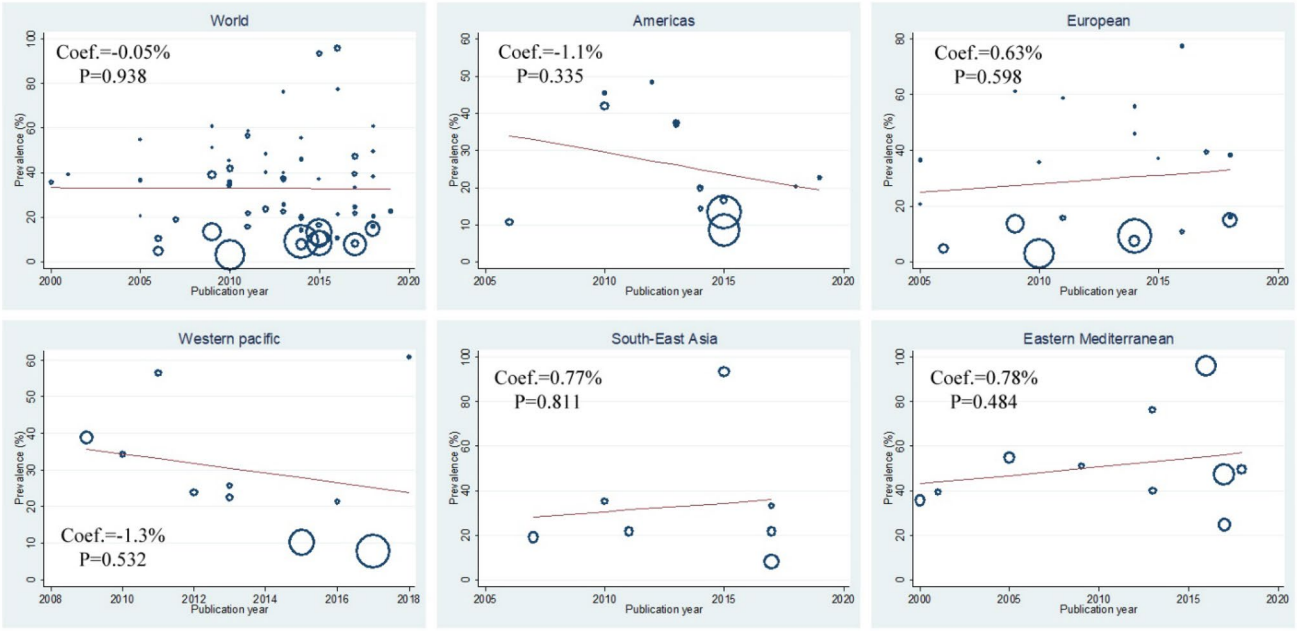

Fig. 4 Meta-regression between publication year of study and the prevalence depression by WHO regions

information and efforts were made to provide such information by contacting with the authors of such studies. (6) Another important limitation was high heterogeneity among the studies, and although the subgroup analysis was carried out, the heterogeneity level was still high. (7) It was not possible to investigate the impact of other demographic factors such as age, economic status, type of treatment, stage of the disease due to the unavailability of relevant information in most studies.

However, the study also had its strengths, which are as follows: (1) According to the authors' best knowledge, this is the first study that specifically investigates depression in patients with breast cancer during this period. (2) In this study, a systematic review and meta-analysis approach was used to determine the prevalence of depression. (3) The prevalence of depression was also investigated based on the economic level of countries (SDI). (4) The studies included have been evaluated for their methodological quality and only the studies with a low-medium risk were included. (5) The prevalence of depression was calculated based on various instruments examined.

