

Title: Experiences of Psychological Burden and Care in Women with Hyperemesis Gravidarum and Nausea and Vomiting in Pregnancy: A Mixed-Methods Systematic Review

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Abstract

Background: Hyperemesis gravidarum (HG) affects 0.3–2% of pregnancies, while nausea and vomiting in pregnancy (NVP) affects up to 70–80% worldwide. Although physical complications are well recognised, the psychological burden and role of care experiences are less clearly defined.

Aim: To synthesise evidence on psychological morbidity in HG and NVP, alongside women's experiences of care.

Methods: Mixed-methods systematic review of peer reviewed studies (2010–2025). CINAHL, Embase, MEDLINE, and PsycINFO were searched in line with PRISMA. Study quality was appraised using Joanna Briggs Institute tools. Quantitative data was synthesised narratively, qualitative data thematically, and findings integrated using a convergent segregated approach.

Results: Results: Sixty four international studies were included, comprising 57 quantitative studies, 6 qualitative studies and 1 mixed-methods studies. Depression and anxiety were the most frequently assessed outcomes and were generally higher in HG compared with controls, with some persistence beyond pregnancy. Greater symptom severity in HG and NVP was associated with higher depression and anxiety. Large cohort studies reported increased risks of anxiety and depression, including postnatal and longer term risk. Additional outcomes included stress, psychological distress, post-traumatic stress symptoms, suicidal ideation, and reduced mental health related quality of life. Qualitative studies identified four themes: psychological burden and trauma, invalidation and unmet care needs, disruption to daily life, identity and relationships, and support and coping. Women reported dismissal and lack of validation, while valuing specialist services and psychological support. Integrated findings indicated psychological morbidity was associated with both symptom severity and care experiences.

Conclusion: HG and severe NVP are associated with substantial psychological burden that extends beyond symptom scores alone. Integrating quantitative and qualitative evidence highlights the importance of considering both psychological outcomes and women's experiences of care when assessing the impact of these conditions.

Keywords: Hyperemesis gravidarum; Nausea and vomiting in pregnancy; Depression; Anxiety; Mental health; Psychological distress

Introduction

Hyperemesis Gravidarum (HG) is characterised by severe nausea and vomiting in pregnancy, often leading to dehydration, malnutrition and hospitalisation (Maslin & Dean 2022). An international consensus definition, the Windsor definition, was established in 2021 to standardise research criteria, specifying onset before 16 weeks and symptoms severe enough to limit daily activities and prevent normal eating and drinking (Jansen et al. 2021). HG affects approximately 0.3–2% of pregnancies worldwide, while nausea and vomiting in pregnancy (NVP) affects up to 70–80% (Einarson et al. 2013). Although NVP is often described as self-limiting, many women experience substantial distress without meeting diagnostic criteria for HG. Given the continuum of symptom severity and evidence that psychological burden increases with symptom intensity, this review includes both HG and NVP (Kramer et al. 2013; Heitmann et al. 2017). Advances in understanding the biological mechanisms underlying HG, including the role of growth differentiation factor 15 (GDF15), have strengthened recognition of its physiological basis (Fejzo et al. 2024). However, despite these developments, the psychological consequences of HG remain comparatively underexplored.

Evidence indicates elevated rates of depression, anxiety, trauma symptoms and reduced quality of life among women experiencing HG, with some reporting persistent distress beyond pregnancy (Mitchell-Jones et al. 2017; Mignot et al. 2025; Christodoulou-Smith et al. 2011; Nijsten et al. 2022). Women frequently describe profound functional impairment, social isolation and disruption to family life (Poursharif et al. 2007; Heitmann et al. 2017). Although debate persists regarding directionality, prospective cohort studies suggest psychological symptoms more commonly arise in response to the physical and psychosocial burden of the condition (Kjeldgaard et al. 2017; McCarthy et al. 2011). However, existing evidence remains fragmented across study designs, psychological outcomes and populations, and much of the literature has focused on individual conditions or specific clinical samples rather than the broader psychological burden associated with HG and NVP.

Recent national reports have highlighted the clinical significance of HG. The MBRRACE-UK report (2024) identified HG as a contributory factor in maternal deaths, highlighting under-recognition of mental health deterioration and gaps in referral pathways. The RCOG Green-Top Guideline (2024) similarly recommends integrated mental health assessment and support, yet implementation remains inconsistent.

The James Lind Alliance Priority Setting Partnership identified understanding the psychosocial consequences of HG as a research priority (Dean et al. 2022). Previous systematic reviews have demonstrated increased depression and anxiety among women with HG (Mitchell-Jones et al. 2017; Mignot et al. 2025), while qualitative reviews exploring women's experiences have highlighted social isolation, disruption to family roles, psychological distress and experiences of inadequate care (Dean et al. 2018). However, these bodies of evidence have largely been considered separately. Previous quantitative reviews focused primarily on depression and anxiety and did not examine the broader range of psychological outcomes increasingly reported in the literature, including trauma related symptoms, psychological distress, quality of life and suicidality (Christodoulou-Smith et al. 2011; Heitmann et al. 2017; Nana et al. 2022). In addition, no previous review has integrated quantitative and qualitative evidence to examine how symptom severity, persistence and experiences of care shape psychological outcomes across the continuum of HG and NVP. Consequently, the full scope and lived experience of psychological morbidity associated with HG and NVP has not yet been brought together in a single synthesis. This mixed-methods systematic review therefore integrates quantitative and qualitative evidence to examine psychological morbidity across the spectrum of HG and NVP, its persistence over time, and its implications for maternity care.

Methodology

Design

A mixed-methods systematic review was conducted in accordance with the Joanna Briggs Institute (JBI) Manual for Evidence Synthesis (2024) and reported in line with PRISMA 2020 guidelines (Page et al. 2021). The review integrated quantitative evidence on psychological morbidity with qualitative evidence exploring women's lived experiences of HG and NVP. A convergent segregated approach was used; whereby quantitative and qualitative data were analysed separately and integrated during interpretation. This method enabled examination of psychological outcomes alongside contextual accounts of symptom experience, coping, and care. The study selection process is presented in the

PRISMA flow diagram (Figure 1). The review protocol was prospectively registered with (redacted for review).

Research Questions

This review examined the psychological morbidity associated with Hyperemesis Gravidarum (HG) and Nausea and Vomiting in Pregnancy (NVP) and explored women's experiences of care.

The objectives were to:

- I. Synthesise evidence on psychological symptoms and mental health conditions associated with HG and NVP.
- II. Examine the impact of symptom severity on psychological wellbeing and daily functioning.
- III. Explore women's experiences of psychological support, care pathways, and unmet needs.
- IV. Identify implications for clinical practice and future research.

