Vascular Health and Risk Management

Dovepress
Taylor & Francis Group

Open Access Full Text Article

ORIGINAL RESEARCH

Sex as a Modifier of Health-Related Quality of Life, Illness Acceptance, and Psychological Distress in Patients After Aortic Aneurysm Repair: A 2-Year Prospective Study

Aneta Maria Kubisa[1], Sara Daria Janczak[2], Izabella Uchmanowicz[1], Ercole Vellone[1,3], Gianluca Pucciarelli[1,3], Dariusz Janczak[4], Aleksandra Kołtuniuk[1]

[1]Department of Nursing, Faculty of Nursing and Midwifery, Wroclaw Medical University, Wroclaw, Poland; [2]Faculty of Medicine, Wroclaw Medical University, Wroclaw, Poland; [3]Department of Biomedicine and Prevention, University of Rome Tor Vergata, Rome, Italy; [4]Department of Vascular, General and Transplantation Surgery, Wroclaw Medical University, Wroclaw, Poland

Correspondence: Aleksandra Kołtuniuk, Department of Nursing, Faculty of Nursing and Midwifery, Wroclaw Medical University, ul. Bartla 5, 51-618, Wroclaw, Poland, Email aleksandra.koltuniuk@umw.edu.pl

Vascular Health and Risk Management downloaded from https://www.dovepress.com/
For personal use only.

Introduction: Women constitute a minority of patients undergoing aortic aneurysm repair, yet available data suggest a worse quality of life and a higher burden of perioperative anxiety in this group. Prospective, multi-timepoint data comparing the sexes in Polish clinical centres are virtually absent. We assessed whether sex modifies quality of life, illness acceptance, and psychological distress over 2 years following aortic aneurysm repair.

Material and Methods: In this prospective, single-centre cohort study, 150 consecutive patients (113 men, 37 women; mean age 69.9, SD 8.1 years) treated for aortic aneurysm between 2021 and 2024 completed the WHOQOL-Bref, the Acceptance of Illness Scale (AIS) and the Hospital Anxiety and Depression Scale, Polish modified version (HADS-M), immediately after surgery and at 6 months, 1 year and 2 years. The cohort was unrestricted with respect to aneurysm extent and repair modality. The primary analysis used generalised estimating equations including sex, time and the sex-by-time interaction, adjusted for age, repair modality, urgency of admission, ischaemic heart disease and partnered status. A prespecified sensitivity analysis was restricted to infrarenal aneurysms treated by standard endovascular repair (n=94).

Results: Immediately after surgery, women scored lower than men in all four WHOQOL-Bref domains: physical 52.7 vs 60.2 (p=0.013), psychological 58.4 vs 68.1 (p=0.001), social relationships 59.0 vs 69.6 (p<0.001) and environmental 62.8 vs 67.5 (p=0.037); anxiety was higher in women (8.7 vs 7.1; p=0.035). After adjustment, the early deficit remained significant for the psychological domain (adjusted difference −9.26, 95% CI −15.54 to −2.98; p=0.004) and the social relationships domain (−9.85, 95% CI −15.95 to −3.74; p=0.002) but not for the physical or environmental domains, and the crude anxiety difference did not survive adjustment (p=0.253). Significant sex-by-time interactions indicated convergence in all domains except social relationships, for which the adjusted female deficit persisted across follow-up (−6.86, 95% CI −12.27 to −1.44; p=0.013). At 2 years no woman remained in the low illness-acceptance category compared with 20.5% of men (p=0.037); this categorical comparison rests on small and unstable cell counts and is presented as descriptive only. The sensitivity analysis reproduced and strengthened these findings.

Conclusion: Women undergoing aortic aneurysm repair report a lower quality of life in the early postoperative period, and the deficit in the social relationships domain is the one that persists over 2 years after adjustment. In the absence of a preoperative baseline and with a small female subgroup, these observations are hypothesis-generating and support the routine, sex-stratified capture of patient-reported outcome measures in aortic practice.

Keywords: aortic aneurysm, sex differences, quality of life, WHOQOL-Bref, anxiety, depression, HADS, illness acceptance, vascular surgery, patient-reported outcome measures

https://doi.org/10.2147/VHRM.S626089
Received: 3 June 2026
Accepted: 27 August 2026
Published: 14 September 2026

© 2026 Kubisa et al. This work is published and licensed by Dove Medical Press Limited. The full terms of this license are available at https://www.dovepress.com/terms.php and incorporate the Creative Commons Attribution – Non Commercial (unported, v4.0) License (http://creativecommons.org/licenses/by-nc/4.0/). By accessing the work you hereby accept the Terms. Non-commercial uses of the work are permitted without any further permission from Dove Medical Press Limited, provided the work is properly attributed. For permission for commercial use of this work, please see paragraphs 4.2 and 5 of our Terms (https://www.dovepress.com/terms.php).

Introduction

Aortic aneurysm predominantly affects older men; women account for approximately one fifth of patients undergoing repair and exhibit a distinct clinical course and worse early outcomes, being less often anatomically suitable for endovascular repair, more often not offered intervention at all, and having higher 30-day mortality after both endovascular and open repair.[1,2] The 2024 European Society for Vascular Surgery (ESVS) Clinical Practice Guidelines emphasise the need to consider sex as an important modifier of therapeutic outcomes, including quality of life and patient-reported outcome measures (PROMs).1 Despite growing awareness, women remain chronically under-represented both in clinical trials and in aortic registries.

Data from large registry databases indicate that women undergo repair at a more advanced age, with a higher proportion of morphologically challenging aneurysms and greater perioperative mortality.[3,4] In an analysis of 6661 intact infrarenal abdominal aortic aneurysm repairs from the Targeted Vascular module of the American College of Surgeons National Surgical Quality Improvement Program, Deery et al[5] showed that women have significantly higher 30-day mortality and more major complications than men. Pirinen et al,[6] in a binational registry study (n=32,324), confirmed inferior long-term survival after endovascular aneurysm repair. Katz et al[7] were among the first to document worse operative mortality in women, and these findings were corroborated by the meta-analysis of Grootenboer et al[8] and the study by Zommorodi et al.[9] This evidence base has been consolidated in the most recent literature. In a systematic review and narrative synthesis of more than half a million procedures, Marzano et al[10] concluded that anatomical constraints, including smaller access vessels and more angulated proximal necks, contribute to less favourable endovascular outcomes in women. Using harmonised patient-level administrative data from eleven high-income countries, Woo et al[11] demonstrated that the male-to-female ratio of intact repairs and the sex-related outcome gap persist across health systems, indicating that the disparity is not attributable to a single national context. In a contemporary analysis of Medicare beneficiaries treated by infrarenal endovascular repair, Raja et al[12] likewise reported worse outcomes in women. In a contemporary series confined to endovascular repair of thoracoabdominal aortic aneurysm, Kang et al[13] showed that the same sex-related disadvantage extends to complex, more proximal disease. Sex is therefore a robust determinant of outcome after aortic repair, and this provides the contemporary background against which patient-reported outcomes should now be examined.

The psychological dimension, comprising anxiety, depression, and illness acceptance, is of particular relevance in this context. Bjelland et al[14] reported that women achieve higher anxiety scores than men in hospital populations. In a systematic review, Liblik et al[15] observed higher levels of depression and anxiety in women after acute cardiovascular events, persisting for at least 1 year. Villard and Hultgren[16] highlight that women with abdominal aortic aneurysm constitute a group whose specific psychological needs remain insufficiently investigated. Data on sex differences in quality of life after aortic repair are scarce and inconclusive,[17–21] and prospective, multi-timepoint Polish studies addressing this question are essentially absent.

