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Predictors of survival rates among breast cancer patients in Ethiopia: a systematic review and meta-analysis 2024

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Abstract

Introduction Breast cancer remains the most common cancer and a leading cause of cancer-related deaths among women worldwide. In Ethiopia, the survival rate of breast cancer patients is influenced by various socio-demographic, clinical, and health system factors. This systematic review and meta-analysis aimed to identify and synthesize the predictors of survival rates among breast cancer patients in Ethiopia.

Methods We conducted a systematic review of observational cohort studies. The literature search was performed between August 1 and 30, 2024, using PubMed, Hinari, EMBASE, Google, Google Scholar, and Web of Science. The Newcastle Ottawa 2016 Critical Appraisal Checklist assessed methodological quality. Publication bias was evaluated using a funnel plot and Egger's test, and heterogeneity was examined with the I-squared test. Data were extracted with Microsoft Excel and analyzed using Stata 11.

Results A total of 15 articles with 6,375 study participants from six regions were included. We found that significant predictors of decreased survival rate among breast cancer patients were age (aHR 1.05, 95% CI 1.02–1.08), illiteracy (aHR 7.34, 95% CI 4.38–10.3), married (aHR 1.21, 95% CI 1.03–1.40), rural residence (aHR 1.71, 95% CI 1.06–2.36), two or more lymph node involvement (aHR 3.57, 95% CI 1.02–6.13), histological grade two or more (aHR 1.44, 95% CI 1.12–2.77), overweight (aHR 0.56, 95% CI 0.24–0.87), and having comorbidity (aHR 1.86, 95% CI 1.04–2.68).

Conclusion This systematic review and meta-analysis identified several key predictors of reduced survival rates among breast cancer patients in Ethiopia, including older age, illiteracy, rural residence, involvement of two or more lymph nodes, higher histological grade, marital status, and the presence of comorbidities. Interestingly, being overweight was associated with improved survival. Health stakeholders and policymakers emphasizing public health education, managing comorbidities, and expanding access to early detection and treatment, especially in rural areas, are critical.

Keywords Survival rate, Breast cancer, Predictors, Survival time, Ethiopia

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Text box 1. Contributions to the literature

- This study is the first systematic review and meta-analysis to synthesize predictors of breast cancer survival in Ethiopia, addressing a significant gap in public health research in low-resource settings.
- It provides evidence on how socio-demographic, clinical, and health system factors influence survival rates, offering critical insights for designing targeted interventions in similar contexts.
- This research underscores the importance of equitable healthcare access, particularly for rural and underprivileged populations, to improve breast cancer outcomes in Ethiopia and comparable regions.

Introduction

In 2020 there was an anticipated 19.3 million new cases of cancer worldwide and over 10.0 million cancer-related deaths. The most prevalent cancer to be diagnosed in women is breast cancer, which has overtaken lung cancer. Colon, prostate, and stomach cancers are the next most common malignancies [1]. Globally, 2.3 million women received a breast cancer diagnosis in 2022, and 670,000 people died from the disease [2]. While breast cancer mortality is highest in less developed nations, the disease's incidence is higher in more developed country [3]. Sub-Saharan Africa as a whole is facing a growing cancer-related public health burden. Currently, 4% of Ethiopian mortalities are related to cancer [4]. In Africa, women die from breast cancer at a rate of 20% and account for 28% of all cancer cases [5].

The World Health Organization (WHO) launched the Global Breast Cancer Initiative (GBCI) in 2021 to reduce mortality rates by 2.5% per year to 2040 through three key pillars of action on health promotion for early detection, timely diagnosis; and comprehensive breast cancer management [6]. A systematic review and meta-analysis revealed that the average duration between recognizing symptoms and presenting them to a medical professional was less than 4 months in North Africa and between 3 and 6 months in sub-Saharan Africa [7].

Evidence showed that the effects of delay on prognosis have generally demonstrated that longer delays are linked to malignancies that are diagnosed at an advanced stage, which lowers the likelihood of survival [8–10]. Longer patient delays were linked to bigger tumor sizes, positive nodes, and a 24% death rate compared to shorter patient delays [11]. Longer delays were associated with lower survival rates for women, both from the date of diagnosis and from the beginning of symptoms [12]. Evidence suggests that breast cancer mortality rates are decreasing in most high-income countries, despite increasing or stable incidence rates [13].

A meta-analysis done in Iraq revealed that the one-year, three-year, five-year, and ten-year survival rates of breast cancer were estimated to be 95.8%, 82.4%, 69.5%, and 58.1%, respectively [14]. A systematic review and meta-analysis done in sub-Saharan African countries the pooled 1-year survival rate of patients with breast cancer was 0.79; 2-year survival rate was 0.70, 3-year survival rate0.56, 4-year survival rate was 0.54, and 5-year survival rate was 0.40 [15]. Previous Systematic Review and meta-analysis revealed that age [14, 16], stage of disease [14, 16, 17], lymph node involvement [14, 17] size of the tumor [14], high level of education [18], high level of income [18], high level of socioeconomic status [18], positive progesterone receptor [19] and positive estrogen receptor [19] were predictors of survival rate of breast cancer patient.

Previous primary studies done around the globe identified overweight [20–22], married [23], higher level of education [23], lymph node involvement [24–26], tumor size [24, 26–28], stage of breast cancer [27, 29], hormone therapy [21], comorbidities [30], distant metastasis [29, 30], lower socioeconomic status [24, 31], negative estrogen receptor [24], smoking [22], negative progesterone receptor [25], family history of breast cancer [32], and age [26, 32, 33] were factors that influence the survival rate of breast cancer patients.

Cancer accounts for 5.8% of all deaths in Ethiopia, with 60,000 new cases diagnosed and over 44,000 deaths annually, the most prevalent being breast cancer (30.2%), cervical cancer (13.4%), and colorectal cancer (5.7%) [34]. Research done in Ethiopia revealed that breast cancer was the second leading neoplasm, responsible for 21 (2.7%) of all deaths (95% CI 1.5–3.7%), and was among the top five causes of non-communicable deaths [35]. The estimated 1- and 2-year overall survival probability rates in the rural part of Ethiopia were 78 and 53%, respectively [36]. The majority of the cancer burden occurs in low- and middle-income countries where cancer has a profound social and economic effect on communities because of the limited access to care [37].

WHO urges significant investments involving a broad range of partners in comprehensive cancer control are required and crucial to improving the quality of life of vulnerable communities while at the same time strengthening national health systems [38]. There was previous primary research conducted in Ethiopia to determine the survival rate and its predictors of breast cancer patients; however, findings from those studies varied across regions. To the best of our knowledge, this topic has not yet been investigated by systematic review and meta-analysis at the national level. In particular, this study covered a wider geographical area and provided pooled results. This information is necessary for policy planners and program managers to identify gaps in the predictors of survival rate among breast cancer patients and to plan strategies to increase the survival time of breast cancer patients. Early identification and prompt treatment of breast cancer are crucial for improving maternal health. Thus, the goal of this study was to assess predictors of

survival rates among breast cancer patients in Ethiopia. The literature search was conducted over one month, from August 1 to 30, 2024, to identify relevant studies.

Methods and materials

Study protocol and reporting

This systematic review and meta-analysis was carried out per the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) criteria [39] (supplementary S1 file). The eligibility criteria were adapted from the Newcastle Ottawa 2016 review guidelines [40]. We used Endnote (version X7) reference management software to download, organize, and review and Zotero to cite related articles.

Inclusion criteria

We searched our studies on human studies published in English language. Participants were all quantitative studies with variables or indicators indicating predictor of survival rate among breast cancer patients were included in the systematic review and meta -analysis.

The review considered all observational cohort studies written in English, and conducted in Ethiopia. We searched literatures included for the review for one-month duration August 1 to 30, 2024.All published articles were included in the form of journal articles without time limit. Results of interest: The main investigations revealed predictor of survival rate among breast cancer patients.

Exclusion criteria

Excluded from the study were anonymous reports, duplicate research, articles lacking an abstract or full text, and qualitative investigations. We excluded systematic reviews, case reports, and retrospective reviews. We also excluded studies focusing on specific factors and frequency with descriptive studies. Since there was no concrete data to take from this research, they were eliminated (Table 1).