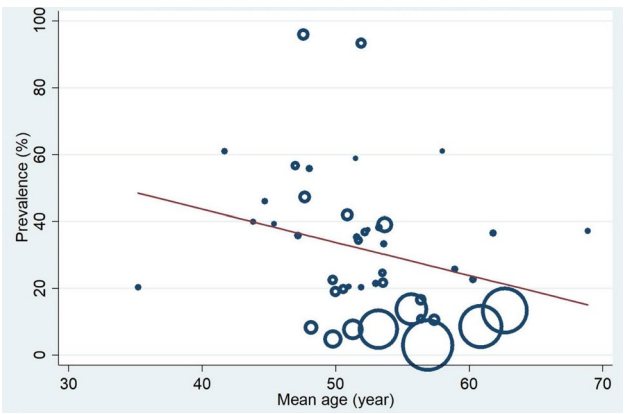

Fig. 5 Meta-regression between mean age of participants and global prevalence of depression

Conclusions

This meta-analysis study examined the prevalence of depression in patients with breast cancer. The results of the present study indicate a relatively high prevalence of depression in patients with breast cancer. The results of this study can help policymakers and health personnel determine the importance of timely diagnosis and treatment of depression. It is important to consider depression as an important risk factor affecting the daily lives of patients. It is essential to train healthcare personnel for proper depression screening and familiarity with its various treatments.

Compliance with ethical standards

Conflicts of interest All authors declare that they have no competing of interest.

Ethical approval This article does not contain any studies with human participants or animals performed by any of the authors.

Informed consent As this study was a systematic review and did not involve contact with patients or patient information, it was not applicable for informed consent to be obtained.

Research involving human participants and/or animals This article does not contain any studies with human participants or animals performed by any of the authors.