Aim of the Study

We prospectively examined whether sex modifies health-related quality of life, illness acceptance, and the severity of anxiety, depression and irritability over 2 years following aortic aneurysm repair. The parameter of primary interest was the sex-by-time interaction, that is, whether any between-sex difference present in the early postoperative period persists, attenuates or widens over follow-up.

Materials and Methods

Study Design and Population

We conducted a prospective, single-centre cohort study at the University Clinical Hospital in Wroclaw, Poland. The study was approved by the Bioethics Committee of Wroclaw Medical University (approval no. 70/2021), was conducted in accordance with the Declaration of Helsinki, and written informed consent was obtained from all participants.

One hundred and fifty consecutive patients treated between 2021 and 2024 for aortic aneurysm and discharged alive were enrolled. Eligibility required a diagnosis confirmed on computed tomography angiography, qualification for

Table 1 Sociodemographic, Clinical and Treatment Characteristics by Sex (N=150)

Variable	Men (n=113)	Women (n=37)	Test	p
Age, years, mean (SD)	69.1 (8.1)	72.5 (7.7)	U	0.012
Marital status: partnered	91 (80.5%)	28 (75.7%)	χ^2	0.603
Residence: urban	73 (64.6%)	26 (70.3%)	χ^2	0.666
Education: higher	40 (35.4%)	13 (35.1%)	χ^2	0.503
Admission: urgent	30 (26.5%)	10 (27.0%)	χ^2	1.000
Aneurysm extent: infrarenal	71 (62.8%)	23 (62.2%)	χ^2	0.987
Aneurysm extent: juxtarenal	23 (20.4%)	8 (21.6%)		
Aneurysm extent: suprarenal/complex	14 (12.4%)	4 (10.8%)		
Aneurysm extent: dissection	5 (4.4%)	2 (5.4%)		
Repair: standard EVAR	73 (64.6%)	27 (73.0%)	χ^2	0.723
Repair: TEVAR	18 (15.9%)	5 (13.5%)		
Repair: BEVAR	20 (17.7%)	5 (13.5%)		
Repair: open	2 (1.8%)	0 (0.0%)		
Aneurysm size 6 to 8 cm	89 (78.8%)	32 (86.5%)	χ^2	0.115
Hospital stay, days, mean (SD)	5.2 (1.9)	4.9 (1.2)	U	0.703
Intensive care stay, days, mean (SD)	0.0 (0.4)	0.2 (0.9)	U	0.091
Hypertension	112 (99.1%)	35 (94.6%)	Fisher	0.151
Atherosclerosis	83 (73.5%)	28 (75.7%)	χ^2	0.959
Ischaemic heart disease	61 (54.0%)	1 (2.7%)	χ^2	<0.001
Diabetes mellitus	30 (26.5%)	14 (37.8%)	χ^2	0.271
Re-admission for staged procedure	35 (31.0%)	6 (16.2%)	χ^2	0.125

Notes: Values are n (%) unless otherwise stated. U, Mann–Whitney *U*-test; χ^2, Pearson chi-squared test; Fisher, Fisher exact test. For categorical variables with more than two levels the p value refers to the overall comparison across levels and is shown on the first row of the group.

Abbreviation: SD, standard deviation; EVAR, endovascular aneurysm repair; TEVAR, thoracic endovascular aortic repair; BEVAR, branched endovascular aortic repair.

aneurysm repair, survival to discharge, and the ability to complete self-report questionnaires. The composition of the cohort is described explicitly rather than presented as a homogeneous infrarenal endovascular population. The series comprised infrarenal aneurysms in 94 patients (62.7%), juxtarenal aneurysms in 31 (20.7%), suprarenal or otherwise complex aneurysms in 18 (12.0%) and aortic dissection in 7 (4.7%). Repair was by standard infrarenal endovascular aneurysm repair (EVAR) in 100 patients (66.7%), by thoracic endovascular aortic repair (TEVAR) in 23 (15.3%), by branched endovascular repair (BEVAR) in 25 (16.7%) and by conventional open repair in 2 (1.3%). We emphasise that TEVAR and BEVAR are not alternative treatment options for infrarenal abdominal aortic aneurysm; TEVAR is indicated for thoracic aortic pathology and branched repair is reserved for selected complex thoracoabdominal or juxtarenal and pararenal aneurysms, and in this series these techniques were used only in patients whose aneurysm extent placed them outside the infrarenal category. The distribution of aneurysm extent and repair modality did not differ between the sexes (Table 1). Of the 100 patients treated by standard endovascular repair, 94 had an infrarenal aneurysm and 6 had a juxtarenal aneurysm whose proximal neck anatomy was suitable for an infrarenal device; this accounts for the difference between the number of patients classified as infrarenal and the number treated by standard EVAR.

Because this heterogeneity is a genuine feature of a consecutive real-world series rather than a design flaw, the title, aim and terminology of the manuscript refer to aortic aneurysm repair, and a prespecified sensitivity analysis restricted to the 94 patients with an infrarenal aneurysm treated by standard EVAR is reported alongside the main analysis.

No patient required mechanical ventilation or experienced cardiac arrest in the intensive care unit, and only 3 patients (2.0%) were admitted to the intensive care unit at all. A staged subsequent endovascular procedure, predominantly the second stage of a branched repair, was planned in 41 patients (27.3%) and constituted the reason for re-admission. Preoperative frailty, functional status and clinical vulnerability were not assessed within the study protocol and no validated frailty instrument was applied before intervention; this is acknowledged as a limitation.

Perioperative and Post-Discharge Care Pathway

Because the outcomes under study are sensitive to the organisation of care, the care pathway is described here in detail. All patients were admitted to the Department of Vascular, General and Transplantation Surgery. Immediately after the vascular procedure patients remained under continuous monitoring and nursing care in the postoperative recovery room, with one nurse assigned to each patient; transfer to the intensive care unit occurred only when clinically indicated, which was the case in 3 patients. From the first postoperative day, mobilisation was conducted by a physiotherapist. Psychological or psychiatric consultation was available when clinically indicated; no structured counselling, psychosocial programme or formal vascular rehabilitation was offered routinely during the postoperative period. On the following days, care was organised so as to provide, on average, one nurse per five patients. After discharge all patients entered the standard outpatient surveillance programme of the department, comprising clinical review and computed tomography angiography according to the departmental protocol, without dedicated nursing contact, psychological support or structured outpatient counselling. The care pathway was identical for women and men, and no component of it was allocated by sex, so differential access to support is unlikely to account for the between-sex differences reported below.

Instruments and Timepoints

WHOQOL-Bref: a 26-item World Health Organization instrument assessing quality of life across four domains, namely physical (D1, 7 items), psychological (D2, 6 items), social relationships (D3, 3 items) and environmental (D4, 8 items). Items 3, 4 and 26 are reverse scored. The Polish version has established psychometric properties.[22] Domain scores were transformed to a 0 to 100 scale according to the WHO scoring manual, with higher scores indicating better quality of life.[23]

AIS (Acceptance of Illness Scale),[24] in the Polish adaptation by Juczyński,[25] comprises eight statements rated on a 1 to 5 Likert scale; totals of 8 to 19 points denote low, 20 to 29 moderate and 30 to 40 high illness acceptance.