Eligibility Criteria

Eligibility criteria were developed using the PEOS (Population, Exposure, Outcome, Setting) framework (Aromataris & Munn 2024). Studies were included if they involved women who had experienced HG or NVP of sufficient severity to affect daily functioning. Both HG and NVP were included because definitions and severity thresholds vary across the literature, and functional impairment is increasingly recognised as a key feature of clinically significant disease (Jansen et al. 2021). Inclusion of both conditions also enabled examination of whether psychological burden varied according to symptom severity. Functional impairment was used to identify clinically significant HG/NVP and was not based on psychological outcomes or quality of life measures. Participants could be pregnant, postnatal, or in the extended postpartum period, recognising that psychological effects may persist beyond pregnancy.

Eligible studies examined psychological distress or mental health outcomes associated with HG or NVP, including symptoms of depression, anxiety, trauma related distress, emotional distress, or mental health related quality of life. Qualitative studies exploring women's experiences of psychological wellbeing, coping, access to support, care pathways, and unmet needs were also included.

Studies conducted in any healthcare or community setting were eligible, with no geographical restrictions applied. Primary peer-reviewed qualitative, quantitative, and mixed methods studies published in English from 2010 onwards were included to reflect contemporary clinical practice. Case reports, editorials, grey literature, and systematic reviews were excluded; however, reference lists of relevant reviews were screened to identify additional eligible studies.

Searching and Screening

Search terms were derived in conjunction with librarian (XX) from key concepts relating to the population (Hyperemesis Gravidarum; Nausea and Vomiting in Pregnancy) and psychological outcomes (e.g. anxiety, depression, trauma, psychological distress). Controlled vocabulary (e.g. MeSH) and free text terms were combined using Boolean operators. The full search strategy is provided in the Supplementary File.

Four databases were searched: CINAHL, Embase (Ovid), MEDLINE (EBSCOHost), and APA PsycINFO (EBSCOHost). Reference lists of included studies and relevant reviews were also hand-searched to identify additional articles.

All records were imported into Rayyan, an AI assisted web based platform designed to support systematic review screening, where duplicates were identified using the platform's duplicate detection function and manually checked prior to removal. Title and abstract screening were conducted independently by two reviewers, followed by full text assessment of potentially eligible studies. Each full text article was reviewed by at least two team members (XX, XX, XX, XX, XX), with disagreements resolved through discussion.

Data Extraction

Data extracted from each study included study design, participant characteristics, definitions of HG/NVP, psychological outcomes and measurement tools, and key findings relevant to the review questions. Where required, uncertainties were checked against the original papers and discussed with team members.

Quality Appraisal and Certainty of Evidence

Methodological appraisal was undertaken by the lead author and used to inform interpretation of findings rather than to exclude studies.

Consistent with JBI guidance, overall numerical scores were not calculated and studies were not categorised using predefined cut-off thresholds (JBI 2024). Instead, appraisal findings were considered narratively to identify methodological strengths and limitations across the evidence base.

Certainty of evidence was considered separately for quantitative and qualitative findings in line with the convergent segregated design. For quantitative outcomes, certainty was informed by methodological rigour and consistency of findings. Confidence in qualitative findings was assessed using the ConQual approach (Munn et al. 2014), considering the dependability and credibility of contributing studies.

Data Synthesis

Quantitative findings were synthesised narratively due to heterogeneity in study design, outcome measures, and reporting formats (JBI 2024). Outcomes were grouped thematically and results were reported as presented in the original studies without statistical transformation.

Qualitative findings were analysed using thematic synthesis (Thomas & Harden 2008). Findings were extracted from the included studies and coded line by line. Codes were grouped into descriptive themes and subsequently synthesised into four review themes. These represent review generated interpretations of the data rather than a direct reproduction of findings reported in the primary studies. An example of the qualitative coding and theme development process is provided in Supplementary File.

For mixed methods primary studies, quantitative and qualitative components were extracted and analysed within their respective strands.

Qualitative coding was undertaken by the lead reviewer. Emerging codes and themes were discussed with the wider review team throughout the synthesis process to support interpretation and refinement of the final themes. Any differences in interpretation were resolved through discussion and consensus.

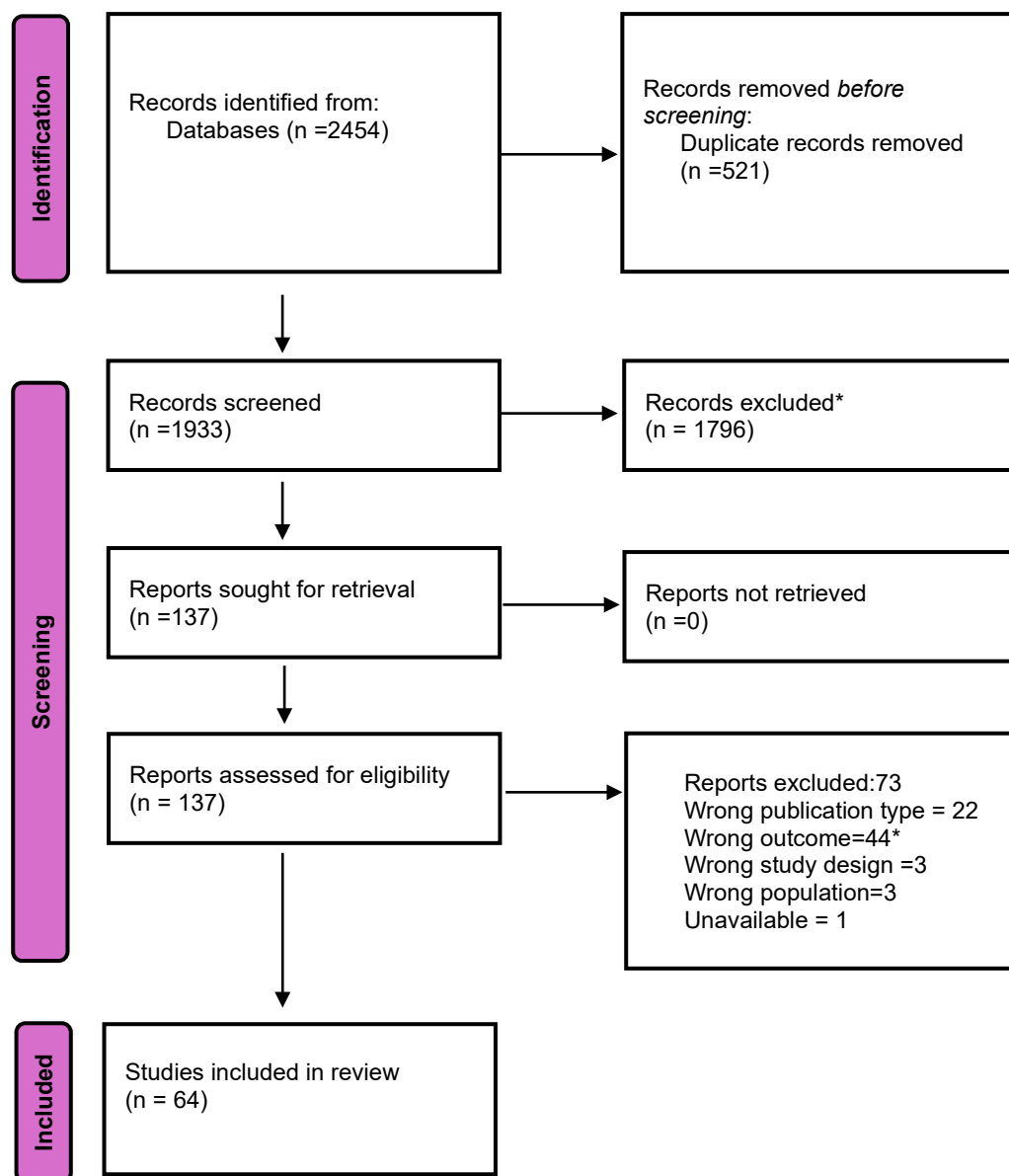
During integration, a JBI convergent segregated approach was used (Aromataris & Munn 2024). Quantitative outcome domains were compared with relevant qualitative themes and brought together to examine how women's experiences supported, explained or expanded upon the quantitative findings. Integrated interpretations were then developed to inform the overall conclusions and implications for practice and future research.