Table 1 Inclusion and exclusion criteria predictor of survival rate among breast cancer patients in Ethiopia: systematic review and meta -analysis 2024

Study characteristics	Inclusion criteria	Exclusion criteria
Design	observational studies cohort studies	Clinical trials, qualitative studies, editorial letters, case reports/series
Population	Breast cancer patients	Studies not involving the target population or focused on different health conditions
Condition	Predictors of survival rate among breast cancer patients	Unclear to articles with the outcome variable of breast cancer patient, articles only reviews and descriptive static's
Context	Studies conducted in Ethiopia	Studies outside Ethiopia
Language	Articles published in English	Articles published in other languages

Operational definition

Survival time: The duration a patient remains free from the outcome following their diagnosis [41–43]. Individuals who were lost to follow-up, still alive, or transferred out by the end of the study period were considered censored [44].

The place of residence was classified as rural or urban and educational status was classified as literate and illiterate, comorbidities were categorized as yes or not having comorbidities, having a family history of breast cancer was categorized as having a history of breast cancer or not, tumor size is grouped into < 5 cm or = > 5 cm. Marital status is grouped into married or not married. Age is a continuous variable and is expressed in a unit. About histological grade of breast cancer was grouped into < 2 or = > 2. Lymph node involvement is grouped as < 2 or = > 2 lymph involved. Lymph nodal status was grouped into positive or negative. Weight of patients classified as underweight or overweight. Treatment taken is grouped into combined chemotherapy taken or single treatment taken.

Search strategy

A systematic search of peer-reviewed, published literature in English was conducted to identify the factors contributing to the survival rate among breast cancer patients in Ethiopia (supplementary S2 file). We looked through the databases at PubMed, Hinari, EMBASE, Google, Google Scholar, and Web Science to find pertinent research. To find pertinent key phrases, we first searched by article title in PubMed, Google, and Google Scholar. Secondly, we discovered related ideal keywords. Third, we conducted a second search using these phrases in the databases after looking for more research in the reference lists of all the recognized papers and publications. Terms like "breast cancer," "associated factors," "predictors," "determinants," "contributing factors," "survival time," "survival rate," "survival analysis," "determinant of breast cancer mortality," "survival time of breast cancer patient," "survival analysis of breast cancer patient," "survival rate of a breast cancer patient," "Ethiopia,". We experimented and improved utilizing several test searches, combining related search phrases with Boolean operators like OR and combining distinct notions using the Boolean operator AND.

Data extraction

The data was extracted using Microsoft Excel. Two distinct data extraction formats were utilized to collect the

information needed for analysis. In the extraction form, we included the author's last name, the year the work was published, the study country, the study design, sample size, associated factor, study area, the hazard rate of predictors and its confidence interval, and the quality score of each study. The author's last name and the year of publication were also included in the data extraction format for contributing factors. Every necessary piece of information was separately collected by two writers, who then cross-checked their findings and agreed on any discrepancies.

Quality assessment/critical appraisal

The article was manually transferred to EndNote and checked for duplicates. The inclusion and exclusion criteria were applied to review the remaining articles, focusing on patient predictors of survival rate among breast cancer patients in Ethiopia. The Newcastle-Ottawa quality appraisal checklist was used to evaluate the quality of individual studies [40] (Supplementary S3 file).

Two reviewers evaluated each primary study individually, and a decision was made to accept or reject based on specific criteria. In case of disagreement, the average score of both reviewers was taken. A study was categorized as good quality if it scored more than 50% on quality assessment indicators. Each cohort study was assessed using eight criteria: inclusion criteria, study subject and setting description, valid measurement of exposure, and identification of confounders using objective criteria, confounder handling strategies, outcome measurement, and statistical analysis. Fifteen cohort studies met quality criteria and were included in the analysis.

Statistical analysis

Meta-analysis was conducted using STATA version 11. Hazard ratios (HRs) with 95% confidence intervals (CIs) were extracted or calculated to summarize the predictors of survival. Heterogeneity among studies was assessed using the I^2 statistic, with values > 50% indicating substantial heterogeneity. A random-effects model was used to account for variability among studies.

Publication bias

Publication bias was assessed using a funnel plot and Egger's test, with a p-value < 0.05 indicating significant bias [45].

Result

A total of 800 published studies (PubMed = 100, Hinari = 10, Google = 85, EMBASE = 10, Google Scholar = 585, Web science = 10) were identified. 100 duplicates were removed, leaving 700 abstracts for evaluation. 550 articles were excluded based on different. Resulting in 150 articles was retained for full-text screening. 100 articles were further excluded for various reasons, leaving only 50 studies assessed for eligibility. Finally,15 reports of articles were included for the final systematic review and meta-analysis. 35 articles were excluded for various reasons different outcome definitions, overlapping of participants, and lack of full data = 10 (Fig. 1).

Study characteristics

Fifteen studies were included in this analysis [41–44, 46–56]. Six articles were included from Amhara, three articles were from AdisAbeba, two articles were from Tigray, two articles were from Oromia, one article was from Sidama and one article was included in south nation nationalities of people Ethiopia region (SNNPE). From the included articles 6,375 breast cancer patients participated in the determinant of survival rate among breast cancer. The included articles were published. All the included studies were facility-based cohorts by design and reported survival rate predictors among breast cancer patients. The sample sizes across the studies ranged from 86 [56] to 819 [55] (Table 2).

Publication bias

The Egger's test yielded non-significant results, indicating no evidence of publication bias across the included studies. Additionally, the funnel plot appeared symmetrical, further supporting the absence of significant publication bias. The funnel plot for each predictor is provided in Supplementary File S4 for detailed reference.

Predictors of survival rate among breast cancer patients in Ethiopia: a systematic review 2024

We included 12 selected variables to identify relationships with the survival rate of breast cancer patients in Ethiopia. Of these, eight variables, namely age years, illiterate educational level, rural residence, lymph node involvement, histological grade = > 2, overweight, having comorbidity, and married women were significantly associated with the survival rate of breast cancer patients (Table 3). The review also demonstrated that family history of breast cancer, treatment taken, tumor stage, tumor size, and nodal status had no statistically significant association with predictors of survival rate among breast cancer patients.

Histological grade

In the overall analysis of this study, histological grades of breast cancer patients were significantly associated with survival rates. Patients with histological grade two and above were 1.44 times more likely to short survival rate than their counterparts (aHR, 1.44; 95% CI: 1.12, 2.77). This means that breast cancer patients with grade two histological involvement have a 44% higher risk of