HADS-M: the Polish modified version of the Hospital Anxiety and Depression Scale.[26,27] In the original instrument, 14 items form the anxiety and depression subscales, each scored 0 to 21; the Polish modification adds two items forming an irritability subscale scored 0 to 6, giving 16 items in total. Scores of 8 points or more on the anxiety and depression subscales are treated as the screening threshold.[14]

Assessments were performed at T1, immediately after surgery and before discharge; T2, at 6 months; T3, at 1 year; and T4, at 2 years, each with a tolerance of 4 weeks (6 weeks at T4). No preoperative assessment was performed. Recruitment followed the decision to operate and, for the 40 patients (26.7%) admitted urgently, no interval existed in which a preoperative assessment could have been obtained under conditions identical for the whole cohort. T1 therefore represents an early postoperative reference point and not a true baseline, and all results are interpreted accordingly.

Statistical Analysis

Continuous variables are presented as means with standard deviations and categorical variables as counts with percentages. Normality was verified with the Shapiro–Wilk test and was not met for most variables. Cross-sectional between-sex comparisons at each timepoint used the Mann–Whitney *U*-test for continuous variables and the Pearson chi-squared test, or the Fisher exact test where expected counts were small, for categorical variables; these are reported for description only. Within-sex change across the four timepoints was assessed with the Friedman test in patients with complete data.

The primary analysis was longitudinal and used generalised estimating equations with an exchangeable working correlation structure and robust standard errors,[28] fitted separately for each WHOQOL-Bref domain and for the AIS and HADS-M scores. Each model included sex, time as a categorical factor, and the sex-by-time interaction, and was adjusted for age, repair modality (standard EVAR versus complex or open repair), urgency of admission, ischaemic heart disease and partnered status as a proxy for available social support. Estimates are reported as adjusted mean differences with 95% confidence intervals; the coefficient for sex represents the adjusted female-minus-male difference at T1 and the interaction terms represent the change in that difference at each subsequent timepoint. A companion model omitting the interaction provides the overall adjusted female effect across follow-up. Because the analysis is exploratory and the

female subgroup small, no correction for multiplicity was applied and the findings are presented as hypothesis-generating. Attrition was compared between the sexes and the plausibility of the missing-at-random assumption was examined by comparing the baseline characteristics of completers and non-completers. A prespecified sensitivity analysis repeated the primary models in the subgroup with an infrarenal aneurysm treated by standard EVAR. The level of statistical significance was set at 0.05. Analyses were performed in Statistica (TIBCO Software Inc).

All WHOQOL-Bref domain scores were derived from item-level data using the WHO scoring algorithm, without intermediate rounding. The domain assignment of every item and the reverse coding of items 3, 4 and 26 were verified independently against the WHO manual before the tables were generated.

Results

Characteristics of the Study Cohort

Full sociodemographic, clinical and early postoperative characteristics of the cohort, stratified by sex, are shown in Table 1. Women were significantly older than men (72.5, SD 7.7 vs 69.1, SD 8.1 years; p=0.012), and 21 of the 37 women (56.8%) were aged 71 to 80 years. The sexes differed significantly with respect to ischaemic heart disease, recorded in 54.0% of men but in only one woman (2.7%; p<0.001). No other demographic, clinical or treatment-related variable differed significantly between the sexes, including aneurysm extent (p=0.987), repair modality (p=0.723), urgency of admission (p=1.000), marital status (p=0.603) and length of hospital stay (p=0.703).

The study database recorded intensive care admission, duration of mechanical ventilation, in-unit cardiac arrest, length of stay and re-hospitalisation. Of these, no patient required mechanical ventilation or experienced cardiac arrest, 3 patients were admitted to intensive care, and re-admission for a staged procedure occurred in 35 men (31.0%) and 6 women (16.2%; p=0.125). Mortality, major adverse cardiovascular events, stroke or transient ischaemic attack, myocardial infarction, renal and access-site complications, bleeding, endoleak, reintervention and spinal cord ischaemia were not captured in the study database, and postoperative psychological status could therefore not be related to procedural morbidity. This is stated explicitly here and acknowledged in the limitations.

Complete follow-up to 2 years, with all four assessments available, was achieved in 78 men (69.0%) and 25 women (67.6%); attrition did not differ between the sexes (p=0.877). Patients lost to follow-up were older than completers (72.4 vs 68.8 years; p=0.026) and reported higher early depression scores (7.0 vs 5.3; p=0.035), whereas early quality-of-life and illness-acceptance scores did not differ, so informative dropout cannot be excluded.

Quality of Life, Illness Acceptance and Psychological Distress by Sex

WHOQOL-Bref, AIS and HADS-M scores at each timepoint, stratified by sex, are presented in Table 2. Immediately after surgery, women scored significantly lower than men in all four WHOQOL-Bref domains: physical 52.7 (SD 15.4) vs 60.2 (SD 16.4), p=0.013; psychological 58.4 (SD 17.2) vs 68.1 (SD 13.7), p=0.001; social relationships 59.0 (SD 16.4) vs 69.6 (SD 15.5), p<0.001; and environmental 62.8 (SD 14.4) vs 67.5 (SD 12.5), p=0.037. Anxiety was higher in women at the same timepoint (8.7, SD 4.3 vs 7.1, SD 4.4; p=0.035), with 62.2% of women and 43.4% of men scoring at or above the screening threshold of 8 points (p=0.072). Depression and irritability did not differ significantly at T1.

At subsequent timepoints most differences attenuated. The physical and environmental domains no longer differed at any later timepoint. The social relationships domain remained lower in women at 6 months (58.9 vs 64.3; p=0.043) and at 2 years (58.7 vs 66.1; p=0.026), and the psychological domain, which had converged at 6 months and 1 year, differed again at 2 years (64.2 vs 70.5; p=0.034). Anxiety converged by 6 months (6.6 vs 6.0; p=0.249) and remained comparable thereafter. Irritability differed marginally at 1 year (1.7 vs 1.4; p=0.049); given the number of comparisons performed and the absence of correction for multiplicity, this isolated result is not interpreted further.

The Friedman test in patients with complete data showed significant improvement over time in anxiety in both sexes (men p<0.001, women p<0.001) and in depression (men p=0.015, women p=0.001). In men the social relationships domain declined significantly over follow-up (p<0.001) while the psychological domain improved (p=0.002); in women no domain changed significantly over time, the social relationships domain remaining essentially flat between 58.6 and 59.0 points.