Results

Study Selection

A total of 2454 records were identified through database and hand searching. After removing 521 duplicates, 1933 records were screened by title and abstract. Following full text review, 64 studies met the inclusion criteria and were included in the final synthesis: 57 quantitative, six qualitative, and one mixed methods. The study selection process is shown in the PRISMA 2020 flow diagram (Figure 1).

Figure 1. PRISMA 2020 flow diagram (adapted from Page et al. 2021)



*Records excluded after title and abstract screening due to not meeting criteria **studies reporting only physical, obstetric or symptom related outcomes and no psychological outcomes

Quality Appraisal

Methodological appraisal was undertaken using the appropriate Joanna Briggs Institute (JBI) critical appraisal checklists according to study design. No studies were excluded based on methodological quality. Appraisal findings were considered narratively to inform interpretation of results.

Overall, methodological quality ranged from low to high across included studies. Among cohort studies, high (n=13), moderate (n=8) and low (n=2) methodological quality ratings were assigned. Cross-sectional studies were predominantly of moderate (n=6) or high quality (n=4), with one low-quality study (n=1). Case-control studies demonstrated greater methodological variability, with most appraised as moderate (n=14) or low quality (n=8), and one assessed as high quality (n=1). Qualitative studies were appraised as either high (n=3) or moderate quality (n=3), while the mixed-methods study was appraised as high quality (n=1). Common methodological limitations included inadequate reporting and management of confounding factors, variation in exposure definitions, and inconsistent reporting of researcher positioning and reflexivity within qualitative studies. Detailed quality appraisal findings for all included studies are provided in Supplementary File.

Summary of Study Characteristics

The review included 64 studies, comprising 57 quantitative studies (22 case-control, 21 cohort and 14 cross-sectional), six qualitative studies and one mixed methods study (Table 1). Studies were published between 2010 and 2025 and conducted across multiple countries, most commonly Turkey (n = 22), followed by the United Kingdom (n = 7), Japan (n = 6), Malaysia (n = 5) and the United States (n = 5). Depression and anxiety were the most frequently assessed psychological outcomes, with fewer studies examining stress, post-traumatic stress disorder, or suicidal ideation.

Table 1. *Characteristics of included studies*

Study ID	Author/Year	Country	Quant/Qual/Mix	Study Design	Sample size	Psychological Outcomes Measured
1	Aksoy 2015	Turkey	Quant	Case-control	n = 160 (78 HG; 82 control)	Dep
2	Annagur 2013	Turkey	Quant	Cohort	n = 47	Dep, Anx
3	Annagur 2014	Turkey	Quant	Case-control	n = 92 (48 HG; 44 control)	Dep, Anx
4	Asyikin 2020	Malaysia	Quant	Case-control	n = 117 (55 HG; 62 control)*	Dep, Anx
5	Ay 2023	Turkey	Quant	Cross-sectional	n = 659	Distress
6	Bai 2015	Netherlands	Quant	Cross-sectional	n = 5079	QoL
7	Balik 2015	Turkey	Quant	Case-control	n = 148 (77 HG; 71 control)	Dep, Anx, Distress
8	Bazarganipour 2015	Iran	Quant	Cross-sectional	n = 200	Dep
9	Beck 2023	United States of America	Qual	Qualitative Interview	n = 33	Dep, Anx, Distress, PTSD, SI
10	Beirne 2023	Ireland	Qual	Qualitative focus group	n = 11	Dep, Distress
11	Berger 2024	Global – English language posts	Qual	Qualitative study	n = 3546	Dep, Anx, Distress, SI
12	Beyazit 2018	Turkey	Quant	Case-control	n = 166 (83 NVP; 83 control)	Dep, Anx
13	Bozzo 2011	Canada	Quant	Cohort	n = 57	Dep
14	Bray 2021	Australia	Quant	Cross-sectional	n = 861	Dep
15	Calisir 2021	Turkey	Quant	Cross-sectional	n = 278	QoL
16	Challacombe 2025	United Kingdom	Qual	Qualitative interview	n = 22	Dep, Anx, Distress, PTSD
17	Christodoulou-Smith 2011	United States of America	Quant	Case-control	n = 610 (377 HG; 233 control)	PTSD
18	Dekkers 2020	Netherlands	Quant	Cross-sectional	n = 1682	Dep
19	Elder 2024	Australia	Qual	Qualitative interview	n = 9	Distress, QoL
20	Elmas 2021	Turkey	Quant	Case-control	n = 157 (60 HG; 97 control)	Anx
21	El-Skaan 2023	Egypt	Quant	Cross-sectional	n = 109	Dep, Anx, SI