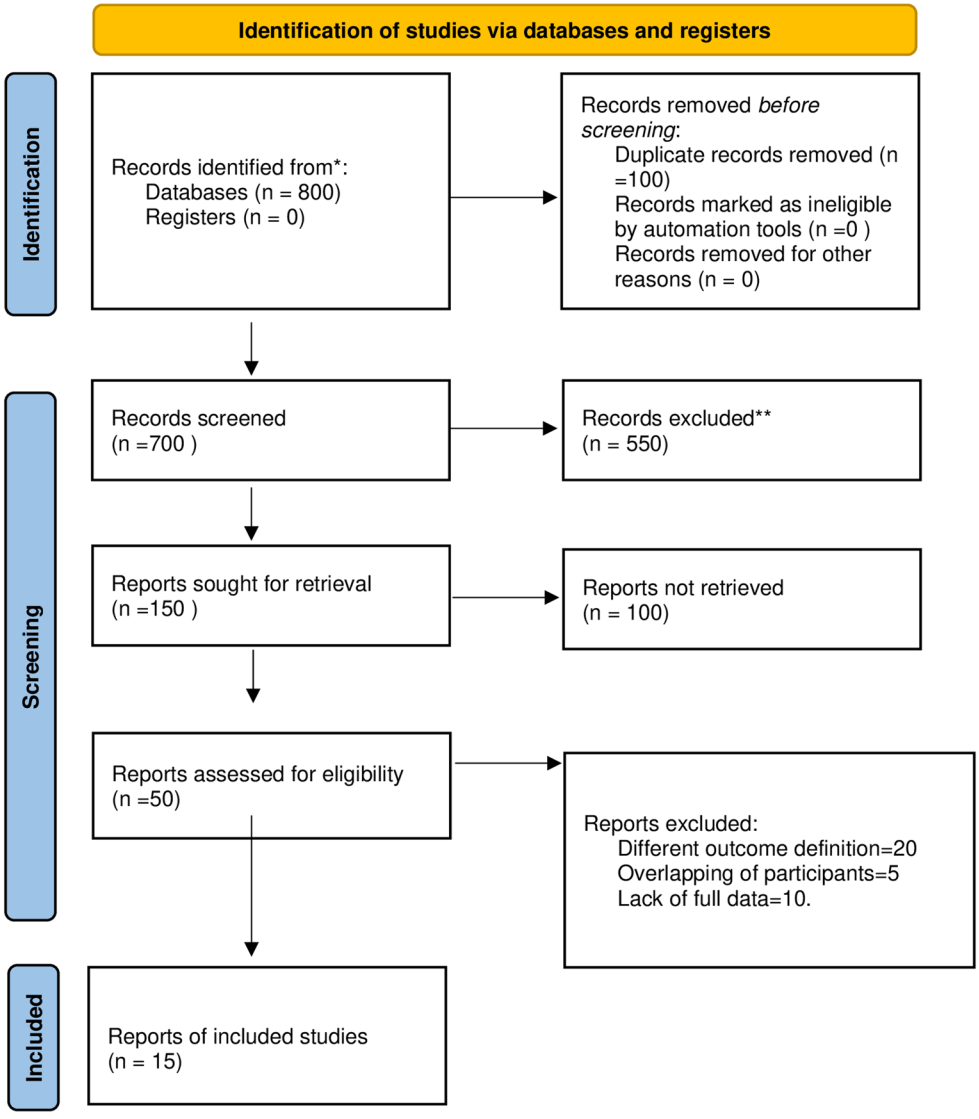

Fig. 1 PRISMA flowchart diagram of the study selection process for predictors of survival rates among breast cancer patients in ethiopia 2024

decreased survival compared to their counterparts. A random effects model was assumed for the analysis as I2 (98.1%) and Egger test 0.517 with a p-value of (< 0.001) showed statistically significant heterogeneity among the included studies for this factor analysis (Fig. 2).

Having comorbidity

In the overall analysis of this study having comorbidity of breast cancer patients was significantly associated with survival rate. Patients with comorbidity were 1.86 times more likely to reduced survival rate than their counterparts (aHR, 1.86; 95% CI: 1.04, 2.68). This means that breast cancer patients having comorbidity have a 68% higher risk of reduced survival compared to their counterparts. A random effects model was assumed for the analysis as I2 (99.2%) and Egger test 0.090 with a p-value of (< 0.001) showed statistically significant heterogeneity among the included studies for this factor analysis (Fig. 3).

Educational status

In this meta-analysis educational status was significantly associated with the survival rate of breast cancer patients. Patients with illiterate educational levels were 7.34 times reduced the survival rate than that of educated one (aHR, 7.34; 95% CI: 4.38, 10.30). This means that breast cancer patients illiterate have a 34% higher risk of reduced survival compared to those educated ones. The random effect model was used for the analysis as I2 = 99.8% and Egger test 0.020 showed statically significant heterogeneity among the included studies (Fig. 4).

Table 2 Study characteristics of systematic review and meta-analysis on breast cancer survival predictors in Ethiopia 2024

Author	Region	Study period	Study design	Sample size	Predictors	Adjusted HR	LCI	UCI
Wondimu AD, et al.	Addis Abeba	2019	Cohort	408	Family history of breast cancer	0.7959	0.074	1.517
					Tx taken	0.5726	0.204	1.349
					Tumor size	1.1365	0.331	1.94
					Age	0.0834	0.055	0.112
Feleke B, et al.	Amhara	2022	Cohort	322	Family hx	1.86	1.096	3.158
					Tx taken	1.274	0.91	1.783
					Tumor stage	0.258	0.088	0.752
					Having comorbidity	4.569	2.104	9.921
					Age	1.028	0.975	0.999
					Lymph node involvement	0.726	0.56	0.997
Tesfay B, et al.	Tigray	2021	Cohort	186	Tx taken	0.132	0.01577	1.16
					Tumor size	1.17	1.06	1.29
					Educational status	30.3	1.11	833
					Residence	4.69	1.08	20
					Age	1.012	0.0036	0.02
Hagos BT, et al.	Tigray	2024	Cohort	146	Tx taken	0.84	0.6	1.179
					Tumor size	0.98	0.968	0.996
					Tumor stage	0.48	0.297	0.789
					Educational status	0.52	0.325	0.823
					Residence	0.68	0.516	0.904
					Marital status	1.1	0.546	2.031
					Age	0.98	0.968	0.997
					Lymph node involvement	0.52	0.341	0.787
Tasfa Marine B, et al.	Oromia	2023	Cohort	552	Tx taken	0.53	0.16	1.12
					Tumor size	0.4	0.39	1.44
					Tumor stage	0.4	0.34	1.47
					Histological grade	1.17	0.26	0.56
					Having comorbidity	2.46	0.39	1.41
					Educational status	2.32	0.79	2.43
					Residence	0.84	0.0001	0.35
					Marital status	1.3	0.05	0.47
					Overweight	0.05	1.57	4.41
					Age	2.54	3.95	7.13
					Nodal status	0.04	1.88	4.45
Gashu C, et al.	Amhara	2024	Cohort	382	Tumor size	0.43	0.05	0.46
					Having comorbidity	0.42	0.16	0.51
					Educational status	0.28	0.32	1.13
					Overweight	0.21	0.15	0.62
					Lymph node involvement	0.53	0.26	0.81
					Nodal status	0.32	0.26	0.81
Yismaw D, et al.	Amhara	2022	Cohort	392	Family hx	0.643	0.579	0.714
					Tumor size	0.595	0.541	0.655
					Tumor stage	0.33	0.198	0.548
					Residence	1.806	1.27	2.564
					Overweight	0.971	0.97	0.988
					Age	0.98	0.968	0.994
Areri HA, et al.	Addis Abeba	2019	Cohort	627	Tx taken	0.67	0.451	0.989

Table 2 (continued)

Author	Region	Study period	Study design	Sample size	Predictors	Adjusted HR	LCI	UCI
					Tumor size	2.31	0.891	4.123
					Tumor stage	1.86	1.127	3.08
					Histological grade	3.12	1.16	8.36
					Having comorbidity	1.49	0.98	2.29
					Residence	1.48	0.999	2.195
					Marital status	1.44	0.81	2.5
					Lymph node involvement	0.79	0.517	1.205
					Nodal status	1.83	1.217	2.736
Sharma MK, et al.	Addis Abeba	2019	Cohort	819	Tumor size	0.906	0.824	0.995
					Tumor stage	0.397	0.307	0.513
					Histological grade	1.154	1.05	1,26
Misganaw M, et al.	Amhara	2023	Cohort	410	Tumor stage	9.43	6.3	11.03
					Histological grade	2.12	1.26	3.55
					Having comorbidity	1.5	1.01	2.21
					Residence	1.25	0.88	1.78
					Lymph node involvement	12.58	5.19	30.46
					Nodal status	1.68	0.56	5.05
Tiruneh M, et al.	Amhara	2021	Cohort	482	Tumor stage	1.82	1.52	3.62
					Marital status	1.1	0.8	1.53
					Lymph node involvement	0.85	0.62	1.05
Bacha RH, et al.	Oromia	2021	Cohort	642	Family history of breast cancer	0.99	0.82	1.21
					Tx taken	0.56	0.37	0.85
					Tumor size	0.59	0.46	0.75
					Tumor stage	0.32	0.22	0.46
					Histological grade	0.64	0.5	0.83
					Residence	0.14	0.11	0.17
					Overweight	0.87	0.68	1.1
					Age	0.99	0.98	0.99
Fentaw S, et al.	Amhara	2024	Cohort	632	Tumor size	0.853	0.82	0.899
					Tumor stage	0.637	0.578	0.745
					Histological grade	0.866	0.612	0.926
					Having comorbidity	0.782	0.634	0.867
					Lymph node involvement	0.883	0.645	0.996
Shita A, et al.	Sidama	2020	Cohort	289	Tx taken	6.69	2.2	20.3
					Tumor stage	3.01	1.05	8.59
					Residence	2.71	1.44	5.09
Tekle G, et al.	SNNPE	2019	Cohort	86	Educational status	4.306	1.085	4.966
					Age	1.06	0.896	0.992

Residence

In the overall analysis of this study residence of breast cancer patients was significantly associated with survival rate. Patients with rural residence were 1.71 times more likely to reduced survival rate than their counterparts (aHR, 1.71 95% CI: 1.06, 2.36). This means that breast cancer patients residing in rural areas have a 71% higher risk of decreased survival compared to those living in urban areas. A random effects model was assumed for the analysis as I2 (99.1%) and Egger test 0.070 with a p-value of (< 0.001) showed statistically significant heterogeneity among the included studies for this factor analysis (Fig. 5).