Table 2 WHOQOL-Bref, AIS and HADS-M Scores by Sex at Four Timepoints, Mean (SD)

Measure	Timepoint	Men, Mean (SD)	Women, Mean (SD)	U	p
WHOQOL-Bref D1 physical	T1	60.2 (16.4)	52.7 (15.4)	2546	0.013
	T2	55.7 (11.1)	54.0 (12.0)	1862	0.353
	T3	56.0 (10.1)	53.9 (10.1)	1546	0.365
	T4	57.2 (11.5)	55.3 (11.4)	1061	0.381
WHOQOL-Bref D2 psychological	T1	68.1 (13.7)	58.4 (17.2)	2801	0.001
	T2	65.8 (11.7)	61.7 (15.2)	2046	0.140
	T3	67.2 (10.5)	62.6 (11.3)	1769	0.058
	T4	70.5 (10.8)	64.2 (14.3)	1234	0.034
WHOQOL-Bref D3 social relationships	T1	69.6 (15.5)	59.0 (16.4)	2888	<0.001
	T2	64.3 (13.7)	58.9 (16.0)	2091	0.043
	T3	62.7 (14.1)	58.6 (15.5)	1619	0.147
	T4	66.1 (14.9)	58.7 (16.4)	1261	0.026
WHOQOL-Bref D4 environmental	T1	67.5 (12.5)	62.8 (14.4)	2522	0.037
	T2	64.8 (11.4)	63.8 (14.1)	1778	0.557
	T3	63.6 (10.7)	62.8 (11.5)	1425	0.578
	T4	66.9 (10.7)	62.4 (12.0)	1172	0.101
AIS total	T1	26.1 (7.7)	26.8 (5.4)	2019	0.758
	T2	25.0 (6.2)	25.2 (6.0)	1704	0.825
	T3	24.3 (5.9)	26.1 (5.6)	1222	0.187
	T4	24.9 (6.9)	27.0 (4.1)	861	0.382
HADS-M anxiety	T1	7.1 (4.4)	8.7 (4.3)	1608	0.035
	T2	6.0 (3.5)	6.6 (2.8)	1517	0.249
	T3	5.2 (3.0)	5.3 (2.3)	1374	0.645
	T4	4.3 (2.6)	4.5 (1.9)	905	0.592
HADS-M depression	T1	5.5 (4.0)	6.9 (4.6)	1713	0.100
	T2	5.9 (3.5)	5.6 (3.2)	1812	0.756
	T3	5.3 (3.1)	4.8 (2.7)	1562	0.543
	T4	4.6 (2.7)	4.5 (3.0)	1017	0.748
HADS-M irritability	T1	2.1 (1.5)	2.1 (1.5)	2123	0.886
	T2	1.6 (1.1)	1.7 (0.9)	1643	0.582
	T3	1.4 (1.0)	1.7 (0.9)	1128	0.049
	T4	1.5 (1.1)	1.6 (0.9)	818	0.205

Notes: T1, immediately after surgery; T2, 6 months; T3, 1 year; T4, 2 years. WHOQOL-Bref domain scores are transformed to a 0 to 100 scale, higher scores indicating better quality of life. range 8 to 40, higher scores indicating greater acceptance. HADS-M, Hospital Anxiety and Depression Scale, Polish modified version; anxiety and depression subscales range 0 to 21, irritability subscale 0 to 6, higher scores indicating greater severity. Numbers available at each timepoint were 113 men and 37 women at T1, 106 and 33 at T2, 97 and 30 at T3, and 78 and 25 at T4, with minor variation by instrument owing to missing items. All comparisons are cross-sectional and unadjusted; adjusted longitudinal estimates are given in Table 4.

Abbreviations: SD, standard deviation; U, Mann–Whitney U statistic AIS, Acceptance of Illness Scale, HADS-M, Hospital Anxiety and Depression Scale, Polish modified version.

Illness Acceptance: Categorical Distribution by Sex

The distribution of illness acceptance categories by sex is shown in Table 3. Immediately after surgery the distributions differed at the conventional threshold (χ^2=6.00; p=0.050): low acceptance was recorded in 21.2% of men but in only 5.4% of women, whereas women were concentrated in the moderate category (59.5% vs 41.6%). The distributions did not differ at 6 months or at 1 year. At 2 years the difference reappeared (χ^2=6.57; p=0.037): no woman remained in the low-acceptance category, whereas 20.5% of men continued to show a low level. The smallest expected cell count at 2 years was 3.9, so these proportions are unstable and the comparison is presented for description only. On the continuous AIS score no between-sex difference reached significance at any timepoint (Table 2), and the adjusted longitudinal analysis likewise showed no significant sex effect.

Table 3 Distribution of Acceptance of Illness Scale Categories by Sex at Four Timepoints

Timepoint	AIS Category	Men	Women	χ^2	p
T1 immediately after surgery	Low (8 to 19)	24 (21.2%)	2 (5.4%)	6.00	0.050
	Moderate (20 to 29)	47 (41.6%)	22 (59.5%)		
	High (30 to 40)	42 (37.2%)	13 (35.1%)		
T2 6 months	Low (8 to 19)	21 (19.8%)	4 (12.1%)	1.48	0.478
	Moderate (20 to 29)	64 (60.4%)	20 (60.6%)		
	High (30 to 40)	21 (19.8%)	9 (27.3%)		
T3 1 year	Low (8 to 19)	19 (19.6%)	4 (13.3%)	0.75	0.688
	Moderate (20 to 29)	54 (55.7%)	19 (63.3%)		
	High (30 to 40)	24 (24.7%)	7 (23.3%)		
T4 2 years	Low (8 to 19)	16 (20.5%)	0 (0.0%)	6.57	0.037
	Moderate (20 to 29)	40 (51.3%)	18 (72.0%)		
	High (30 to 40)	22 (28.2%)	7 (28.0%)		

Notes: Values are n (%) of the sex-specific total at each timepoint. AIS, Acceptance of Illness Scale. χ^2 and p refer to the overall Pearson chi-squared test of the three-by-two table at that timepoint and are shown on the first row of each block. Smallest expected cell counts were 6.4 at T1, 5.9 at T2, 5.4 at T3 and 3.9 at T4.
Abbreviation: AIS, Acceptance of Illness Scale.

Table 4 Adjusted Sex Effects from Generalised Estimating Equation Models, Full Cohort and Sensitivity Subgroup

Outcome	Adjusted Female Effect at T1 (95% CI), p	Overall Adjusted Female Effect (95% CI), p	Sensitivity Subgroup: Effect at T1 (95% CI), p
D1 physical	−5.18 (−11.09 to 0.73), p=0.086	−2.08 (−6.59 to 2.42), p=0.365	−10.68 (−17.68 to −3.68), p=0.003
D2 psychological	−9.26 (−15.54 to −2.98), p=0.004	−5.87 (−11.05 to −0.69), p=0.026	−10.84 (−18.50 to −3.19), p=0.005
D3 social relationships	−9.85 (−15.95 to −3.74), p=0.002	−6.86 (−12.27 to −1.44), p=0.013	−11.83 (−18.57 to −5.09), p<0.001
D4 environmental	−4.74 (−10.06 to 0.58), p=0.081	−3.09 (−7.72 to 1.55), p=0.192	−7.35 (−13.38 to −1.32), p=0.017
AIS total	+1.39 (−1.03 to 3.81), p=0.261	+1.81 (−0.33 to 3.95), p=0.097	−0.89 (−4.02 to 2.24), p=0.578
HADS-M anxiety	+1.03 (−0.73 to 2.79), p=0.253	+0.24 (−0.94 to 1.43), p=0.690	+1.60 (−0.68 to 3.87), p=0.169
HADS-M depression	+1.05 (−0.65 to 2.75), p=0.227	+0.02 (−1.24 to 1.27), p=0.980	+1.89 (−0.22 to 3.99), p=0.079
HADS-M irritability	−0.16 (−0.73 to 0.41), p=0.583	−0.02 (−0.36 to 0.33), p=0.914	−0.39 (−1.03 to 0.24), p=0.226

Notes: Estimates are adjusted mean differences for women relative to men, from generalised estimating equations with an exchangeable working correlation structure and robust standard errors, adjusted for age, repair modality, urgency of admission, ischaemic heart disease and partnered status. The effect at T1 is the sex coefficient in the model containing the sex-by-time interaction; the overall effect is the sex coefficient in the corresponding model without the interaction. The sensitivity subgroup comprises the 94 patients with an infrarenal aneurysm treated by standard endovascular repair.
Abbreviations: CI, confidence interval; D1 to D4, WHOQOL-Bref domains; AIS, Acceptance of Illness Scale; HADS-M, Hospital Anxiety and Depression Scale, Polish modified version.