References

1. Observatory TGC (2018) GLOBOCAN. Breast Cancer 2019. http://gco.iarc.fr/today/data/factsheets/cancers/20-Breast-fact-sheet.pdf
2. Siegel RL, Miller KD, Jemal A (2019) Cancer statistics, 2019. CA 69(1):7–34
3. Grunfeld E, Coyle D, Whelan T, Clinch J, Reyno L, Earle CC et al (2004) Family caregiver burden: results of a longitudinal study of breast cancer patients and their principal caregivers. CMAJ 170(12):1795–1801
4. Kale HP, Carroll NV (2016) Self-reported financial burden of cancer care and its effect on physical and mental health-related quality of life among US cancer survivors. Cancer 122(8):283–289
5. care Co (2019) The costs of breast cancer in the U.S. https://costsofcare.org/the-costs-of-breast-cancer-in-the-u-s/
6. Ecclestone C, Chow R, Pulenzas N, Zhang L, Leahey A, Hamer J et al (2016) Quality of life and symptom burden in patients with metastatic breast cancer. Support Care Cancer 24(9):4035–4043
7. McFarland DC, Shaffer KM, Tiersten A, Holland J (2018) Physical symptom burden and its association with distress, anxiety, and depression in breast cancer. Psychosomatics 59(5):464–471
8. Brunault P, Champagne AL, Huguet G, Suzanne I, Senon JL, Body G et al (2016) Major depressive disorder, personality disorders, and coping strategies are independent risk factors for lower quality of life in non-metastatic breast cancer patients. Psycho-Oncology 25(5):513–520
9. Hopko DR, Clark C, Cannity K, Bell JL (2016) Pretreatment depression severity in breast cancer patients and its relation to treatment response to behavior therapy. Health Psychol 35(1):10
10. Jacob L, Bleicher L, Kostev K, Kalder M (2016) Prevalence of depression, anxiety and their risk factors in German women with breast cancer in general and gynecological practices. J Cancer Res Clin Oncol 142(2):447–452
11. Purkayastha D, Venkateswaran C, Nayar K, Unnikrishnan U (2017) Prevalence of depression in breast cancer patients and its association with their quality of life: a cross-sectional observational study. Indian J Palliat Care 23(3):268
12. Caplette-Gingras A, Savard J (2008) Depression in women with metastatic breast cancer: a review of the literature. Palliat Support Care 6(4):377–387
13. Moher D, Liberati A, Tetzlaff J, Altman DG (2009) Preferred reporting items for systematic reviews and meta-analyses: the PRISMA statement. Ann Intern Med 151(4):264–269
14. WHO (2019) Definition of regional groupings. https://www.who.int/healthinfo/global_burden_disease/definition_regions/en/
15. Bank W (2019) How does the World Bank classify countries? https://databank.worldbank.org/data/source/world-development-indicators
16. Hoy D, Brooks P, Woolf A, Blyth F, March L, Bain C et al (2012) Assessing risk of bias in prevalence studies: modification of an existing tool and evidence of interrater agreement. J Clin Epidemiol 65(9):934–939
17. Ahmed AE, Albalawi AN, Qureshey ET, Qureshey AT, Yenugadhati N, Al-Jahdali H et al (2018) Psychological symptoms in adult Saudi Arabian cancer patients: prevalence and association with self-rated oral health. Breast Cancer (Dove Medical Press) 10:153–159
18. Akel R, El Darsa H, Anouti B, Mukherji D, Temraz S, Raslan R et al (2017) Anxiety, depression and quality of life in breast cancer patients in the levant. Asian Pac J Cancer Prev 18(10):2809–2816
19. Alacacioglu A, Yavuzsen T, Dirioz M, Yilmaz U (2009) Quality of life, anxiety and depression in Turkish breast cancer patients and in their husbands. Med Oncol (Northwood, London, England) 26(4):415–419
20. Alacacioglu A, Ulger E, Varol U, Yildiz I, Salman T, Bayoglu V et al (2014) Depression, anxiety and sexual satisfaction in breast cancer patients and their partners-Izmir oncology group study. Asian Pac J Cancer Prev 15(24):10631–10636
21. Ardebil MD, Bouzari Z, Shenas MH, Keighobadi M (2013) Depression and health related quality of life in breast cancer patients. JPMA 63(1):69–71
22. Aukst-Margetic B, Jakovljevic M, Margetic B, Biscan M, Samija M (2005) Religiosity, depression and pain in patients with breast cancer. Gen Hosp Psychiatry 27(4):250–255
23. Bener A, Alsulaiman R, Doodson L, Agathangelou T (2017) Depression, hopelessness and social support among breast cancer patients: in highly endogamous population. Asian Pac J Cancer Prev 18(7):1889–1896
24. Carlson LE, Campbell TS, Garland SN, Grossman P (2007) Associations among salivary cortisol, melatonin, catecholamines, sleep quality and stress in women with breast cancer and healthy controls. J Behav Med 30(1):45–58
25. Chang HA, Barreto N, Davtyan A, Beier E, Cangin MA, Salman J et al (2019) Depression predicts longitudinal declines in social support among women with newly diagnosed breast cancer. Psycho-Oncology 28(3):635–642
26. Chang HY, Keyes KM, Mok Y, Jung KJ, Shin YJ, Jee SH (2015) Depression as a risk factor for overall and hormone-related cancer: the Korean cancer prevention study. J Affect Disord 173:1–8
27. Chen X, Zheng Y, Zheng W, Gu K, Chen Z, Lu W et al (2009) Prevalence of depression and its related factors among Chinese women with breast cancer. Acta Oncol (Stockholm, Sweden) 48(8):1128–1136
28. Christensen S, Zachariae R, Jensen AB, Vaeth M, Moller S, Ravnsbaek J et al (2009) Prevalence and risk of depressive symptoms 3-4 months post-surgery in a nationwide cohort study of Danish women treated for early stage breast-cancer. Breast Cancer Res Treat 113(2):339–355
29. Christie KM, Meyerowitz BE, Maly RC (2010) Depression and sexual adjustment following breast cancer in low-income Hispanic and non-Hispanic White women. Psycho-Oncology 19(10):1069–1077
30. Couillet A, Tredan O, Oussaid N, Saltel P (2015) Prevalence of depressive syndrome in patients with breast cancer treated with or without aromatase inhibitors. Oncologie 17(11–12):587–594
31. Cvetković J, Nenadović M (2016) Depression in breast cancer patients. Psychiatry Res 240:343–347
32. De Medeiros MCL, Veiga DF, Neto MS, Abla LEF, Juliano Y, Ferreira LM (2010) Depression and conservative surgery for breast cancer. Clinics 65(12):1291–1294
33. de Souza BF, de Moraes JA, Inocenti A, dos Santos MA, Silva A, Miasso AI (2014) Women with breast cancer taking chemotherapy: depression symptoms and treatment adherence. Revista Latino-Americana De Enfermagem 22(5):866–873
34. Dujmović A, Marčinko D, Bulić K, Kisić H, Duduković M, Mijatović D (2017) Quality of life and depression among