Marital status

In the overall analysis of this study marital status of breast cancer patients was significantly associated with survival rate. Patients with married were 1.21 times more likely to reduced survival rate than their counterparts (aHR, 1.21; 95% CI: 1.03, 1.40). A random effects model was assumed for the analysis as I2 (50.9%) and Egger test 0.512 showed statistically moderate heterogeneity among the included studies for this factor analysis (Fig. 6).

Weight

In the overall analysis of this study weight of breast cancer patients was significantly associated with survival rate. Patients with overweight were 44% increased

Table 3 Predictors of survival rate among breast Cancer patients in Ethiopia– a systematic review and Meta-analysis 2024

Variable	Exposed	Comparator	aHR (95% CI)	I 2
Marital status	Yes	No	1.21;(1.03, 1.40)	50.9%
Age	A unit increase	-	1.05;(1.02, 1.08)	99.3%
Educational status	Illiterate	Literate	7.34;(4.38, 10.30)	99.8%
Residence	Rural	Urban	1.71(1.06, 2.36)	99.1%
Lymph node involvement	=>2	< 2	3.57(1.02, 6.13).	99.8%
Histological grade	=>2	< 2	1.44;(1.12, 2.77)	98.1%
Weight	Overweight	Normal	0.56;(0.24, 0.87)	96.7%
Having comorbidity	Yes	No	1.86;(1.04, 2.68)	99.2%

survival rate than their counterparts (aHR, 0.56; 95% CI: 0.24, 0.87). A random effects model was assumed for the analysis as I2 (96.7%) and Egger test 0.105 with a p-value of (< 0.001) showed statistically significant heterogeneity among the included studies for this factor analysis (Fig. 7).

Lymph node involvement

In this meta-analysis lymph node involvement of breast cancer patients was significantly associated with survival rate. Patients with two or more lymph node involvement were 1.86 times more likely to reduced survival rate than their counterparts (aHR, 3.57; 95% CI:1.02, 6.13). This means that Patients with two or more lymph node involvement were an 86% reduced survival rate than their counterparts A random effects model was assumed for the analysis as I2 (99.9%) and Egger test 0.073 with a p-value of (< 0.001) showed statistically significant heterogeneity among the included studies for this factor analysis (Fig. 8).

Age

In this meta-analysis age of breast cancer patients was significantly associated with survival rate. As age increased by one unit the survival rate of breast cancer patients was reduced by by1.05 times (aHR, 1.05; 95% CI:1.02, 1.08). A random effects model was assumed for the analysis as I2 (99.3%) with a p-value of (< 0.001) and the Egger test 0.472 showed statistically significant heterogeneity among the included studies for this factor analysis (Fig. 9).

Predictors not associated with survival rate among breast cancer patients– a systematic review in Ethiopia 2024

Family history of breast cancer

Family history of breast cancer patients was not associated with survival rate. The overall Adjusted Hazard Ratio of married women is 1.09(0.69–1.49). Random

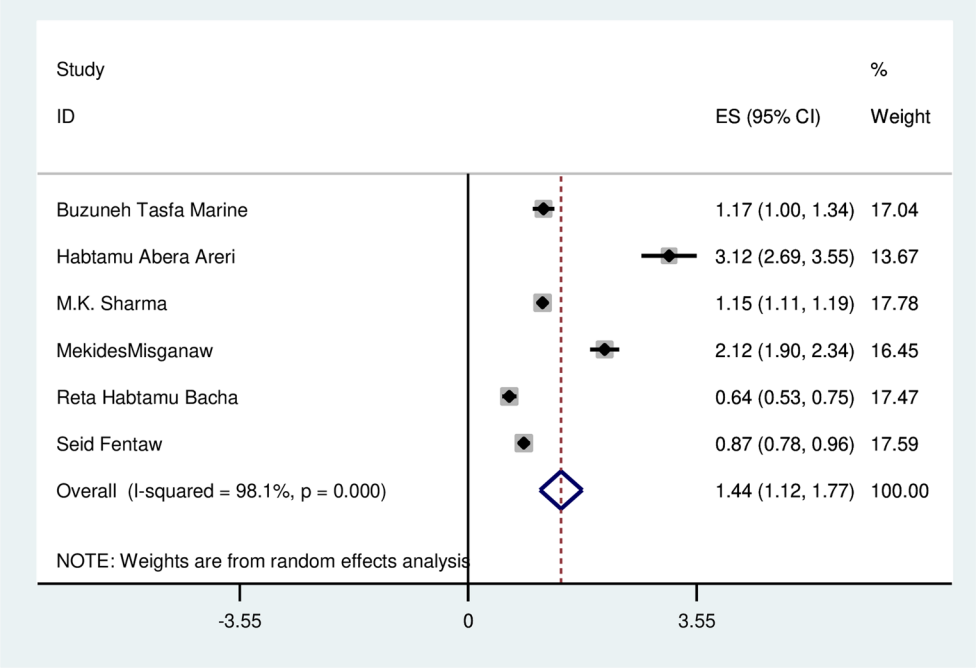

Fig. 2 The pooled adjusted hazard ratio (aHR) for the association between histological grade of breast cancer and survival rate– a systematic review in Ethiopia 2024

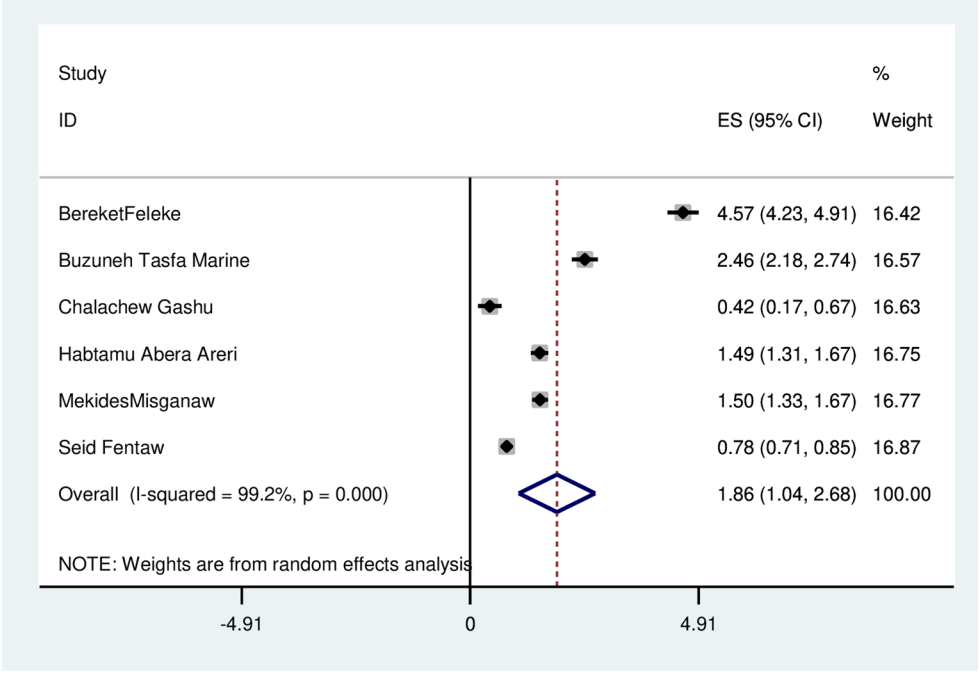

Fig. 3 The pooled adjusted hazard ratio (aHR) for the association between comorbidities and survival rate among breast cancer patients– a systematic review in Ethiopia 2024