Adjusted Longitudinal Analysis

Adjusted estimates from the generalised estimating equation models are presented in Table 4. After adjustment for age, repair modality, urgency, ischaemic heart disease and partnered status, the early female deficit remained significant in the psychological domain (−9.26 points, 95% CI −15.54 to −2.98; p=0.004) and in the social relationships domain (−9.85, 95% CI −15.95 to −3.74; p=0.002), but was no longer significant in the physical domain (−5.18, 95% CI −11.09 to 0.73; p=0.086) or the environmental domain (−4.74, 95% CI −10.06 to 0.58; p=0.081). The crude anxiety difference observed at T1 did not survive adjustment (+1.03, 95% CI −0.73 to 2.79; p=0.253), which indicates that it was attributable in part to the confounders included in the model rather than to sex alone.

Significant positive sex-by-time interactions in the physical, psychological and environmental domains confirm that the female deficit narrowed after the early postoperative period. In the social relationships domain the interaction terms were smaller and did not reach significance at 6 months (p=0.079) or 2 years (p=0.075), and the model without interaction showed a persisting overall adjusted female deficit of 6.86 points (95% CI −12.27 to −1.44; p=0.013). The social relationships domain is therefore the only outcome for which an adjusted difference persisted across the whole

follow-up. For depression, the sex-by-time interactions were significantly negative at every subsequent timepoint, indicating that women started from a higher early score and improved more steeply than men, while the overall adjusted sex effect was null (+0.02; p=0.980). No adjusted sex effect was found for illness acceptance or irritability.

The prespecified sensitivity analysis restricted to the 94 patients with an infrarenal aneurysm treated by standard EVAR reproduced and strengthened these findings. In this homogeneous subgroup the early female deficit was larger in every WHOQOL-Bref domain, reaching −10.68 points in the physical domain (p=0.003), −10.84 in the psychological domain (p=0.005), −11.83 in the social relationships domain (p<0.001) and −7.35 in the environmental domain (p=0.017), and the persisting overall deficit in the social relationships domain was of similar magnitude to that in the full cohort (−7.49, 95% CI −13.12 to −1.86; p=0.009). Population heterogeneity therefore diluted rather than generated the observed associations.

Discussion

The relationship between sex and outcome after aortic repair has been established almost entirely on hard endpoints. The registry and administrative literature is concerned with mortality, technical success and perioperative morbidity, whereas the quality-of-life literature in this field has developed along a separate axis, comparing endovascular with open repair rather than women with men.[17–21] Where sex has been examined at all in patient-reported work, it has usually entered as a covariate rather than as the exposure of interest, and domain-level scores stratified by sex across several postoperative timepoints, adjusted for clinical confounders, are not to our knowledge previously available in this population. The value of the present data therefore lies less in confirming that women fare worse, which is well established, than in showing which components of self-reported functioning carry that disadvantage once the clinical profile is accounted for, and which of them recover.

The registry literature offers a ready mechanism for a worse early patient-reported outcome in women. Lo et al[3] attributed the sex gap principally to later presentation and greater comorbidity, Deery et al[5] identified female sex as an independent predictor of mortality after elective repair, and the meta-analysis of Liu et al[29] and the large series of Tan et al[30] reached the same conclusion; Li et al[31] extended it to ruptured aneurysm and De Guerre et al[32] to complex repair. Kang et al[13] reported the same pattern after endovascular repair of thoracoabdominal aneurysm. The most recent syntheses reinforce that account: Marzano et al[10] relate the less favourable endovascular outcomes in women principally to anatomical constraints, Woo et al[11] show that the outcome gap is reproduced across eleven high-income health systems, and Raja et al[12] confirm it in a contemporary infrarenal endovascular cohort. Common to all of these is the proposition that women arrive at operation older, with more hostile anatomy and a heavier comorbidity burden, and that outcome follows from that starting point rather than from sex as such. If the same mechanism governed quality of life, a uniform early deficit across all domains would be expected, and that is precisely what our unadjusted comparison appears to show. Our adjusted analysis does not support that reading. Once age, repair modality, urgency, ischaemic heart disease and partnered status are taken into account, the physical and environmental deficits disappear while the psychological and social deficits do not. The most economical interpretation is that the early physical disadvantage in women is largely the clinical starting point reasserting itself, exactly as the registry literature would predict, whereas the psychological and social disadvantage is something the clinical profile does not explain. Nederstigt et al[33] provide the only comparable absolute frame of reference, reporting that long-term WHOQOL-Bref scores after emergency repair approach those of the general elderly Dutch population. Their analysis was not stratified by sex, and our data suggest why that matters: a pooled return to population norms can conceal a residual deficit confined to one sex and one domain.

Our findings on anxiety sit awkwardly with part of the literature, and we prefer to say so rather than to present the agreement selectively. Liu et al[34] reported female sex as an independent predictor of elevated anxiety in patients scheduled for aneurysm repair, with an odds ratio of 2.81, and Liblik et al[15] described anxiety and depression persisting in women for at least a year after acute cardiovascular events. We replicated neither. The crude difference in our cohort ran in the same direction and was of comparable size, but it did not survive adjustment, and anxiety improved steadily in both sexes with convergence by six months. Three explanations merit consideration. First, Liu et al measured anxiety preoperatively, at the point where anticipatory anxiety is highest and least entangled with recovery, whereas our first measurement was taken after the procedure, when the principal source of threat has already been removed; the two

studies may simply not be measuring the same psychological moment. Second, the population studied by Liblik et al[15] comprised women after myocardial infarction, an event that carries a different prognostic and symbolic weight from a successful elective repair of an asymptomatic aneurysm, and the persistence they describe may be specific to that context. Third, our result aligns closely with Nilsson et al,[35] whose randomised trial showed that anxiety after aneurysm surgery normalises spontaneously within six months irrespective of an eHealth intervention. Taken together, this suggests that postoperative anxiety in this population is a self-limiting phenomenon rather than a stable sex-linked trait. Hoel et al[36] supply the necessary qualification: although mean emotional impact scores fell beyond the first postoperative year in their multicentre cohort, roughly a quarter of patients continued to report substantial anxiety despite technically successful repair, so convergence of group means should not be read as resolution in every patient.