22	Ezberci 2014	Turkey	Quant	Case-control	n = 200 (100 HG; 100 control)	Dep, Anx
23	Hirose 2020	Japan	Quant	Cohort	n = 153	QoL
24	Hizli 2012	Turkey	Quant	Case-control	n = 400 (200 HG; 200 control)	Dep
25	Iliadis 2018	Sweden	Quant	Cohort	n = 4329	Dep
26	Jones 2025	United Kingdom	Quant	Cohort	n = 255 (117 at follow-up)	Dep, Anx
27	Kasap 2016	Turkey	Quant	Case-control	n = 80 (40 HG; 40 control)	Dep, Anx
28	Kender 2015	Turkey	Quant	Case-control	n = 92 (51 HG; 41 control)	Dep, Anx
29	Khodabakhsh 2021	Malaysia	Quant	Cross-sectional	n = 40	Anx
30	Kivrak 2018	Turkey	Quant	Case-control	n = 90 (45 HG; 45 control)	Dep, Anx
31	Kjeldgaard 2017	Norway	Quant	Cohort	n = 92947 (851 HG; 92096 no HG)	Distress
32	Kjeldgaard 2019	Norway	Quant	Cohort	n = 1945	PTSD
33	Kramer 2013	Canada	Quant	Cohort	n = 648	Dep, Anx
34	Lindgren 2025	Sweden	Qual	Qualitative interview	n = 15	Distress
35	Liu 2019	Taiwan	Quant	Cohort	n = 101	Stress, QoL
36	Maruya 2023	Japan	Quant	Cohort	n = 153	Anx
37	McCarthy 2011	Australia, New Zealand, Ireland, UK	Quant	Cohort	n = 3423	Dep, Anx, Stress
38	McCormack 2011	United Kingdom	Quant	Case-control	n = 73 (32 HG; 41 control)	Dep, Anx, Distress
39	Mitchell-Jones 2020	United Kingdom	Quant	Case-control	n = 214 (106 HG; 108 control)	Dep
40	Morrin 2025	Multinational	Quant	Cohort	n = 953,714 (476,857 HG; 476,857 control)	Dep, Anx, PTSD, SI
41	Muchanga 2022	Japan	Quant	Cohort	n = 80396	Dep
42	Mullin 2011	United States of America	Quant	Case-control	n = 395 (201 HG; 194 control)	Dep, Anx, PTSD
43	Munch 2011	United States of America	Quant	Cross-sectional	n = 93 (29 HG; 48 NVP; 16 control)	Dep, Anx , QoL
44	Na 2025	United Kingdom	Quant	Cohort	n = 267,925	Dep, Anx, SI
45	Nana 2022	United Kingdom	Mix	Mixed methods	n = 5071	SI
46	Nijsten 2022	Netherlands	Quant	Cohort	n = 215	Dep, Anx, PTSD
47	Pirimoglu 2010	Turkey	Quant	Case-control	n = 68 (34 HG; 34 control)	Dep, Anx, Distress
48	Power 2010	United Kingdom	Quant	Case-control	n = 101 (51 HG; 50 control)	Dep, Anx, QoL
49	Sahin 2016	Turkey	Quant	Cross-sectional	n = 606	Dep
50	Senturk 2017	Turkey	Quant	Cohort	n = 384 (207 HG; 177 control)	Dep, Anx, Distress
51	Simsek 2011	Turkey	Quant	Case-control	n = 86 (41 HG; 45 control)	Dep, Anx
52	Speyer 2020	United Kingdom	Quant	Cohort	n = 17531	Distress
53	Taguchi 2022	Japan	Quant	Cohort	n = 110	Dep, Anx, Distress
54	Tan 2010	Malaysia	Quant	Cross-sectional	n = 209	Dep, Anx
55	Tan 2014	Malaysia	Quant	Cohort	n = 234 (121 HG; 113 control)	Dep, Anx, Stress
56	Tan 2018	Malaysia	Quant	Cohort	n = 116	QoL
57	Tian 2017	United States of America	Quant	Case-control	n = 908 (449 HG; 459 control)	Dep, Anx
58	Topalahmetoğlu 2017	Turkey	Quant	Case-control	n = 200 (100 HG; 100 control)	Dep, Anx
59	Turkmen 2020	Turkey	Quant	Case-control	n = 300 (150 HG; 150 control)	QoL
60	Ulusoy 2022	Turkey	Quant	Case-control	n = 128 (83 NVP; 45 control)	Dep, Anx
61	Yamada 2025	Japan	Quant	Cohort	n = 2124	Dep
62	Yang 2023	Japan	Quant	Cohort	n = 87258	Dep
63	Yildirim 2019	Turkey	Quant	Case-control	n = 98 (46 HG; 52 control)	Dep, Anx
64	Yilmaz 2016	Turkey	Quant	Cross-sectional	n = 200	Dep

Dep = Depression; Anx = Anxiety; QoL = Mental Health Related Quality of Life; PTSD = Post-traumatic stress disorder; Distress = Psychological distress; SI = Suicidal ideation

Quantitative Synthesis

Quantitative evidence formed the largest component of this review, comprising 57 studies, and the quantitative component of one mixed methods study. The studies employed a range of designs, including case-control, cohort, and cross-sectional approaches. These studies examined a range of psychological outcomes associated with HG and NVP, most commonly depression and anxiety, alongside stress, psychological distress, post-traumatic stress symptoms, suicidal ideation, and quality of life.

Considerable heterogeneity was present across study designs, populations, and outcome measures, including the use of different psychological assessment tools and variation in the timing of outcome assessment from pregnancy through to the postnatal period; therefore, findings were synthesised narratively by outcome. A summary of quantitative findings across outcomes is presented in Table 2.

Table 2. Summary of quantitative findings by psychological outcome

Outcome	No. of studies	Designs represented	Main pattern of findings
Depression	43	Case-control, Cohort, Cross-sectional	HG > controls; severity gradient; some null findings; persistence postnatally and longer-term risk
Anxiety	33	Case-control, Cohort, Cross-sectional	HG > controls; evidence of severity gradient; some evidence of elevated anxiety beyond pregnancy
Stress	3	Cohort, Case-control, Cross-sectional	HG > controls; variation across pregnancy (higher early, may decrease over time)
Psychological distress	7	Case-control, Cohort, Cross-sectional	HG > controls; increased psychological distress, with evidence of severity effects and some persistence
PTSD	5	Cohort, Case-control, Cross-sectional	HG > controls; increased PTSD symptoms; some evidence of longer-term symptoms, though findings on persistence are mixed
Suicidal ideation	4	Cohort, Mixed methods	Evidence of suicidal ideation among women with HG; mixed findings regarding increased risk; limited evidence for suicide attempts
Quality of life	8	Cohort, Case-control, Cross-sectional, Mixed methods	Worse mental health related QoL with increasing symptom severity; some evidence of gradient (HG > NVP > controls)

“>” indicates relatively higher levels of symptoms or poorer outcomes (e.g. HG > NVP > controls = HG highest, NVP intermediate, controls lowest)

Findings

Table 2 summarises the quantitative evidence across psychological outcomes. Overall, findings consistently indicate higher levels of psychological morbidity among women experiencing HG compared with control populations, with several studies demonstrating worse psychological outcomes with increasing symptom severity. The following sections present detailed findings for each outcome domain, drawing on the contributing studies summarised in Table 2

Depression

Depression was the most frequently examined psychological outcome, reported in 43 quantitative studies (Tables 1 and 2). Sample sizes ranged from 47 participants in small hospital based studies to 953,714 pregnancies in a multinational electronic health record cohort, reflecting evidence from both small clinical samples and large population based datasets. Outcomes were assessed during pregnancy and postnatally, with several cohort studies examining longer term outcomes [25, 40, 41, 46, 50, 61].