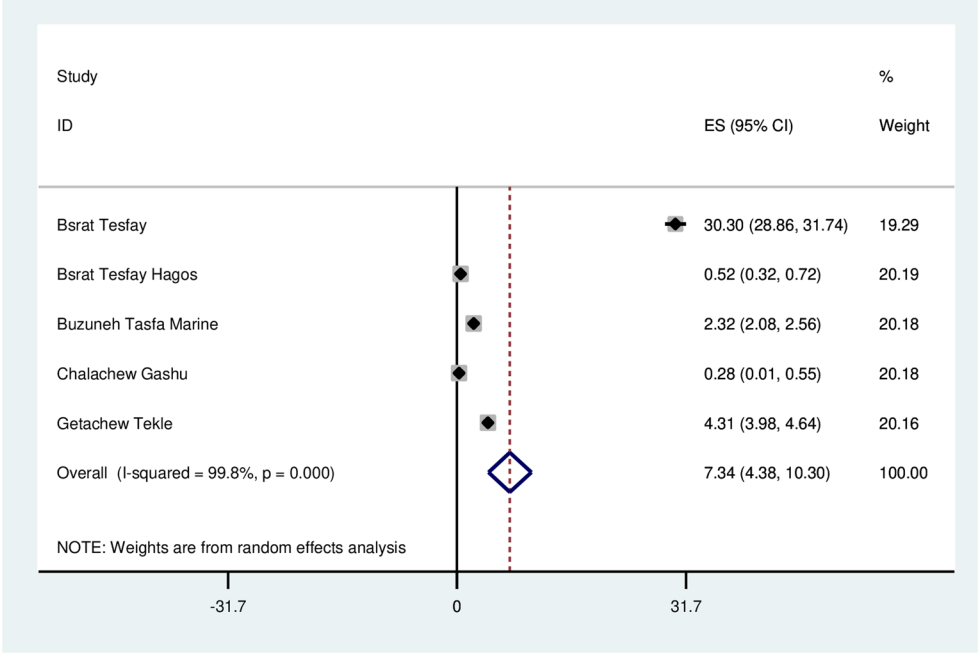

Fig. 4 The pooled adjusted hazard ratio (aHR) for the association between educational status and survival rate among breast cancer patients– a systematic review in Ethiopia 2024

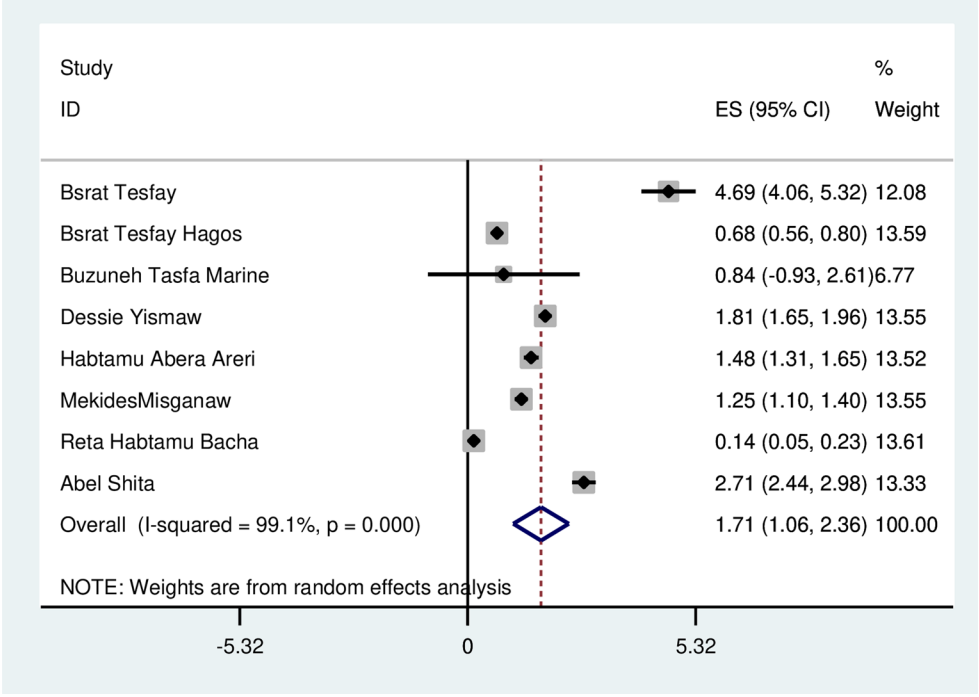

Fig. 5 The pooled adjusted hazard ratio (aHR) for the association between residence and survival rate among breast cancer patients– a systematic review in Ethiopia 2024

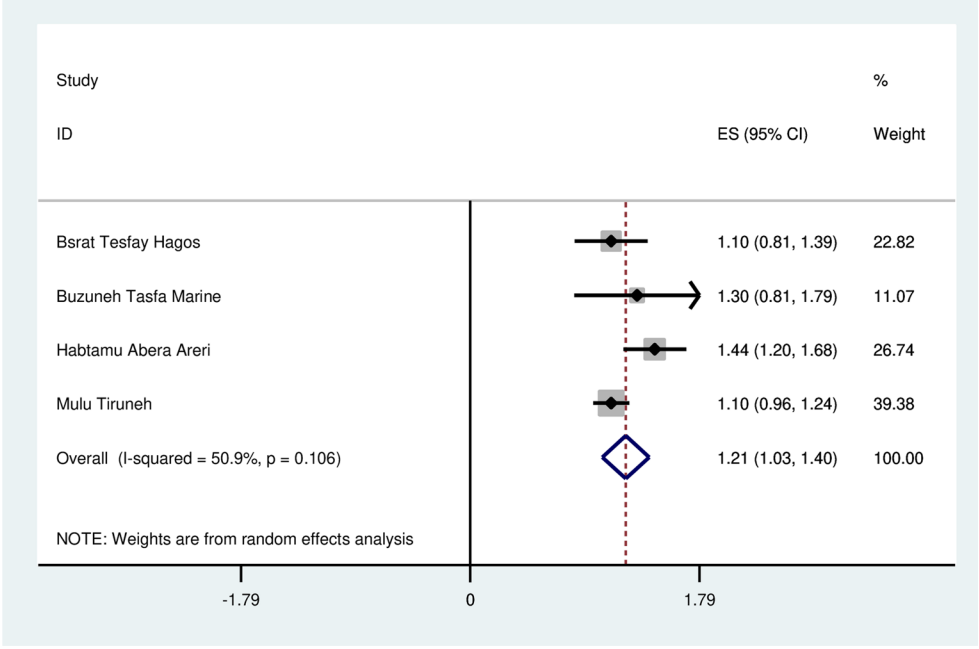

Fig. 6 The pooled adjusted hazard ratio (aHR) for the association between marital status and survival rate among breast cancer patients– a systematic review in Ethiopia 2024

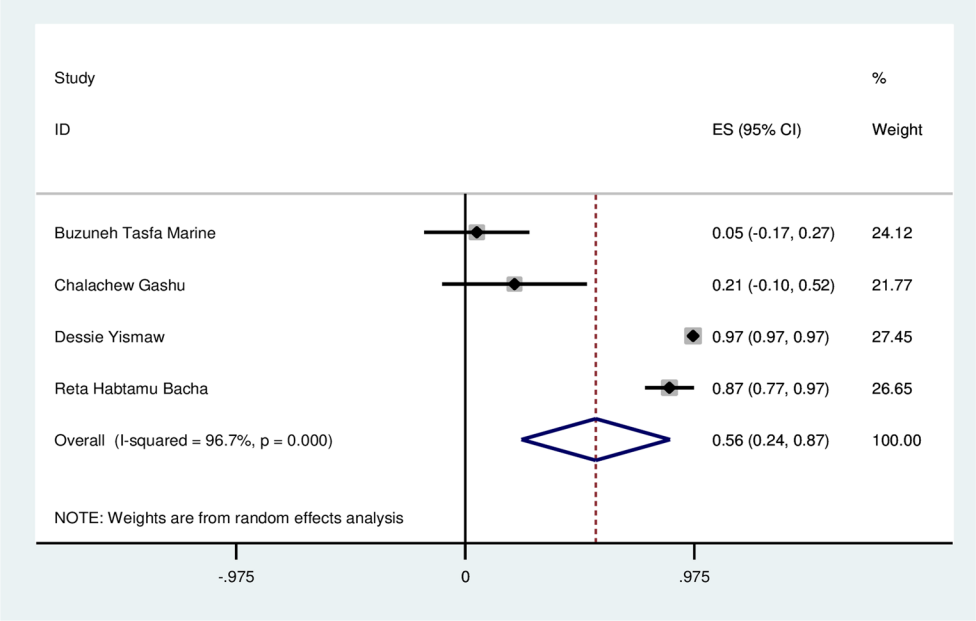

Fig. 7 The pooled adjusted hazard ratio (aHR) for the association between weight and survival rate among breast cancer patients– a systematic review in Ethiopia 2024