female patients undergoing surgical treatment for breast cancer: a prospective study. Psychiatr Danub 29(3):345–350
35. Eskelinen M, Ollonen P (2011) Beck Depression Inventory (BDI) in patients with breast disease and breast cancer: a prospective case-control study. In Vivo (Athens, Greece) 25(1):111–116
36. Fafouti M, Paparrigopoulos T, Zervas Y, Rabavilas A, Malamos N, Liappas I et al (2010) Depression, anxiety and general psychopathology in breast cancer patients: a cross-sectional control study. In Vivo (Athens, Greece) 24(5):803–810
37. Galloway SK, Baker M, Giglio P, Chin S, Madan A, Malcolm R et al (2012) Depression and anxiety symptoms relate to distinct components of pain experience among patients with breast cancer. Pain Res Treat 2012:851276
38. Geyikci R, Cakmak S, Demirkol ME, Uguz S (2018) Correlation of anxiety and depression levels with attitudes towards coping with illness and sociodemographic characteristics in patients with a diagnosis of breast cancer. Dusunen Adam-J Psychiatry Neurol Sci 31(3):246–257
39. Hegel MT, Moore CP, Collins ED, Kearing S, Gillock KL, Riggs RL et al (2006) Distress, psychiatric syndromes, and impairment of function in women with newly diagnosed breast cancer. Cancer 107(12):2924–2931
40. Hill J, Holcombe C, Clark L, Boothby MRK, Hincks A, Fisher J et al (2011) Predictors of onset of depression and anxiety in the year after diagnosis of breast cancer. Psychol Med 41(7):1429–1436
41. Ho SS, So WK, Leung DY, Lai ET, Chan CW (2013) Anxiety, depression and quality of life in Chinese women with breast cancer during and after treatment: a comparative evaluation. Eur J Oncol Nurs 17(6):877–882
42. Hopwood P, Sumo G, Mills J, Haviland J, Bliss JM (2010) The course of anxiety and depression over 5 years of follow-up and risk factors in women with early breast cancer: results from the UK Standardisation of Radiotherapy Trials (START). Breast 19(2):84–91
43. Huang CY, Guo SE, Hung CM, Shih SL, Lee LC, Hung GC et al (2010) Learned resourcefulness, quality of life, and depressive symptoms for patients with breast cancer. Oncol Nurs Forum 37(4):E280–E287
44. Jang JE, Kim SW, Kim SY, Kim JM, Park MH, Yoon JH et al (2013) Religiosity, depression, and quality of life in Korean patients with breast cancer: a 1-year prospective longitudinal study. Psycho-Oncology 22(4):922–929
45. Jimenez-Fonseca P, Calderon C, Hernandez R, Cajal TRY, Mut M, Ramchandani A et al (2018) Factors associated with anxiety and depression in cancer patients prior to initiating adjuvant therapy. Clin Trans Oncol 20(11):1408–1415
46. Jones SM, LaCroix AZ, Li W, Zaslavsky O, Wassertheil-Smoller S, Weitlauf J et al (2015) Depression and quality of life before and after breast cancer diagnosis in older women from the Women's Health Initiative. J Cancer Surviv 9(4):620–629
47. Kalender M, Buyukhatipoglu H, Balakan O, Suner A, Dirier A, Sevinc A et al (2014) Depression, anxiety and quality of life through the use of complementary and alternative medicine among breast cancer patients in Turkey. J Cancer Res Ther 10(4):962–966
48. Karakoyun-Celik O, Gorken I, Sahin S, Orcin E, Alanyali H, Kinay M (2010) Depression and anxiety levels in woman under follow-up for breast cancer: relationship to coping with cancer and quality of life. Med Oncol (Northwood, London, England) 27(1):108–113
49. Kim SY, Stewart R, Kim SW, Yang SJ, Kim JM, Shin IS et al (2012) Predictors of depression in Korean breast cancer patients: a one-year longitudinal study. Asia-Pacific Psychiatry 4(4):250–257