Overall, findings indicated higher depressive symptoms among women with HG, with increasing symptom severity generally associated with higher depression scores [7, 8, 18, 21, 26, 33, 49, 60, 64]. Similar severity gradients were reported for postpartum depressive symptoms in some cohort studies [41, 61], while prolonged HG was also associated with higher rates of depression [42]. However, findings were not entirely consistent, with some smaller prospective studies reporting no significant association between NVP severity and depressive symptoms [12, 13], and one longitudinal study demonstrating differences in psychological distress, including depressive symptoms, across NVP symptom trajectories [53].

A large multinational retrospective cohort study of over 950,000 pregnancies reported a significantly increased risk of both depression and postpartum depression among women with HG compared with matched controls [40]. Extending this evidence beyond the perinatal period, population-based cohort data further demonstrated an elevated long-term risk of depression following pregnancies affected by excessive vomiting [44]. Retrospective cross-sectional survey data further indicated that the

psychosocial impact of nausea and vomiting in pregnancy was associated with increased odds of self-reported postpartum depression, independent of depression before and during pregnancy [14]. A large population based longitudinal cohort study reported that prolonged nausea was associated with increased odds of postpartum depressive symptoms, independent of prior depression [25].

Across case–control studies, women with HG reported higher depressive symptoms compared with healthy pregnant controls [1, 22, 24, 27, 28, 30, 38, 39, 47, 51, 57, 58, 63]. However, there was heterogeneity in study design and measurement tools. A range of validated measures were used, most commonly the Beck Depression Inventory (BDI/BDI-II), Hospital Anxiety and Depression Scale (HADS), and Edinburgh Postnatal Depression Scale (EPDS) (Beck et al. 1961; Zigmond & Snaith 1983; Cox et al. 1987).

The BDI/BDI-II were the most frequently used measures of depressive symptoms, reported in thirteen studies (Tables 3a and 3b). Across case–control studies, women with HG generally reported higher depressive symptom scores than controls. Cross-sectional studies also demonstrated increasing depressive symptoms with greater NVP severity [8, 49]. Where reported, median scores and proportions exceeding clinical thresholds were higher among women with HG. Longitudinal data suggested depressive symptoms decreased alongside symptom improvement over time [2].

Studies using other validated depression measures reported elevated or common depressive symptoms among women with HG across study designs [4, 25, 37, 54, 55, 62], with one study also reporting a positive correlation between symptom impact and depressive symptoms [48].

Table 3a. *Studies reporting mean BDI scores across comparison groups*

Study ID	Author (Year)	Country	Design	Sample size	BDI Results	p-value / Significance
1	Aksoy (2015)	Turkey	Case-control	n=160 (78 HG; 82 control)	HG: 18.97 ± 9.85; Control: 6.36 ± 5.61	< 0.001
2	Annagur (2013)	Turkey	Cohort	n=47	T1: 15.38 ± 9.18; T2: 11.32 ± 6.51; T3: 10.26 ± 5.98	0.005 (change over time by NVP resolution status)
3	Annagur (2014)	Turkey	Case-control	n=92 (48 HG; 44 control)	HG: 15.7 ± 9.3; Control: 9.1 ± 6.6	< 0.001
7	Balik (2015)	Turkey	Case-control	n=148 (77 HG; 71 control)	HG: 11.89 ± 8.71; Control: 8.83 ± 8.38	0.009
8	Bazarganipour (2015)	Iran	Cross-sectional	n=200	Mild NVP: 3.89 ± 3.50; Moderate: 4.61 ± 3.55; Severe: 5.33 ± 3.40	0.01
27	Kasap (2016)	Turkey	Case-control	n=80 (40 HG; 40 control)	HG: 21.38 ± 12.90; Control: 8.18 ± 5.51	0.0001
28	Kender (2015)	Turkey	Case-control	n=92 (51 HG; 41 control)	HG: 21.16 ± 11.77; Control: 9.63 ± 6.09	< 0.001
30	Kivrak (2018)	Turkey	Case-control	n=90 (45 HG; 45 control)	HG: 17.13 ± 8.62; Control: 7.64 ± 4.44	< 0.001
51	Simsek (2012)	Turkey	Case-control	n=86 (41 HG; 45 control)	HG: 20.9 ± 10.4; Control: 11.8 ± 10.24	0.0001
63	Yildirim (2019)	Turkey	Case-control	n=98 (46 HG; 52 control)	HG: 17.84 ± 9.37 vs Control: 5.67 ± 2.13	< 0.001

Table 3b. *Studies reporting BDI medians, severity distributions, or longitudinal outcomes*

Study ID	Author (Year)	Country	Design	Sample size	BDI Results	p-value / Significance
24	Hizli (2012)	Turkey	Case-control	n=400 (200 HG; 200 control)	Median BDI-II: HG: 15; Control: 5. HG: 35.1% mild, 26% moderate, 17.8% severe; Control: 95% no depression, 5% mild	< 0.001
51	Simsek (2012)	Turkey	Case-control	n=86 (41 HG;45 control)	BDI > 17: 63.4% HG vs 28.8% controls	0.0001
58	Topalahmetoğlu (2017)	Turkey	Case-control	n=200 (100 HG;100 control)	HG: 19.5 (IQR 11.0); Control: 9.0 (IQR 8.8)	< 0.001
63	Yildirim (2019)	Turkey	Case-control	n=98 (46 HG;52 control)	Moderate depression: 39.1% HG vs 0% control; Severe depression: 13% HG vs 0% control	<0.001

Studies 51 and 63 also reported mean BDI scores (see Table 3a)

Anxiety

Anxiety was reported in 33 quantitative studies (Tables 1 and 2). Sample sizes ranged from fewer than fifty participants in small hospital-based studies to more than 80,000 women in large population-based cohorts. Anxiety symptoms were assessed antenatally and, in several cohort studies, postnatally [26, 40, 44].

Case-control studies reported higher levels of anxiety amongst women experiencing HG compared with healthy pregnant controls [3, 22, 27, 28, 30, 38, 47, 50, 51, 58, 63]. Cohort studies also reported elevated anxiety symptoms among women with HG or increasing NVP severity during pregnancy and, in some studies, beyond pregnancy [2, 21, 26, 33, 37]. Evidence from population based cohort studies indicated an increased risk of diagnosed anxiety disorders following HG, including the postnatal period [40] and over longer term follow up [44]. Case-control data also reported higher self-reported anxiety following pregnancy among women with HG [42, 57]. However, findings were not entirely consistent, with some studies reporting no significant differences in anxiety symptoms between women with HG or NVP and comparison groups, and no clear association with symptom severity [4, 60]. Associations between nausea and vomiting severity and anxiety symptoms were also reported in cohort studies, with evidence that this relationship may be influenced by baseline anxiety [36].

A range of validated anxiety measures were used, most commonly the Beck Anxiety Inventory (BAI), Hospital Anxiety and Depression Scale-Anxiety subscale (HADS-A), and Spielberger State-Trait Anxiety Inventory (STAI) (Beck et al. 1988; Zigmond & Snaith 1983; Spielberger et al. 1983).