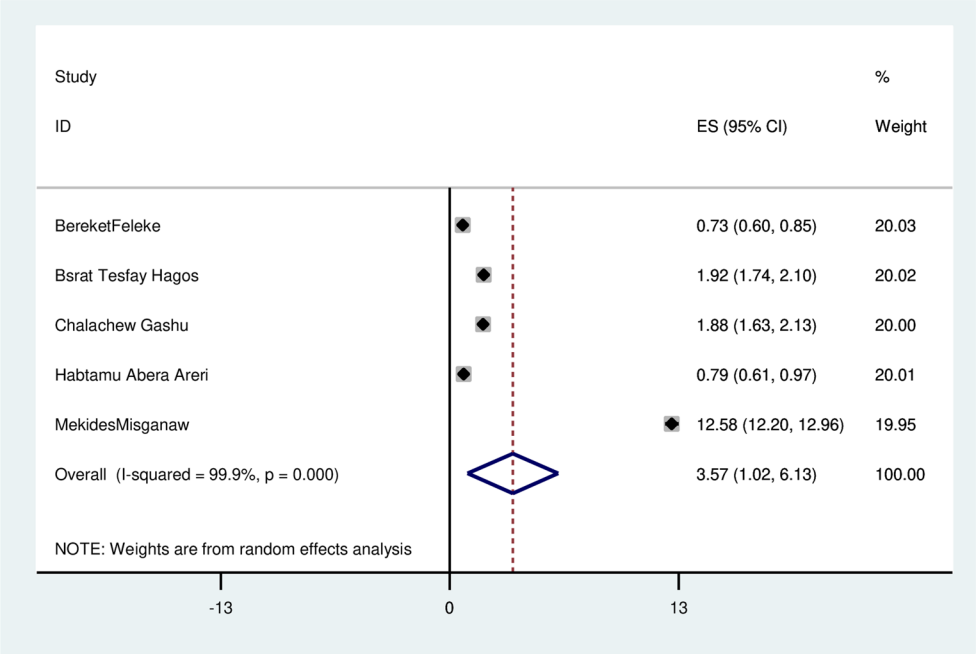

Fig. 8 The pooled adjusted hazard ratio (aHR) for the association between lymph node involvement and survival rate among breast cancer patients– a systematic review in Ethiopia 2024

effect model was used I2,97.9%) with p-value < 0.001 and Egger test 0.314 with significant heterogeneity for this analysis (Fig. 10).

Treatment taken

Treatment taken (radiotherapy, chemotherapy, and combined) was a significance difference in survival rate of breast cancer patients. The overall Adjusted Hazard Ratio of treatment taken is 1.41(0.66–2.16). Random effect model was used I2,98.8%) as p-value,0.001and Egger test 0.441 with significant heterogeneity for this analysis (Fig. 11).

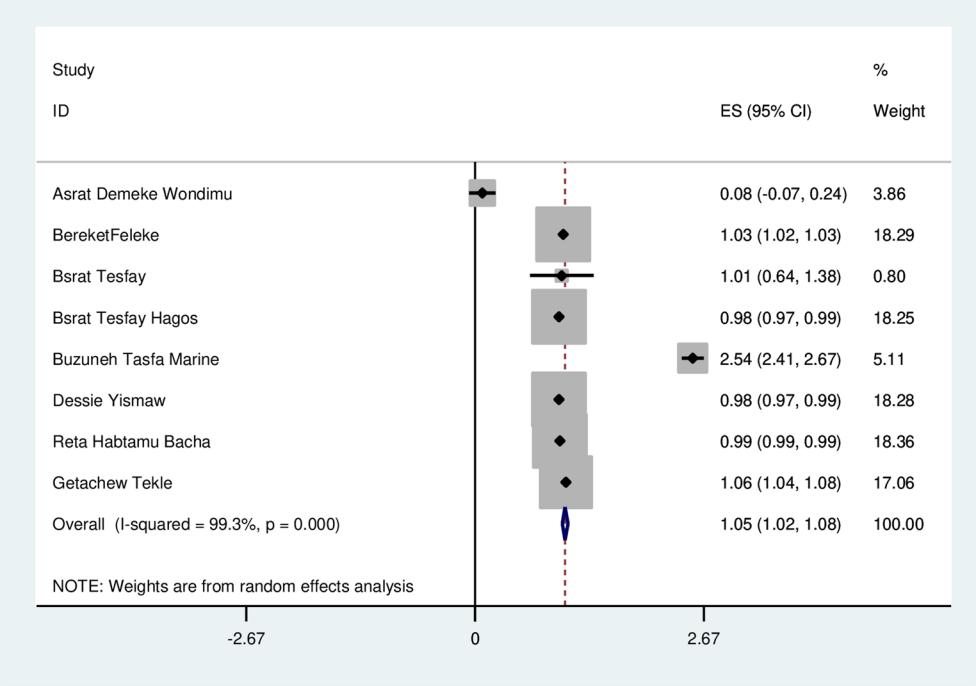

Fig. 9 The pooled adjusted hazard ratio (aHR) for the association between age and survival rate among breast cancer patients– a systematic review in Ethiopia 2024

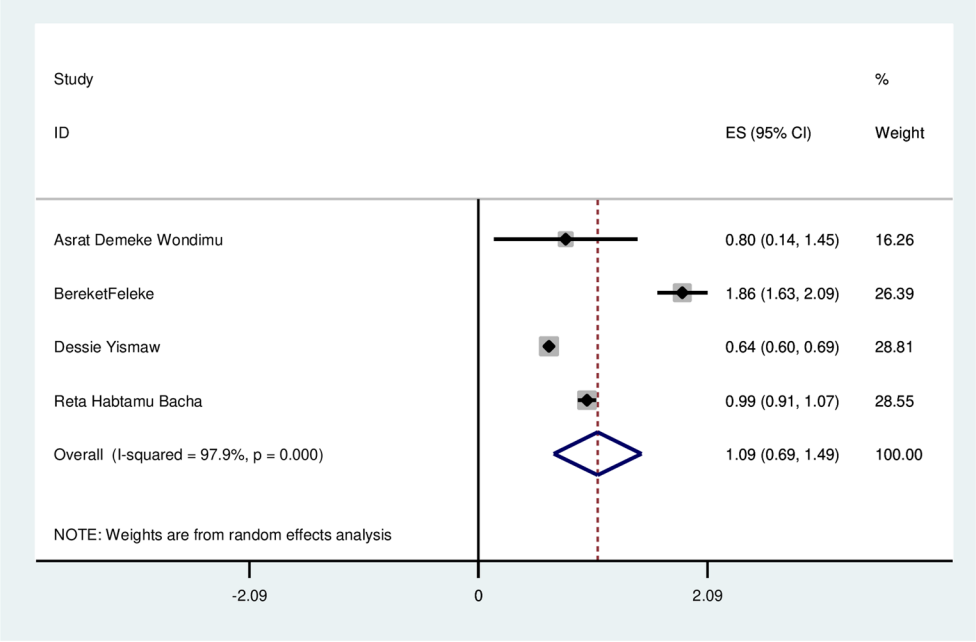

Fig. 10 The pooled adjusted hazard ratio (aHR) for the association between family history of breast cancer and survival rate among breast cancer patients– a systematic review in Ethiopia 2024

Tumor stage

The tumor stage was not associated with the survival rate of breast cancer patients. The overall Adjusted Hazard Ratio of tumor stage two and above is 1.72 (-0.24-3.68). Random effect model was used I2,99.9%) as p-value < 0.001 and Egger test 0.749 with significant heterogeneity for this analysis (Fig. 12).

Tumor size

Tumor size was not associated with survival rate of breast cancer patients. The overall Adjusted Hazard Ratio of

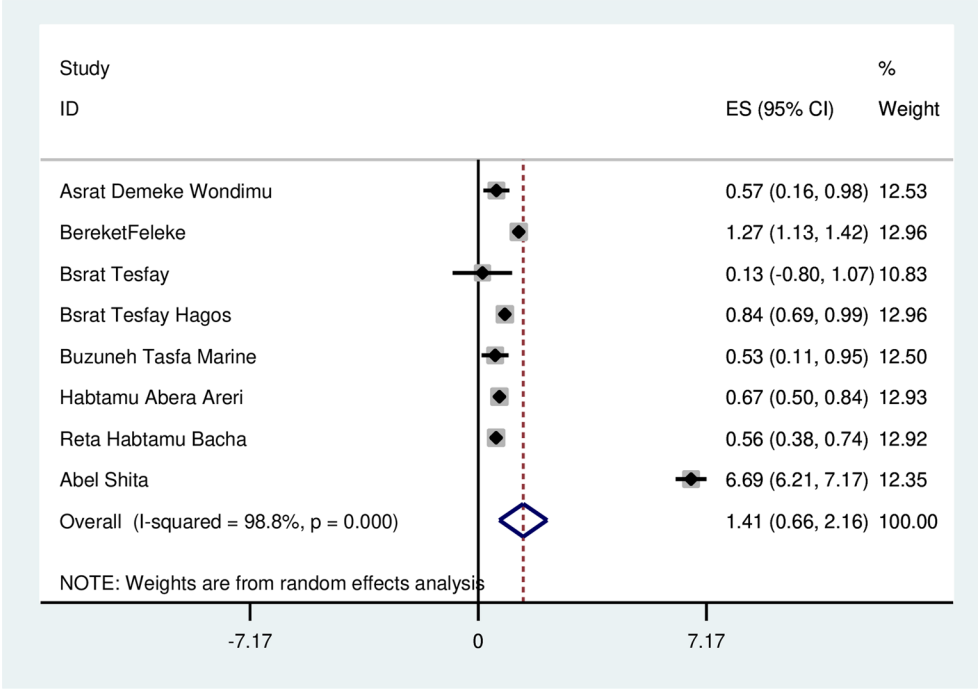

Fig. 11 The pooled adjusted hazard ratio (aHR) for the association between treatment received and survival rate among breast cancer patients: a systematic review in Ethiopia 2024