50. Kovács Z, Rigó AP, Szabó É, Sebestyén Á, Hoyer M, Fülöp E et al (2011) The prevalence of depression and anxiety in patients with malignant breast tumour. New Med 2011-January(2):61–6
51. Kyranou M, Paul SM, Dunn LB, Puntillo K, Aouizerat BE, Abrams G et al (2013) Differences in depression, anxiety, and quality of life between women with and without breast pain prior to breast cancer surgery. Eur J Oncol Nurs 17(2):190–195
52. Lee MK, Park S, Lee ES, Ro J, Kang HS, Shin KH et al (2011) Social support and depressive mood 1 year after diagnosis of breast cancer compared with the general female population: a prospective cohort study. Support Care Cancer 19(9):1379–1392
53. Linden W, Vodermaier A, MacKenzie R, Greig D (2012) Anxiety and depression after cancer diagnosis: prevalence rates by cancer type, gender, and age. J Affect Disord 141(2–3):343–351
54. Lueboonthavatchai P (2007) Prevalence and psychosocial factors of anxiety and depression in breast cancer patients. J Med Assoc Thai 90(10):2164–2174
55. Marijanovic I, Pavlekovic G, Buhovac T, Martinac M (2017) The relationship between health locus of control, depression, and sociodemographic factors and amount of time breast cancer patients wait before seeking diagnosis and treatment. Psychiatria Danubina 29(3):330–344
56. Mashhadi MA, Shakiba M, Zakeri Z (2013) Evaluation of depression in patients with cancer in South of iran (zahedan). Iran J Cancer Prev 6(1):12–16
57. Mhaidat NM, Alzoubi KH, Al-Sweedan S, Alhusein BA (2009) Prevalence of depression among cancer patients in Jordan: a national survey. Support Care Cancer 17(11):1403–1407
58. Milbury K, Badr H (2013) Sexual problems, communication patterns, and depressive symptoms in couples coping with metastatic breast cancer. Psycho-Oncology 22(4):814–822
59. Miura K, Ando S, Imai T (2016) The association of cognitive fatigue with menopause, depressive symptoms, and quality of life in ambulatory breast cancer patients. Breast Cancer 23(3):407–414
60. Montazeri A, Jarvandi S, Haghighat S, Vahdani M, Sajadian A, Ebrahimi M et al (2001) Anxiety and depression in breast cancer patients before and after participation in a cancer support group. Patient Educ Couns 45(3):195–198
61. Montazeri A, Harirchi I, Vahdani M, Khaleghi F, Jarvandi S, Ebrahimi M et al (2000) Anxiety and depression in Iranian breast cancer patients before and after diagnosis. Eur J Cancer Care 9(3):151–157
62. Montazeri A, Sajadian A, Ebrahimi M, Akbari ME (2005) Depression and the use of complementary medicine among breast cancer patients. Support Care Cancer 13(5):339–342
63. Ng GC, Mohamed S, Sulaiman AH, Zainal NZ (2017) Anxiety and depression in cancer patients: the association with religiosity and religious coping. J Relig Health 56(2):575–590
64. Ollonen P, Lehtonen J, Eskelinen M (2005) Anxiety, depression, and the history of psychiatric symptoms in patients with breast disease: a prospective case-control study in Kuopio, Finland. Anticancer Res 25(3c):2527–2533
65. Park B, Youn S, Vi KK, Lee SY, Lee JS, Chung S (2017) The prevalence of depression among patients with the top ten most common cancers in South Korea. Psychiatry Investig 14(5):618–625
66. Park EM, Gelber S, Rosenberg SM, Seah DSE, Schapira L, Come SE et al (2018) Anxiety and depression in young women with metastatic breast cancer: a cross-sectional study. Psychosomatics 59(3):251–258
67. Popoola AO, Adewuya AO (2012) Prevalence and correlates of depressive disorders in outpatients with breast cancer in Lagos, Nigeria. Psycho-Oncology 21(6):675–679
68. Puigpinos-Riera R, Graells-Sans A, Serral G, Continente X, Bargallo X, Domenech M et al (2018) Anxiety and depression