The Beck Anxiety Inventory (BAI) was used in several case-control studies, which consistently reported higher anxiety scores among women with HG compared with controls [27, 28, 51, 63]. One study further reported higher proportions of moderate to severe anxiety among women with HG based on categorised BAI scores [63].

Where studies examined nausea and vomiting severity, anxiety scores increased with greater symptom severity [12], with similar patterns observed in studies comparing mild with moderate to severe nausea and vomiting [7].

Stress and Post Traumatic Stress Disorder

Stress was examined in three studies [Studies 35, 37, 55]. Validated measures included the Perceived Stress Scale, visual analogue measures of prenatal stress, and the stress subscale of the Depression Anxiety Stress Scales (Cohen et al. 1983; Lovibond & Lovibond 1995). A prospective cohort study reported higher perceived stress scores among women with HG or more severe NVP compared with those with milder or no symptoms [37]. A longitudinal study of women with NVP found that stress was highest in the first trimester [35], while another study reported elevated stress among women hospitalised with HG, which decreased over time [55].

Post-traumatic stress symptoms were examined in five quantitative studies [Studies 17, 32, 40, 42, 46]. Overall, women with HG tended to report higher levels of post-traumatic stress symptoms compared with those without HG or with less severe nausea [17, 32, 40]. Evidence from a large population based cohort study also indicated an increased risk of post-traumatic stress disorder among women with HG compared with matched controls [40]. Additional survey based evidence reported higher rates of post-traumatic stress disorder among women with prolonged HG [42]. Some

evidence suggests that these symptoms may persist beyond pregnancy and may be more pronounced among women with more severe or prolonged HG [32, 46].

Suicidal Ideation

Suicidal ideation was examined in four studies [Studies 21, 40, 44, 45]. A large population based cohort study reported higher rates of suicidal ideation among women with HG compared with matched controls, although no significant differences were observed for suicide attempts or self harm [40]. Survey based data indicated that suicidal thoughts were commonly reported, particularly in association with greater symptom severity, poorer functional status, and negative perceptions of care [45]. Smaller clinical studies also reported suicidal thoughts among women hospitalised with HG [21]. However, findings were not entirely consistent, with one large cohort study reporting no significant association between HG and suicidal behaviours [44]. Overall, these findings suggest that while suicidal ideation may be relatively common among women with HG, evidence for increased risk of suicidal behaviour remains limited and inconsistent.

Mental Health Related Quality of Life

Quality of life (QoL) was examined in eight studies [Studies 6, 15, 23, 35, 43, 48, 56, 59]. Measures of mental health related quality of life included the Mental Component Summary (MCS) of the Short Form Health Survey (SF-12/SF-36) and condition specific instruments (Ware et al. 1996; Magee et al. 2002).

Across studies, greater severity of nausea and vomiting was consistently associated with poorer mental health related quality of life [6, 15, 23, 35, 43, 59]. Cross-sectional and cohort studies reported lower MCS scores and poorer emotional wellbeing among women with more severe symptoms, with evidence of a gradient across severity levels [6, 15, 23, 43, 59]. Longitudinal data further indicated that quality of life was most impaired in early pregnancy and improved over time as symptoms reduced, although women with more severe or persistent symptoms continued to report poorer outcomes [35].

Findings from a validation study also demonstrated a significant association between symptom burden and quality of life, with higher symptom impact scores correlating with poorer mental wellbeing [48].

However, findings were not entirely consistent. One study reported lower quality of life scores among women with NVP compared with those with milder symptoms, although differences did not reach statistical significance [56].

Psychological distress

Psychological distress and related constructs were examined across several studies [Studies 5, 7, 31, 47, 50, 52, 53]. Findings generally indicated poorer psychological wellbeing among women with more severe NVP or HG. Cross-sectional studies reported higher levels of psychological distress and poorer psychosocial health with increasing symptom severity, with some evidence of a gradient across severity groups [5, 7], while other studies reported higher levels of distress among women with HG compared with controls [47, 50]. Population based and cohort data further demonstrated elevated emotional distress among women with HG during pregnancy and, in some studies, into the postnatal period [31, 52]. Longitudinal analysis also indicated that poorer psychological wellbeing in

early pregnancy was associated with subsequent worsening of NVP symptoms, suggesting that higher psychological distress may be associated with worsening symptom severity over time [53].

Qualitative Synthesis

Six qualitative studies [Studies 9,10,11,16,19, 34] and the qualitative components of one mixed methods study [45] were included, comprising interviews, focus groups, and analysis of online written accounts. No studies focused exclusively on NVP; therefore, the synthesis reflects experiences of women with HG. Findings were synthesised using thematic synthesis, involving line by line coding, development of descriptive themes, and generation of analytical themes. Four overarching themes were identified: (1) psychological burden and trauma, (2) invalidation and unmet care needs, (3) disruption to daily life, identity and relationships, (4) support and coping.

Confidence in Qualitative findings

Confidence in the synthesised findings was assessed using the ConQual approach (Munn et al. 2014). All themes were initially assigned a high level of confidence and downgraded one level due to minor limitations in dependability, primarily related to inconsistent reporting of researcher positioning and reflexivity across included studies. Credibility was judged to be high, with findings supported by rich participant quotations and clear alignment between data and interpretation. Overall, confidence in all four themes was rated as moderate.

Table 4. ConQual confidence ratings for synthesised qualitative themes

Theme	Dependability	Credibility	Overall Confidence
Theme 1. Psychological burden and trauma	Moderate	High	Moderate
Theme 2. Invalidation and unmet care needs	Moderate	High	Moderate
Theme 3. Disruption to daily life, identity and relationships	Moderate	High	Moderate
Theme 4. Support and coping	Moderate	High	Moderate

Theme 1 – Psychological burden and trauma

Women described HG as an overwhelming physical and psychological experience, with relentless nausea, vomiting, dehydration, and exhaustion severely limiting daily functioning and emotional wellbeing [9, 10, 11, 16, 19, 34]. Participants reported intense emotional distress, including fear, hopelessness, anxiety, and depressive symptoms [9, 10, 11, 16, 19, 34, 45], with some describing a progressive deterioration in mental health over the course of pregnancy [11, 16]. Several accounts reflected extreme distress, including descriptions of suicidal thoughts or wishing not to wake up [9, 11, 19]. Women also described contemplating termination of a wanted pregnancy as a result of prolonged suffering [9, 34, 45]. For some, psychological impacts extended beyond pregnancy, with ongoing symptoms such as depression, anxiety, and trauma-related distress [9, 16].

Theme 2 – Invalidation and unmet care needs

Women described their experiences of healthcare as highly varied, with many reporting dismissal, disbelief, and lack of recognition of HG severity [9, 10, 11, 16, 19, 34]. Symptoms were minimised as typical “morning sickness” [9, 10, 11, 16, 19, 34], leading to delays in diagnosis, access to treatment, and increased distress [9, 11, 19, 34, 45]. Negative interactions with healthcare professionals,

including lack of understanding, and dismissive or judgemental responses, contributed to feelings of invalidation and hesitation to seek further help [9, 11, 16, 34, 45].