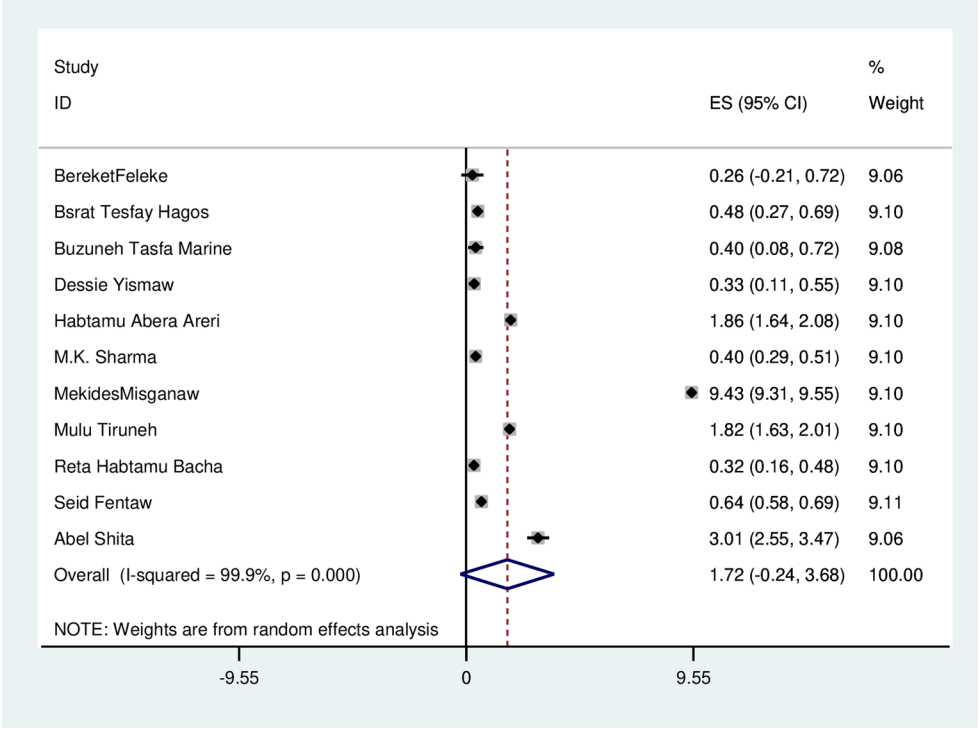

Fig. 12 The pooled adjusted hazard ratio (aHR) for the association between tumor stage and survival rate among breast cancer patients– a systematic review in Ethiopia 2024

tumor size = > 5 cm is 0.91(0.80–1.01). Random effect model was used I2,98.7%) as p-value < 0.001 and Egger test 0.408 with significant heterogeneity for this analysis (Fig. 13).

Nodal status

Nodal status was not associated with the survival rate of breast cancer patients. The overall Adjusted Hazard Ratio of a positive node is 0.92(0.48–1.36). Random effect model was used I2,97.7%) as p-value < 0.001 and Egger test 0.959 with significant heterogeneity for this analysis (Fig. 14).

Discussion

Breast cancer survival five years after diagnosis now exceeds 80% in most high-income countries, compared with 66% in India and just 40% in South Africa [57]. The premature deaths and high out-of-pocket expenditure that arise when breast cancer services are unavailable or unaffordable result in social disruption, impoverishment, family instability, and orphaned children and also threaten economic growth. We found that age, illiterate, rural residence, two or more lymph node involvement, married patients, overweight, histological grade two or more, and having comorbidity were predictors of short survival rate among breast cancer patients in Ethiopia. In this meta- analysis as age increases by one unit the survival rate of breast cancer decreases by 1.05 times. This finding is similar to earlier studies in Iran [14, 58, 59], in France [60]. The possible explanation is older breast cancer patients are less likely to undergo screening leading to late-stage diagnosis [61, 62]. They may have comorbidities that complicate breast cancer treatment and recovery, reducing the overall survival [63–66]. They may have a reduced ability to tolerate aggressive cancer treatments like chemotherapy or surgery and also a weak immune system.

The meta-analysis found that two or more histological grades of breast cancer patient had 1.44 times short survival rate than that of their counterparts. This is congruent with a study done in Denmark [67], in Malaysia [68], in France [59, 60, 69], in Italy [70], in Saudi [71], in Iran [14], United Arab Emirates [72], and in Nigeria [73]. The reason might be high-grade tumor tend to grow and spread rapidly making them more difficult to control. High-grade tumor less responsive to treatment [74], advanced histological grade is associated with a higher proliferation rate, meaning the cancer cells divide more quickly and they may have complex genetic mutations.

It was found that illiterate breast cancer patients had 7.34 times reduced survival rate than educated ones. This is congruent with study done in Vietnam [23], in India [75], in USA [76], in Egypt [77] and in Nigeria [73]. The possible explanations illiterate individuals may have less access to information about breast cancer symptoms, the importance of early detection, and available treatment

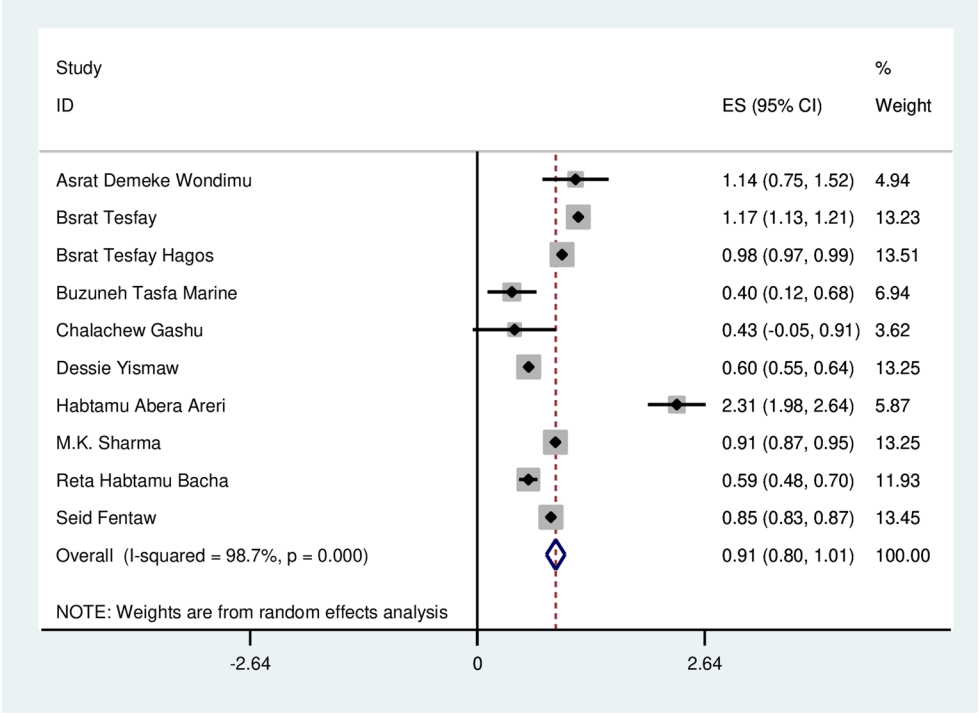

Fig. 13 The pooled adjusted hazard ratio (aHR) for the association between tumor size and survival rate among breast cancer patients– a systematic review in Ethiopia 2024