in women with breast cancer: social and clinical determinants and influence of the social network and social support (DAMA cohort). Cancer Epidemiol 55:123–129
69. Purkayastha D, Venkateswaran C, Nayar K, Unnikrishnan UG (2017) Prevalence of depression in breast cancer patients and its association with their quality of life: a cross-sectional observational study. Indian J Palliat Care 23(3):268–273
70. Reece JC, Chan YF, Herbert J, Gralow J, Fann JR (2013) Course of depression, mental health service utilization and treatment preferences in women receiving chemotherapy for breast cancer. Gen Hosp Psychiatry 35(4):376–381
71. Reuter K, Classen CC, Roscoe JA, Morrow GR, Kirshner JJ, Rosenbluth R et al (2006) Association of coping style, pain, age and depression with fatigue in women with primary breast cancer. Psycho-Oncology 15(9):772–779
72. Saboonchi F, Petersson LM, Wennman-Larsen A, Alexanderson K, Brannstrom R, Vaez M (2014) Changes in caseness of anxiety and depression in breast cancer patients during the first year following surgery: patterns of transiency and severity of the distress response. Eur J Oncol Nurs 18(6):598–604
73. Schleife H, Sachtleben C, Finck Barboza C, Singer S, Hinz A (2014) Anxiety, depression, and quality of life in German ambulatory breast cancer patients. Breast Cancer 21(2):208–213
74. Shakeri J, Golshani S, Jalilian E, Farnia V, Nooripour R, Alikhani M et al (2016) Studying the amount of depression and its role in predicting the quality of life of women with breast cancer. Asian Pac J Cancer Prev 17(2):643–646
75. Sharma A, Zhang JP (2015) Depression and its predictors among breast cancer patients in nepal. Asean J Psychiatry 16(1):106–115
76. Sheppard VB, Llanos AA, Hurtado-de-Mendoza A, Taylor TR, Adams-Campbell LL (2013) Correlates of depressive symptomatology in African-American breast cancer patients. J Cancer Surviv 7(3):292–299
77. Slovacek L, Slovackova B, Slanska I, Petera J, Priester P, Filip S et al (2009) Depression symptoms and health-related quality of life among patients with metastatic breast cancer in programme of palliative cancer care. Neoplasma 56(6):467–472
78. So WK, Marsh G, Ling WM, Leung FY, Lo JC, Yeung M et al (2010) Anxiety, depression and quality of life among Chinese breast cancer patients during adjuvant therapy. Eur J Oncol Nurs14(1):17–22
79. Stafford L, Judd F, Gibson P, Komiti A, Mann GB, Quinn M (2013) Screening for depression and anxiety in women with breast and gynaecologic cancer: course and prevalence of morbidity over 12 months. Psycho-Oncology 22(9):2071–2078
80. Stanton AL, Wiley JF, Krull JL, Crespi CM, Hammen C, Allen JJB et al (2015) Depressive episodes, symptoms, and trajectories in women recently diagnosed with breast cancer. Breast Cancer Res Treat 154(1):105–115
81. Steiner JL, Wagner CD, Bigatti SM, Storniolo AM (2014) Depressive rumination and cognitive processes associated with depression in breast cancer patients and their spouses. Fam Syst Health 32(4):378–388
82. Su JA, Yeh DC, Chang CC, Lin TC, Lai CH, Hu PY et al (2017) Depression and family support in breast cancer patients. Neuropsychiatr Dis Treat 13:2389–2396
83. Tsaras K, Papathanasiou IV, Mitsi D, Veneti A, Kelesi M, Zyga S et al (2018) Assessment of depression and anxiety in breast cancer patients: prevalence and associated factors. Asian Pac J Cancer Prev 19(6):1661–1669
84. Vin-Raviv N, Akinyemiju TF, Galea S, Bovbjerg DH (2015) Depression and anxiety disorders among hospitalized women with breast cancer. PLoS ONE 10(6):e0129169
85. Walker J, Hansen CH, Martin P, Symeonides S, Ramessur R, Murray G et al (2014) Prevalence, associations, and adequacy of treatment of major depression in patients with cancer: a cross-sectional analysis of routinely collected clinical data. Lancet Psychiatry 1(5):343–350
86. Wu SM, Yang HC, Thayer JF, Andersen BL (2014) Association of the physiological stress response with depressive symptoms in patients with breast cancer. Psychosom Med 76(4):252–256