The dimension on which our data contribute something the aortic literature does not currently contain is social relationships. It is also the only outcome for which the adjusted difference persisted across the whole follow-up and the only one reproduced with a larger effect size in the homogeneous infrarenal endovascular subgroup. Two literatures converge here. Frøjd et al[37] showed that social support independently predicts both the physical and mental components of quality of life in coronary heart disease, and Obiegło et al,[38] in a Polish cohort with heart failure, found that patients with low illness acceptance scored worse specifically on social isolation alongside energy, pain and mobility, which places social functioning at the centre rather than the periphery of adaptation to cardiovascular disease. Villard and Hultgren[16] proposed a demographic explanation for the aortic population, namely that women with aneurysm are older and more often widowed and therefore have thinner support networks. Our data qualify that account in a useful way: adjustment for partnered status did not abolish the difference, so the presence or absence of a partner does not by itself carry it. This is consistent with the content of the domain, which concerns the perceived quality of personal relationships, the adequacy of support received and sexual activity, none of which is captured by marital status. The trajectories point the same way. The gap persisted not because women deteriorated, since their scores were essentially flat across two years, but because the domain followed different trajectories in the two sexes: in men it fell over the first postoperative year and then partially recovered, whereas in women it remained flat throughout. Comparative analyses of quality of life after aneurysm repair[17–21,39–44] remain limited by the systematic under-representation of women in subgroup analyses, a methodological gap that Shan et al[44] state explicitly and that our findings suggest is not merely a question of precision but of substantive conclusions. The large contemporary analyses that have consolidated the sex gap[10–12] report mortality and morbidity but no patient-reported outcome at all, so the dimension examined here lies wholly outside their scope. A comparison with the systematic review of Lampridou et al[45] is instructive precisely because it is a disagreement: after thoracoabdominal intervention, the physical domains were the ones that most persistently failed to return to baseline. In our cohort the physical domain recovered and the social domain did not, which suggests that pooled analyses that do not stratify by sex may identify the wrong domain as the persistent problem.

The pattern in illness acceptance does not support the suggestion that women, despite worse early functioning, display greater long-term adaptive capacity: the continuous AIS score differed at no timepoint, the adjusted longitudinal model showed no sex effect, the categorical difference immediately after surgery now sits at the margin of significance, and the two-year comparison rests on twenty-five women with expected cell counts below four. The direction of the categorical finding is also difficult to reconcile with the wider literature. Obiegło et al[38] demonstrated that low illness acceptance travels with poorer functioning, particularly social functioning; in our cohort the sex with the poorer social functioning was the one with less low acceptance, which is the opposite of what that association would predict. Either the AIS is measuring something different in a surgically treated aortic population from what it measures in chronic heart failure, where the illness is continuously symptomatic, or the categorical result is noise. We regard the second as more likely and present the finding descriptively. Schreuder et al[46] identified younger age at operation as an independent predictor of better long-term survival after fenestrated repair, which is a further reason to be cautious about attributing an adaptive advantage to a subgroup that is on average three and a half years older.

A determinant that the present study could not measure, and which may account for part of what we observed, is preoperative frailty. Cuozzo et al[47] showed that the Clinical Frailty Scale stratifies risk in patients undergoing elective endovascular thoracoabdominal repair more effectively than chronological age or comorbidity count, and in a systematic review and meta-analysis comparing frailty instruments in aortic surgery, Coutinho et al[48] confirmed the prognostic value

of frailty across tools while noting the absence of consensus on which to use. The relevance to our data is direct. Adjustment for age is a poor substitute for measured frailty, because frailty and chronological age diverge most in exactly the population under study, and women are more frequently frail than men of the same age in most surgical series. An unmeasured difference in physiological reserve is therefore a plausible competing explanation for the early quality-of-life gap, and one our models cannot exclude. It is a less convincing explanation for the persistent social deficit, since frailty would be expected to act most strongly on the physical domain, which is the domain that recovered in our cohort. Prospective work in this field should incorporate a validated frailty instrument together with a preoperative quality-of-life assessment at the point of surgical qualification, which would allow these two explanations to be separated.

A second measured variable requires comment because it is unlikely to be a faithful reflection of the cohort. Ischaemic heart disease was recorded in 54.0% of men but in only one of the 37 women, a difference far larger than any reported in the aortic or cardiological literature, in which the prevalence of coronary disease among women of this age is substantial even if lower than in men. The most plausible explanation is differential ascertainment rather than a true difference of that magnitude: coronary disease in women presents atypically, is investigated less often and is correspondingly less often recorded in surgical case notes. This has two consequences for the present analysis. First, adjustment for ischaemic heart disease is likely to be incomplete in women, so residual confounding by unrecognised coronary disease may contribute to the early deficits that survived adjustment, and the adjusted estimates should be read with that in mind. Second, the finding is itself consistent with the wider literature on the under-recognition of cardiovascular disease in women, and it reinforces the argument that sex differences observed after aortic repair cannot be interpreted without attention to what was, and was not, recorded before it.

Our findings should be interpreted in the light of several limitations. First, no preoperative assessment of quality of life or psychological status was performed; the first measurement was obtained immediately after surgery and may already have been influenced by the procedure, postoperative pain, the hospital stay and early recovery, so no true baseline exists and change from baseline cannot be estimated. Second, preoperative frailty, functional status and clinical vulnerability were not assessed, and residual confounding by frailty cannot be excluded. Third, the study population is heterogeneous with respect to aneurysm extent and repair modality; the prespecified sensitivity analysis in the infrarenal endovascular subgroup supports rather than undermines the main findings, but it rests on 94 patients of whom 23 were women and is correspondingly imprecise. Fourth, the number of women is small (37 at entry, 25 at 2 years), which limits power, renders categorical comparisons unstable and precludes fully specified multivariable adjustment. Fifth, comprehensive perioperative complication data were not captured in the study database, so postoperative psychological status could not be related to procedural morbidity. Sixth, the care pathway, including nursing and allied-health support, availability of psychological care, rehabilitation and post-discharge follow-up, may have influenced the results, and the single-centre design means these findings reflect one model of care within one health system. Seventh, attrition reached 31% at 2 years and, although it did not differ between the sexes, non-completers were older and more depressed at entry, so informative dropout cannot be excluded. Eighth, the analyses are exploratory and not corrected for multiplicity. Despite these limitations, the prospective design, the standardised multidomain instruments, the adjusted longitudinal modelling and the 2-year follow-up remain methodological strengths that distinguish this study from much of the existing vascular literature.

Conclusions

In this prospective single-centre cohort, women undergoing aortic aneurysm repair reported a lower quality of life than men across all four WHOQOL-Bref domains in the early postoperative period. After adjustment for age, repair modality, urgency, ischaemic heart disease and partnered status, the early deficit remained significant in the psychological and social relationships domains, and only the social relationships domain showed an adjusted deficit that persisted across the whole 2-year follow-up. Most other differences, including the higher early anxiety in women, either attenuated by 6 months or did not survive adjustment. Because no true preoperative baseline was available, the female subgroup was small, and preoperative frailty and perioperative complications were not captured, these observations are hypothesis-generating rather than evidence that the differences are sex-driven, and the suggestion that sex-targeted psychological or rehabilitative support is warranted requires formal testing in an adequately powered interventional study. The findings do

support the routine capture of patient-reported outcome measures, analysed by sex, in aortic practice, consistent with the 2024 ESVS guidelines, and they identify social connectedness rather than mood as the dimension most in need of attention in women after aortic repair.

Type of Research

Prospective, single-centre cohort study.

Data Sharing Statement

The data supporting the findings of this study are available from the corresponding author upon reasonable request.

Ethics Approval and Informed Consent

The study was approved by the Bioethics Committee of Wroclaw Medical University (approval no. 70/2021) and was conducted in accordance with the principles of the Declaration of Helsinki. Written informed consent was obtained from all participants.