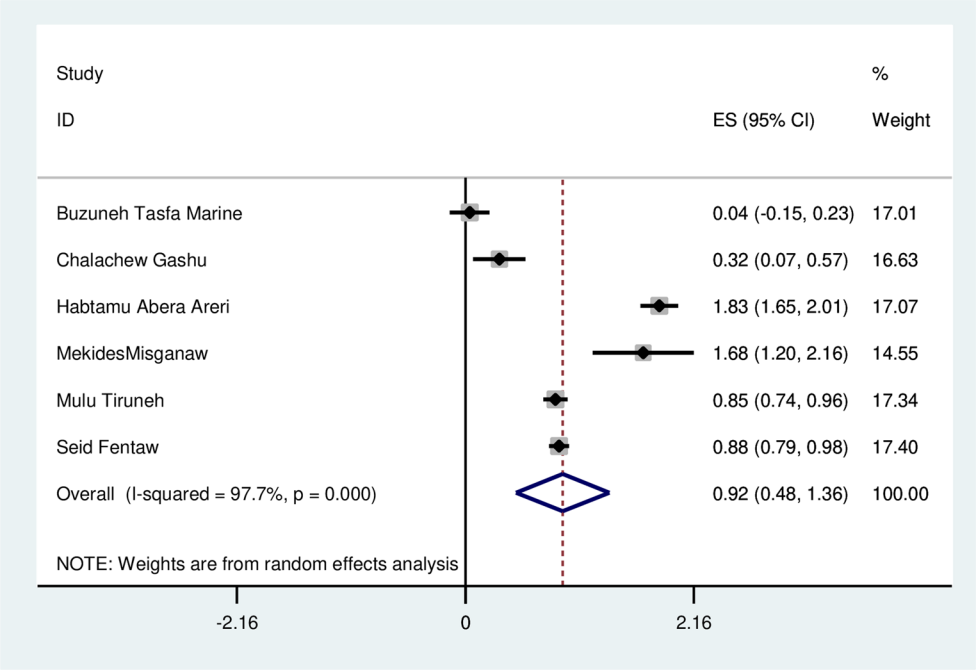

Fig. 14 The pooled adjusted hazard ratio (aHR) for the association between nodal status and survival rate among breast cancer patients– a systematic review in Ethiopia 2024

options. They may not understand health education materials, screening options and leading to delayed diagnosis. Illiteracy might be associated with cultural or social barriers that discourage individuals from seeking timely medical care, particularly for women [78]. Illiterate breast cancer patients may have poor adherence, missed appointment, misunderstanding about medications and lead short survival rate [79].

The meta-analysis found that rural residence breast cancer patients were 1.71times reduced survival rate than that of urban residence. This is similar with study done in Egypt [77], in Poland [80] and New Zealand [81]. The explanation were rural areas have fewer health care facilities, access to advanced cancer treatment and travel long distance to access treatment [82, 83]. Rural residents may have finical challenges including lower income and high cost for traveling for treatment [84]. rural populations might have lower health literacy levels, making it harder for them to understand the importance of early detection, follow complex treatment plans, or seek out specialized care. This can contribute to delays in treatment and lower adherence to recommended therapies [85].

Moreover, this meta-analysis found that two or more lymph node involvement of breast cancer patients were 2.4 times short survival rate than that of the counterparts.it was similar with previous studies done in France [69], in Japan [86], China [87], in Iran [14], and in Egypt [77]. The possible explanation were patients present with lymph node involvement suggests the indication of advanced disease and metastasis other body parts and they may have high cancer cell in the body. Patients with lymph node involvement the cancer cell were more spread rapidly and difficult to control by treatment, surgery and radiography. When cancer has spread to the more lymph nodes, more extensive treatment is often required, such as a combination of surgery, radiation, and chemotherapy. These treatments can be more toxic, and the cancer may still be more likely to recur despite aggressive treatment, contributing to a lower overall survival rate.

Married breast cancer patients were 1.21 times short survival rate than that of unmarried women. It was similar with earlier study done in Vietnam [23]. The justification might be married women delay seeking medical help due to family responsibilities, prioterizing the health and needs of their family member.Insome cases, finicial dependence on spouse, married women in rural area might have limited access to health care facilities, the health care decision made by husbands which may delay treatment.

However, it was contrasts earlier research conducted in India [88], in Saudi [71], in china [89, 90], and in California [91]. The reason might be unmarried women might lack of social support, might delay medical consultation because they are more focused on other responsibilities or lack encouragement from their partner to seek early. Unmarried women may face barriers to accessing health care, lack of someone to assist them for transportation or accompanying them to appointments and unmarried women might be less likely to engage in regular health

screenings or preventive care, leading to later-stage diagnoses and poorer outcomes.

This meta-analysis also found that the survival rate of overweight breast cancer patients increases by 44% than that of their counterparts. The possible reason might be overweight individuals are better to engage in the health care systems for the management of comorbid conditions, and might receive more comprehensive and coordinated care. Overweight patients may have more fat reserves, which can provide additional energy during the physically taxing periods of cancer treatment, such as chemotherapy or radiation therapy. This can help them maintain better overall health during treatment.

However, this finding contrasts with earlier research conducted in Italy [92], in Germany [93], in USA [94, 95], in UK [21, 96] in California [20] and Australia [97] which found that obese breast cancer patients were at higher risk for death and had reduced survival rates. A possible explanation might be excess body fat increases the level of estrogen [98, 99] and other hormones that can fuel the growth of hormone receptor-positive breast cancer. Overweight individuals often have higher levels of inflammation [100], which can promote cancer progression and resistance to treatment. Overweight patients are more likely to have other health conditions such as diabetes, hypertension, and cardiovascular disease [101, 102]. These comorbidities can complicate cancer treatment and reduce overall survival. They may also be more likely to lead a sedentary lifestyle which is associated with poorer health outcomes and short survival rate. Overweight individuals often have insulin resistance, leading to higher levels of insulin and insulin-like growth factors, which can promote tumor growth and metastasis [103, 104]. The efficacy of chemotherapy is influenced by body weight, overweight patients are complicated during surgery and excess body fat can make it more difficult to detect breast tumors early through physical examination.

Having comorbidity of breast cancer patients was 1.86 times short survival rate than their counterparts. This is similar to a study done in Ontario [105], in California [106], in China [107], and in Sweden [108]. The possible explanation might be patients with comorbidities like heart disease, diabetes or chronic respiratory disease may not eligible for certain aggressive cancer treatments of high-dose chemotherapy due to toxicity, and chronic conditions may be prone to infection leading to hospitalization and disrupting treatment follow-up. Some comorbidities like obesity and diabetes can create an environment that promotes tumor growth and metastasis and hormonal imbalance [109–111]. Comorbidities might weaken the immune system and reduce body's ability to fight cancer cells [112] and the cost of managing multiple health conditions can lead to financial strains, potentially limited to access cancer treatment.

However, it was opposed to earlier research conducted in Taiwan [113]. The potential reason might be patients with comorbidity have regular check-ups and more frequent interaction with health care providers, close monitoring of side effects, and may experience engagement in a healthier lifestyle positively impacts survival and overall health. Patients with chronic conditions often have an awareness of their health and are more likely to engage in preventive care, which can lead to earlier detection and treatment of recurrent cancer.

Limitations of the study

Heterogeneity Among Studies: Variations in study designs, sample sizes, and methodologies of included articles may have contributed to heterogeneity, even though efforts were made to address this using statistical tools. Publication Bias: While a funnel plot and Egger's test were used to assess publication bias, unpublished data, and gray literature were not included, which might have led to an overestimation or underestimation of the reported associations.

Conclusion

This systematic review and meta-analysis identified several key predictors of decreased survival rates among breast cancer patients in Ethiopia, including older age, illiteracy, rural residence, involvement of two or more lymph nodes, higher histological grade, marital status, and the presence of comorbidities. Interestingly, being overweight was associated with improved survival. Health stakeholders and policy makers emphasizing providing public health education to improve awareness among women of the signs and symptoms of breast cancer, should focus on managing comorbidities in breast cancer patients, understand the importance of early detection and treatment, and expand access to cancer treatment centers, particularly in primary and general hospitals.

Supplementary Information

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Supplementary Material 1

Supplementary Material 2

Supplementary Material 3

Supplementary Material 4

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Author contributions

CM and AA were the formulation or evolution of overarching research goals and aims and writing the research drafting. TE wrote the development or

design of the methodology.GK &AS facilitates the work by supervision and manages the software.MA&NA wrote the Methodology and analysis.

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Data availability
The datasets used and analyzed during the current study are available from the manuscript or supplementary file.

Declarations

Ethics approval and consent to participate
Not applicable.

Consent for publication
Not applicable.

Competing interests
The authors declare no competing interests.

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