In contrast, positive care experiences were characterised by women feeling believed, listened to, and taken seriously by healthcare professionals [9, 16, 19, 34]. Participants described reassurance and reduced distress when clinicians demonstrated understanding of HG and provided clear management plans or continuity of care [16, 19, 34]. Supportive interactions and empathetic communication were perceived as improving both symptom management and psychological wellbeing (9, 16). However, gaps in professional knowledge, inconsistent care pathways, and limited access to psychological support remained recurring concerns across studies [10, 11, 16, 34, 45].

Theme 3 – Disruption to daily functioning, identity and relationships

Women consistently described significant disruption to daily functioning, with HG affecting their ability to carry out usual activities, including work, household responsibilities, and childcare [9, 10, 11, 16, 19, 34]. Many reported becoming reliant on others for support, reflecting the extent to which symptoms limited independence and daily functioning [9, 10, 19, 34].

Experiences of HG were also associated with a loss of identity, with women describing feeling reduced to the role of a patient and disconnected from their expected experience of pregnancy [10, 34]. This was often accompanied by feelings of guilt and frustration related to an inability to fulfil roles [9, 16, 19, 34].

These impacts extended beyond pregnancy, with ongoing psychological uncertainty around decisions around future pregnancies [10, 16, 19, 34, 45].

Theme 4 – Support and coping

Women employed diverse coping strategies, including practical approaches to manage symptoms, reframing the pregnancy experience, and seeking information or advocating for care to regain a sense of control [16]. Support from partners, family, and healthcare professionals was central [10, 16, 34]. Peer support provided emotional validation, practical tips, and reassurance, reducing isolation [9, 16, 34]. Continuity of compassionate, empathetic, knowledgeable care further helped women cope with the psychological burden of HG [10, 11, 16, 19].

Integrated synthesis of findings

Integration of quantitative and qualitative findings demonstrated consistent agreement across key psychological outcomes. Elevated depression, anxiety, stress, and post-traumatic stress symptoms identified in quantitative analyses were consistently reflected in qualitative accounts describing emotional distress, fear, trauma, and crisis experiences. For outcomes less frequently examined quantitatively, particularly suicidal ideation, broader psychological distress and quality of life, qualitative findings provided complementary depth, capturing experiences not fully reflected in symptom scores, including stigma, social isolation, disruption to daily functioning, and changes to identity and relationships.

Overall, the integrated synthesis indicates that psychological morbidity in HG and NVP is not only reflected in elevated symptom scores but also in women's lived experiences, profoundly affecting identity, social roles, daily life, and access to supportive care. Integrated findings are summarised in Table 4.

Table 5. *Integration of quantitative and qualitative findings*

Outcome	Quantitative Findings	Qualitative Themes	Relationship Between Strands	Integrated Interpretation
Depression	Higher depressive symptoms in HG vs controls; graded pattern with severity; persistence in some cohorts; increased diagnosed and postpartum risk	Emotional distress, hopelessness, loss of joy, emotional exhaustion, disrupted identity	Supportive	Both strands independently demonstrate substantial depressive morbidity associated with HG, increasing with symptom severity and persisting in some cases beyond pregnancy
Anxiety	Higher anxiety in HG vs controls; graded pattern in some studies; persistence in some cohorts	Fear, panic, uncertainty about illness and future pregnancies	Supportive	Elevated anxiety scores are reinforced by qualitative accounts of fear and anxiety
Stress	Higher stress scores in HG; some persistence beyond early pregnancy	Overwhelming thoughts, exhaustion, emotional strain	Supportive	Quantitative stress elevations align with lived experiences of psychological strain
Psychological distress	Higher global distress in HG vs controls; occasional persistence	Shame, stigma, emotional strain, social withdrawal	Supportive	Quantitative distress measures are contextualised and deepened by qualitative narratives of stigma and isolation
Post-traumatic stress	Elevated trauma-related symptoms in HG; persistence in some cohorts	Trauma, flashbacks, avoidance, fear of recurrence	Supportive	Trauma-related symptom scores are supported by qualitative descriptions of traumatic experiences and ongoing psychological impact
Suicidal ideation	Increased self-reported and diagnosed suicidal ideation in HG	Suicidal thoughts and crisis experiences	Generally supportive	Both strands identify suicidality related to severe HG, not all quantitative evidence supports
Quality of life	Reduced mental health-related quality of life in HG; graded pattern with severity	Disrupted roles, loss of identity, isolation	Supportive	Quality of life impairment is elaborated by qualitative accounts of identity disruption and social consequences

Summary of key findings

This mixed-methods systematic review synthesised evidence on the psychological burden associated with Hyperemesis Gravidarum (HG) and nausea and vomiting in pregnancy (NVP). Across 64 studies, depression and anxiety were the most frequently assessed outcomes and were generally elevated among women with HG compared with healthy pregnant controls. Where nausea and vomiting severity was examined, higher symptom severity was associated with increased levels of depression and anxiety. Evidence from longitudinal cohorts and large scale electronic health record analyses suggests that increased risk of depression and anxiety may persist beyond pregnancy and into the postnatal period.

Other psychological outcomes, including stress, psychological distress, post-traumatic stress symptoms, suicidal ideation, and reduced quality of life, were examined less frequently but also showed elevated risk in women with HG. Integration of quantitative and qualitative findings showed that these measurable symptoms were supported by qualitative accounts describing emotional strain, disruption to daily functioning and identity, and challenges in accessing supportive care.

Qualitative evidence further highlighted women's experiences of care, including dismissal, lack of validation, and limited attention to psychological wellbeing. Reports of inconsistent management and lack of follow up were common, while peer support, particularly through online communities, was described as validating and emotionally beneficial. Overall, these findings indicate that women frequently described unmet psychological support needs within existing care pathways.

Interpretation of psychological outcomes and impact on wellbeing

The findings indicate that psychological morbidity associated with HG and NVP extends beyond isolated symptoms to encompass a broader pattern of distress affecting multiple domains of wellbeing. Evidence of symptom persistence and associations with illness severity suggests that psychological morbidity may be closely linked to the experience and duration of physical symptoms.

Quantitative findings of increased stress and post-traumatic symptoms were supported by qualitative accounts describing hypervigilance, intrusive memories, avoidance, and fear of recurrence. Suicidality was less frequently assessed, with mixed quantitative findings, though qualitative reports described suicidal thoughts during periods of severe illness. For some women, HG may be experienced as acute psychological distress.

Impairment in mental health related quality of life was widely reported. Qualitative findings provided additional context, highlighting disruption to daily functioning, withdrawal from social roles, changes in identity, and experiences of inadequate support. Peer support was frequently identified as an important coping resource. Overall, the evidence indicates that the psychological impact of HG and NVP extends

beyond symptom scores to affect broader aspects of wellbeing, daily life, and access to care.