Author Contributions

All authors made a significant contribution to the work reported, whether that is in the conception, study design, execution, acquisition of data, analysis and interpretation, or in all these areas; took part in drafting, revising or critically reviewing the article; gave final approval of the version to be published; have agreed on the journal to which the article has been submitted; and agree to be accountable for all aspects of the work.

Funding

No funding was received for this work.

Disclosure

The authors report no conflicts of interest in this work.

References

1. Wanhainen A, Van Herzeele I, Bastos Goncalves F, et al. Editor's Choice – European Society for Vascular Surgery (ESVS) 2024 clinical practice guidelines on the management of abdominal aorto-iliac artery aneurysms. *Eur J Vasc Endovasc Surg*. 2024;67(2):192–331. doi:10.1016/j.ejvs.2023.11.002
2. Ulug P, Sweeting MJ, Von Allmen RS, Thompson SG, Powell JT, Collaborators SWAN. Morphological suitability for endovascular repair, non-intervention rates, and operative mortality in women and men assessed for intact abdominal aortic aneurysm repair: systematic reviews with meta-analysis. *Lancet*. 2017;389(10088):2482–2491. doi:10.1016/S0140-6736(17)30639-6
3. Lo RC, Bensley RP, Hamdan AD, Wyers M, Adams JE, Schermerhorn ML. Gender differences in abdominal aortic aneurysm presentation, repair, and mortality in the Vascular Study Group of New England. *J Vasc Surg*. 2013;57(5):1261–1268.e5. doi:10.1016/j.jvs.2012.11.039
4. Abedi NN, Davenport DL, Xenos E, Sorial E, Minion DJ, Endean ED. Gender and 30-day outcome in patients undergoing endovascular aneurysm repair (EVAR): an analysis using the ACS NSQIP dataset. *J Vasc Surg*. 2009;50(3):486–491.e4. doi:10.1016/j.jvs.2009.04.047
5. Deery SE, Soden PA, Zettervall SL, et al. Sex differences in mortality and morbidity following repair of intact abdominal aortic aneurysms. *J Vasc Surg*. 2017;65(4):1006–1013. doi:10.1016/j.jvs.2016.08.100
6. Pirinen R, Laine MT, Mani K, et al. The outcome after endovascular and open repair of abdominal aortic aneurysms: a binational study conducted between 1998 and 2017. *J Clin Med*. 2024;13(15):4449. doi:10.3390/jcm13154449
7. Katz DJ, Stanley JC, Zelenock GB. Gender differences in abdominal aortic aneurysm prevalence, treatment, and outcome. *J Vasc Surg*. 1997;25(3):561–568. doi:10.1016/S0741-5214(97)70268-4
8. Grootenboer N, van Sambeek MRHM, Arends LR, Hendriks JM, Hunink MGM, Bosch JL. Systematic review and meta-analysis of sex differences in outcome after intervention for abdominal aortic aneurysm. *Br J Surg*. 2010;97(8):1169–1179. doi:10.1002/bjs.7134
9. Zommorodi S, Bottai M, Hultgren R. Sex differences in repair rates and outcomes of patients with ruptured abdominal aortic aneurysm. *Br J Surg*. 2019;106(11):1480–1487. doi:10.1002/bjs.11258
10. Marzano A, Flora F, Jabbour J, Martinelli O, Cuozzo S. Sex differences in outcomes after endovascular abdominal aortic aneurysm repair: a systematic review and narrative synthesis. *Rev Cardiovasc Med*. 2026;27(3):47920. doi:10.31083/RCM47920
11. Woo S, Kim SJ, Hwang SH, et al. Sex differences in patients hospitalized for repair of intact abdominal aortic aneurysms in 11 high-income countries: a cross-sectional cohort study. *J Vasc Surg*. 2026;84(2):372–383. doi:10.1016/j.jvs.2026.03.623
12. Raja A, Krawisz A, Song Y, et al. Sex differences in outcomes after infrarenal endovascular abdominal aortic aneurysm (AAA) repair among Medicare beneficiaries. *Vasc Med*. 2026;31(2):202–209. doi:10.1177/1358863X251415154