87. Zhang J, Zhou Y, Feng Z, Xu Y, Zeng G (2018) Longitudinal trends in anxiety, depression, and quality of life during different intermittent periods of adjuvant breast cancer chemotherapy. Cancer Nurs 41(1):62–68
88. Mitchell AJ, Chan M, Bhatti H, Halton M, Grassi L, Johansen C et al (2011) Prevalence of depression, anxiety, and adjustment disorder in oncological, haematological, and palliative-care settings: a meta-analysis of 94 interview-based studies. Lancet Oncol 12(2):160–174
89. Hotopf M, Chidgey J, Addington-Hall J, Ly KL (2002) Depression in advanced disease: a systematic review Part 1. Prevalence and case finding. Palliat Med 16(2):81–97
90. Krebber A, Buffart L, Kleijn G, Riepma I, De Bree R, Leemans C et al (2014) Prevalence of depression in cancer patients: a meta-analysis of diagnostic interviews and self-report instruments. Psycho-Oncology 23(2):121–130
91. Aryankhesal A, Ghashghaee A, Sardari E, Mahmoudi S, Alihosseini S, Dehnad A et al (2019) Prevalence of depression in patients with cancer in Iran: a systematic review and meta-analysis. BMJ Support Palliat Care bmjspcare-2018-001724
92. Mitchell AJ, Chan M, Bhatti H, Halton M, Grassi L, Johansen C et al (2011) Prevalence of depression, anxiety, and adjustment disorder in oncological, haematological, and palliative-care settings: a meta-analysis of 94 interview-based studies. Lancet Oncol 12(2):160–174
93. Massie MJ (2004) Prevalence of depression in patients with cancer. J Natl Cancer Inst Monogr 32:57–71
94. Im Song J, Shin DW, Choi JY, Kang J, Baik YJ, Mo H et al (2011) Quality of life and mental health in family caregivers of patients with terminal cancer. Support Care Cancer 19(10):1519
95. Vitaliano PP, Zhang J, Scanlan JM (2003) Is caregiving hazardous to one's physical health? A meta-analysis. Psychol Bull 129(6):946
96. Watts S, Leydon G, Birch B, Prescott P, Lai L, Eardley S et al (2014) Depression and anxiety in prostate cancer: a systematic review and meta-analysis of prevalence rates. BMJ Open 4(3):e003901
97. Watts S, Prescott P, Mason J, McLeod N, Lewith G (2015) Depression and anxiety in ovarian cancer: a systematic review and meta-analysis of prevalence rates. BMJ Open 5(11):e007618
98. Caruso R, Nanni MG, Riba M, Sabato S, Mitchell A, Croce E et al (2017) Depressive spectrum disorders in cancer: prevalence, risk factors and screening for depression: a critical review. Acta Oncol 56(2):146–155
99. Begovic-Juhant A, Chmielewski A, Iwuagwu S, Chapman LA (2012) Impact of body image on depression and quality of life among women with breast cancer. J Psychosoc Oncol 30(4):446–460
100. Collins KK, Liu Y, Schootman M, Aft R, Yan Y, Dean G et al (2011) Effects of breast cancer surgery and surgical side effects on body image over time. Breast Cancer Res Treat 126(1):167–176
101. Przezdziecki A, Sherman KA, Baillie A, Taylor A, Foley E, Stalgis-Bilinski K (2013) My changed body: breast cancer, body image, distress and self-compassion. Psycho-Oncology 22(8):1872–1879
102. Walker J, Hansen CH, Martin P, Symeonides S, Ramessur R, Murray G et al (2014) Prevalence, associations, and adequacy of treatment of major depression in patients with cancer: a cross-sectional analysis of routinely collected clinical data. Lancet Psychiatry 1(5):343–350

103. Alemayehu M, Deyessa N, Medihin G, Fekadu A (2018) A descriptive analysis of depression and pain complaints among patients with cancer in a low income country. PLoS ONE 13(3):e0193713
104. Ell K, Sanchez K, Vourlekis B, Lee P-J, Dwight-Johnson M, Lagomasino I et al (2005) Depression, correlates of depression, and receipt of depression care among low-income women with breast or gynecological cancer. J Clin Oncol 23(13):3052
105. Klein J, Hofreuter-Gätgens K, Lüdecke D, Fisch M, Graefen M, von dem Knesebeck O (2016) Socioeconomic status and health-related quality of life among patients with prostate cancer 6 months after radical prostatectomy: a longitudinal analysis. BMJ Open 6(6):e010968