Discussion

This mixed-methods review reinforces and extends evidence that HG and severe NVP are associated with a substantial psychological burden. Depression and anxiety were generally elevated, alongside additional evidence of trauma related symptoms, suicidal ideation, and reduced mental health related quality of life. A key contribution of this review is the integrated interpretation that psychological morbidity appears to be shaped by both symptom severity and experiences of care. Quantitative data indicating associations between symptom severity and psychological outcomes, alongside persistence of symptoms in some cohorts, is consistent with the view that psychological symptoms may be associated with prolonged physical illness, functional impairment and uncertainty, rather than reflecting solely pre-existing vulnerability. This is consistent with population-based work exploring the complex interplay between prior mental health and HG risk (Kjeldaard et al. 2017).

Although findings were broadly consistent across HG and severe NVP populations, the majority of evidence related to HG, and distinctions between diagnostic categories and symptom severity were not consistently reported across studies. Consequently, findings should be interpreted within the context of a continuum of pregnancy sickness severity.

How this review extends previous evidence

The findings in this review are in line with previous quantitative syntheses showing increased depression and anxiety in HG, including in the postnatal period (Mitchell Jones et al. 2017; Mignot et al. 2025). This review expands the evidence base by integrating outcomes beyond mood symptoms, incorporating qualitative perspectives, and including evidence published since earlier reviews. The inclusion of qualitative evidence enabled exploration of how psychological symptoms are experienced and understood by women. By integrating both strands of evidence, this review provides a more comprehensive account of the psychological impact of HG and NVP, encompassing both the extent of measurable morbidity and the lived context in which it develops and persists.

Importantly, the qualitative findings helped contextualise the quantitative evidence by illustrating how psychological morbidity was experienced in everyday life. While quantitative studies demonstrated elevated depression, anxiety, distress and trauma-related symptoms, qualitative accounts highlighted the profound impact of HG and NVP on women's sense of identity, relationships and ability to fulfil expected social and caregiving roles. Women described loss of independence, dependence on others, social isolation and feeling disconnected from their previous sense of self. These findings suggest that the psychological burden of HG extends beyond measurable symptoms alone and may help explain why distress can persist even when physical symptoms improve.

Findings from this review suggest that psychological assessment may be an important component of care for women with HG and NVP. Across quantitative and qualitative evidence, women with HG frequently reported elevated levels of depression and anxiety, with some studies indicating moderate to severe symptom levels, alongside trauma related distress and in some cases suicidality. Despite this, psychological assessment was inconsistently described, and no study identified a standardised tool specifically designed to capture the combined physical and psychological burden of HG.

These findings suggest a need for more structured approaches to assessment that consider symptom severity, psychological distress, and the impact on daily functioning. Such approaches may support earlier identification of risk, inform referral decisions, and improve continuity of care. Qualitative evidence further highlighted the importance of specialist knowledge and continuity, with women describing dismissal and unmet psychological needs within existing pathways. In this context, specialist midwifery roles with expertise in HG and perinatal mental health may represent a potential model for integrating medical management with psychological assessment and ongoing support. Together, these considerations reflect gaps in recognition and coordination of care identified across the evidence base.

Implications for future research

Future research should prioritise longitudinal designs that examine psychological outcomes beyond pregnancy and into the postnatal period, using consistent definitions and outcome measures to improve comparability across studies. Further evaluation of integrated medical and psychological interventions for women with HG and NVP is warranted.

Greater attention is also needed to care pathways, screening practices and women's support preferences, particularly how psychological needs are identified and managed over time. Development and validation of assessment approaches that capture both physical symptom severity and psychological impact would support more consistent identification of risk and facilitate evaluation of continuity or specialist models of care.

Although qualitative findings highlighted the importance of support from partners and family members, no quantitative studies examined the psychological impact of HG on partners or wider family functioning. Future research should therefore explore the broader family consequences of HG and NVP, including effects on partner wellbeing, family relationships and caregiving roles.

Strengths and limitations

Strengths of this review include a comprehensive search strategy, inclusion of diverse study designs, and use of established JBI methods for mixed-methods synthesis. The integration of quantitative and qualitative evidence enabled examination of both measurable psychological morbidity and women's lived experiences, providing a more comprehensive understanding of psychological burden than would be possible from

either evidence strand alone. The consistency of findings across countries and settings supports the overall conclusions.

Limitations include heterogeneity in definitions of HG and NVP and variation in psychological outcome measures, which limited direct comparability across studies and prevented quantitative pooling of findings through meta-analysis. Many studies were hospital based and included relatively small samples, potentially affecting generalisability. Variation in diagnostic criteria, psychological assessment tools and timing of outcome measurement may have contributed to differences in reported prevalence and severity estimates across studies. Consequently, findings should be interpreted with caution, and emphasis placed on the consistency of overall patterns rather than direct comparisons.

In addition, many included studies were cross-sectional in design, limiting the ability to determine the direction or causality of observed associations between HG/NVP and psychological outcomes. Evidence relating to postnatal outcomes, suicidality and psychological interventions was limited. Reporting of sociodemographic characteristics was inconsistent, limiting assessment of how existing vulnerabilities and health inequalities may influence women's experiences, despite evidence that some groups experience poorer maternity care. Restriction to English language publications and exclusion of grey literature may also have introduced bias, and studies reporting significant psychological associations may have been more likely to be published than those reporting null findings. Furthermore, studies examining depression were disproportionately conducted in Turkey, which may limit transferability of findings to other health systems and cultural contexts.

Conclusion

This review indicates that HG and severe NVP are associated with a substantial psychological burden. Depression and anxiety were generally elevated, alongside evidence of increased stress, trauma related symptoms, suicidal ideation, and poorer health related quality of life. These findings were observed across a range of settings and study designs.

Qualitative findings indicate that this burden extends beyond symptom scores, affecting women's daily lives, relationships and sense of identity, and shaping their experiences of care. The psychological impact of HG therefore appears to be an integral component of the condition as experienced by women.

These findings highlight the importance of improved recognition, structured psychological assessment, and more coordinated models of care. Future research should evaluate approaches that integrate medical management with psychological support, including specialist services designed to provide continuity and expertise.

Ensuring that care addresses both physical and psychological dimensions of HG may contribute to improved outcomes for women and families.

Conflict of interest and Competing interests

The authors declare no conflicts of interest.

CRediT author statement

Alexandra Mills: Conceptualization, Methodology, Investigation, Data curation, Formal analysis, Writing – original draft, Project administration.

Patrick Glaister: Methodology, Investigation, Data curation.

Stephanie Heys: Investigation, Supervision, Writing – review & editing.

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Ethical Approval

Ethical approval was not required as this study was a systematic review of published research.

Data availability statement

All data generated or analysed during this review are included in the article and its Supplementary File. No additional datasets were created or analysed.

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