13. Kang J, Thompson K, Mukherjee T, Fatima J. Sex-related outcomes following endovascular repair of thoracoabdominal aortic aneurysm. *J Vasc Surg*. 2026;83(6):1484–1493. doi:10.1016/j.jvs.2026.01.022
14. Bjelland I, Dahl AA, Haug TT, Neckelmann D. The validity of the Hospital Anxiety and Depression Scale: an updated literature review. *J Psychosom Res*. 2002;52(2):69–77. doi:10.1016/S0022-3999(01)00296-3
15. Liblik K, Mulvagh SL, Hindmarch CCT, Alavi N, Johri AM. Depression and anxiety following acute myocardial infarction in women. *Trends Cardiovasc Med*. 2022;32(6):341–347. doi:10.1016/j.tcm.2021.07.005
16. Villard C, Hultgren R. Abdominal aortic aneurysm: sex differences. *Maturitas*. 2018;109:63–69. doi:10.1016/j.maturitas.2017.12.012
17. Gruel J, Grambow E, Weinrich M, et al. Assessment of quality of life after endovascular and open abdominal aortic aneurysm repair: a retrospective single-center study. *J Clin Med*. 2022;11(11):3017. doi:10.3390/jcm11113017
18. Prinssen M, Buskens E, Blankensteijn JD. DREAM Trial Participants. Quality of life after endovascular and open AAA repair: results of a randomised trial. *Eur J Vasc Endovasc Surg*. 2004;27(2):121–127. doi:10.1016/j.ejvs.2003.11.006
19. De Bruin JL, Groenwold RHH, Baas AF, et al. Quality of life from a randomized trial of open and endovascular repair for abdominal aortic aneurysm. *Br J Surg*. 2016;103(8):995–1002. doi:10.1002/bjs.10130
20. Aljabri B, Al Wahaibi K, Abner D, et al. Patient-reported quality of life after abdominal aortic aneurysm surgery: a prospective comparison of endovascular and open repair. *J Vasc Surg*. 2006;44(6):1182–1187.e2. doi:10.1016/j.jvs.2006.08.015
21. Kayssi A, DeBord Smith A, Roche-Nagle G, Nguyen LL. Health-related quality-of-life outcomes after open versus endovascular abdominal aortic aneurysm repair. *J Vasc Surg*. 2015;62(2):491–498. doi:10.1016/j.jvs.2015.05.032
22. Jaracz K, Kalfoss M, Górna K, Bączyk G. Quality of life in Polish respondents: psychometric properties of the Polish WHOQOL-Bref. *Scand J Caring Sci*. 2006;20(3):251–260. doi:10.1111/j.1471-6712.2006.00401.x
23. World Health Organization. WHOQOL-BREF: introduction, Administration, Scoring and Generic Version of the Assessment. In: *Field Trial Version, December 1996*. Geneva: World Health Organization; 1996.
24. Felton BJ, Revenson TA, Hinrichsen GA. Stress and coping in the explanation of psychological adjustment among chronically ill adults. *Soc Sci Med*. 1984;18(10):889–898. doi:10.1016/0277-9536(84)90158-8
25. Juczyński Z. Skala akceptacji choroby (AIS). In: *Narzędzia pomiaru w promocji i psychologii zdrowia*. Warszawa: Pracownia Testów Psychologicznych Polskiego Towarzystwa Psychologicznego; 2001:168–172.
26. Zigmond AS, Snaith RP. The hospital anxiety and depression scale. *Acta Psychiatr Scand*. 1983;67(6):361–370. doi:10.1111/j.1600-0447.1983.tb09716.x
27. Majkowicz M. Praktyczna ocena efektywności opieki paliatywnej – wybrane techniki badawcze. In: de Walden-Gałuszko K, Majkowicz M, editors. *Ocena jakości opieki paliatywnej w teorii i praktyce*. Gdańsk: Akademia Medyczna w Gdańsku, Zakład Medycyny Paliatywnej; 2000:21–42.
28. Liang KY, Zeger SL. Longitudinal data analysis using generalized linear models. *Biometrika*. 1986;73(1):13–22. doi:10.1093/biomet/73.1.13
29. Liu Y, Yang Y, Zhao J, et al. Systematic review and meta-analysis of sex differences in outcomes after endovascular aneurysm repair for infrarenal abdominal aortic aneurysm. *J Vasc Surg*. 2020;71(1):283–296.e4. doi:10.1016/j.jvs.2019.06.105
30. Tan X, Jung G, Herrmann E, et al. Sex difference in early mortality after abdominal aortic aneurysm repair. *J Vasc Surg*. 2023;77(6):1658–1668.e2. doi:10.1016/j.jvs.2023.02.001
31. Li B, Eisenberg N, Witheford M, Lindsay TF, Forbes TL, Roche-Nagle G. Sex differences in outcomes following ruptured abdominal aortic aneurysm repair. *JAMA Network Open*. 2022;5(5):e2211336. doi:10.1001/jamanetworkopen.2022.11336
32. De Guerre LEVM, Varkevisser RRB, Swerdlow NJ, et al. Sex differences in perioperative outcomes after complex abdominal aortic aneurysm repair. *J Vasc Surg*. 2020;71(2):374–381. doi:10.1016/j.jvs.2019.04.479
33. Nederstigt TFCM, van der Veen D, Lardenoije JWHP, et al. Long term quality of life, health status, and residential destination after emergency abdominal aortic aneurysm repair. *Eur J Vasc Endovasc Surg*. 2025;69(5):693–701. doi:10.1016/j.ejvs.2024.11.002
34. Liu XY, Ma YK, Zhao JC, et al. Risk factors for preoperative anxiety and depression in patients scheduled for abdominal aortic aneurysm repair. *Chin Med J*. 2018;131(16):1951–1957. doi:10.4103/0366-6999.238154
35. Nilsson O, Stenman M, Letterstål A, Hultgren R. One-year results of an eHealth intervention on anxiety in patients undergoing abdominal aortic aneurysm surgery: randomized clinical trial. *BJS Open*. 2025;9(1):zrae144. doi:10.1093/bjsopen/zrae144
36. Hoel AW, Nayak T, Ponukumati AS, et al. Disease-specific patient-reported quality of life after fenestrated/branched endovascular aortic aneurysm repair. *J Vasc Surg*. 2025;81(2):280–286.e3. doi:10.1016/j.jvs.2024.09.012
37. Frøjd LA, Munkhaugen J, Papageorgiou C, Sverre E, Moum T, Dammen T. Predictors of health-related quality of life in outpatients with coronary heart disease. *Front Psychol*. 2023;14:1119093. doi:10.3389/fpsyg.2023.1119093
38. Obiegło M, Uchmanowicz I, Wleklik M, Jankowska-Polańska B, Kuśmierz M. The effect of acceptance of illness on the quality of life in patients with chronic heart failure. *Eur J Cardiovasc Nurs*. 2016;15(4):241–247. doi:10.1177/1474515114564929
39. Pol RA, Zeebregts CJ, van Sterkenburg SMM, Ferreira LM, Goktay Y, Reijnen MMPJ. Outcome and quality of life after endovascular abdominal aortic aneurysm repair in octogenarians. *J Vasc Surg*. 2014;60(2):308–317. doi:10.1016/j.jvs.2014.02.009
40. Yildirim H, van Lammeren GW, Ünlü Ç, van Dongen EP, van de Mortel RHW, de Vries JPPM. Long-term outcome and quality of life after ruptured abdominal aortic aneurysm repair. *Vascular*. 2018;26(3):231–238. doi:10.1177/1708538117727360
41. Akbulut M, Aksoy E, Kara I, Cekmecelioglu D, Koksal C. Quality of life after open surgical versus endovascular repair of abdominal aortic aneurysms. *Braz J Cardiovasc Surg*. 2018;33(3):265–270. doi:10.21470/1678-9741-2017-0236
42. Ballard JL, Abou-Zamzam AM, Teruya TH, Bianchi C, Petersen FF. Quality of life before and after endovascular and retroperitoneal abdominal aortic aneurysm repair. *J Vasc Surg*. 2004;39(4):797–803. doi:10.1016/j.jvs.2003.11.037
43. De Rango P, Verzini F, Parlani G, et al. Quality of life in patients with small abdominal aortic aneurysm: the effect of early endovascular repair versus surveillance in the CAESAR trial. *Eur J Vasc Endovasc Surg*. 2011;41(3):324–331. doi:10.1016/j.ejvs.2010.11.005
44. Shan L, Saxena A, Goh D, Robinson D. A systematic review on the quality of life and functional status after abdominal aortic aneurysm repair in elderly patients with an average age older than 75 years. *J Vasc Surg*. 2019;69(4):1268–1281. doi:10.1016/j.jvs.2018.09.032
45. Lampridou S, Bolton Saghdaoui L, Bicknell C, Kumlien C, Lear R. Health related quality of life following intervention for thoracoabdominal aortic aneurysm: a systematic review and narrative synthesis. *Ann Vasc Surg*. 2024;101:105–119. doi:10.1016/j.avsg.2023.10.032
46. Schreuder WMA, Dijkstra ML, von Meijenfeldt GCI, et al. Long-term survival and quality of life after fenestrated endovascular repair for complex abdominal aortic aneurysms. *Vasc Endovascular Surg*. 2023;57(6):555–563. doi:10.1177/15385744231154123

47. Cuozzo S, Sbarigia E, Jabbour J, et al. Impact of frailty on outcomes of patients undergoing elective endovascular thoraco-abdominal aortic aneurysm repair. *J Cardiovasc Surg*. 2024;65(6):515–522. doi:10.23736/S0021-9509.24.13052-2
48. Coutinho ML, Delgado LM, Torres IO, et al. Prognostic value of frailty in aortic surgery: a systematic review and meta-analysis comparing frailty assessment tools. *Ann Vasc Surg*. 2026;132:200–213. doi:10.1016/j.avsg.2026.06.034

Vascular Health and Risk Management

Dovepress
Taylor & Francis Group

Publish your work in this journal

Vascular Health and Risk Management is an international, peer-reviewed journal of therapeutics and risk management, focusing on concise rapid reporting of clinical studies on the processes involved in the maintenance of vascular health; the monitoring, prevention and treatment of vascular disease and its sequelae; and the involvement of metabolic disorders, particularly diabetes. This journal is indexed on PubMed Central and MedLine. The manuscript management system is completely online and includes a very quick and fair peer-review system, which is all easy to use. Visit http://www.dovepress.com/testimonials.php to read real quotes from published authors.

Submit your manuscript here: https://www.dovepress.com/vascular-health-and-risk-management-journal