New Ideas in Psychology 81 (2026) 101235

Contents lists available at ScienceDirect

New Ideas in Psychology

journal homepage: www.elsevier.com/locate/newideapsych

Is emesis a part of antenatal depression? A proposal of emesis-depression complex during pregnancy

Toshinori Kitamura [a,b,c,*], Ayako Hada [a,b,d,e,**], Yuriko Usui [a,b,f], Mizuki Takegata [a], Mariko Minatani [g], Mikiyo Wakamatsu [h], Satoru Takeda [i,j]

[a] Kitamura Institute of Mental Health Tokyo, Tokyo, Japan
[b] Kitamura KOKORO Clinic Mental Health, Tokyo, Japan
[c] T. and F. Kitamura Foundation for Studies and Skill Advancement in Mental Health, Tokyo, Japan
[d] Department of Community Mental Health & Law, National Institute of Mental Health, National Center of Neurology and Psychiatry, Tokyo, Japan
[e] Department of Mental Health and Psychiatric Nursing, Institute of Science Tokyo, Tokyo, Japan
[f] Department of Midwifery and Women's Health, the Graduate School of Medicine, the University of Tokyo, Japan
[g] Life Value Creation Unit, NTT DATA Institute of Management Consulting, Inc., Tokyo, Japan
[h] Department of Reproductive Health Care Nursing, Kagoshima University Faculty of Medicine School of Health Sciences, Japan
[i] Department of Obstetrics & Gynecology, Faculty of Medicine, Juntendo University, Tokyo, Japan
[j] Aiiku Research Institute for Maternal, Child Health and Welfare, Imperial Gift Foundation Boshi-Aiiku-Kai, Tokyo, Japan

ARTICLE INFO

Keywords:
Emesis
Depression

ABSTRACT

Both depression and emesis (nausea and vomiting) are commonly seen during pregnancy. The two often coexist but their symptomatic structure and causal relationships remain unclear. Using two independent follow-up data (Study 1 with women of 10–13 weeks of gestation [N = initially 382 and follow-up 129] and Study 2 with women of 12–15 weeks of gestation [N = initially 696 and follow-up 245]) sets of pregnant women, we measured depressed mood, loss of interest and three emesis symptoms (nausea, vomiting, and retching). The samples were re-examined with an interval. The 5 symptoms were substantially correlated with each other at each time point and factor analyses identified two factors reflecting depression and emesis. However, depression and emesis were associated with clinical correlates in a very similar manner. Two-step cluster analysis yielded only two clusters: one with and another without depression and emesis simultaneously. Taxometrics indicated dimensionality rather than taxonicity. Findings suggest that emesis and depression during pregnancy are two discrete aspects of a single clinical phenomenon that we propose to name emesis-depression complex.

1. Introduction

Pregnancy is not a period immune to psychological maladjustment. One of such maladjustment is depression during pregnancy. This is also known as antenatal (prepartum) depression. Incidence of major depressive episode is about 5 % (Kitamura et al., 2006) and, if including minor depressions, the incidence of antenatal depression was reported as high as 16 % (Kitamura, Sugawara, et al., 1996). Many psychosocial correlates were found to be associated with antenatal depression (Kitamura, Shima, et al., 1996). Clinical manifestations of antenatal depression are similar to those of depressions observed in non-pregnancy-related situations. However, one of the specific features of antenatal depression is nausea (Kitamura, Sugawara, et al., 1996).

Nausea and vomiting related to pregnancy (NVP) are termed emesis. Emesis is very frequently observed among pregnant women. Its prevalence is about 80 % (Gadsby et al., 1993). If accompanied by dehydration, ketonuria, and more than 5 % body weight loss, emesis is called hyperemesis gravidarum (HG). The prevalence of HG is 2–4 % (Seng et al., 2007). Clinical definition of HG does not seem to have reached a consensus. Koot et al., 2018 [6] reviewed all the randomised controlled trials of HG (definition by researchers) and examined the definition of HG. They identified 34 reports. The items used for the definition were

* Corresponding author. Kitamura Institute of Mental Health Tokyo, 2-26-3 Flat A, Tomigaya, Shibuya-ku, Tokyo, 151-0063, Japan.
** Corresponding author. Kitamura Institute of Mental Health Tokyo, 2-26-3 Flat A, Tomigaya, Shibuya-ku, Tokyo, 151-0063, Japan.
E-mail addresses: kitamura@institute-of-mental-health.jp (T. Kitamura), hada.a.341e@m.isct.ac.jp (A. Hada), yusui@g.ecc.u-tokyo.ac.jp (Y. Usui), takegata@instiute-of-mental-health.jp (M. Takegata), minatanim@nttdata-strategy.com (M. Minatani), mikiwaka@health.nop.kagoshima-u.ac.jp (M. Wakamatsu), stakeda@juntendo.ac.jp (S. Takeda).

https://doi.org/10.1016/j.newideapsych.2025.101235
Received 13 June 2025; Received in revised form 29 November 2025; Accepted 6 December 2025
Available online 16 December 2025

vomiting (100 %), nausea (88 %), ketonuria or acidosis (56 %), need for hospitalisation (50 %), weight loss (26 %), dehydration (21 %), electrolyte disturbances (15 %), and inability to tolerate oral food/water intake (12 %). This suggests lack of consensus on the definition of HG. Whether individual differences should be understood as differences of degree or of the kind is one of our interests. We are not aware of any taxometric studies about HG. We therefore think fair to consider emesis/HG dimensional.

Majority of pregnant women reported negative psychosocial changes due to emesis or HG (Poursharif et al., 2008; Wood et al., 2013). Emesis or HG is often accompanied by depression (Aksoy et al., 2015; Fell et al., 2006; Hizli et al., 2012; Mitchell-Jones et al., 2017; Pirimoglu et al., 2010), anxiety (Pirimoglu et al., 2010), tokophoia (Poursharif et al., 2008), or higher emotional distress (Kjeldgaard et al., 2017). Emesis/HG are often preceded or followed by history of mental illnesses. Past history of depression is higher among women with HG (Kjeldgaard, Eberhard-Gran, Benth, & Vikanes, 2017; Seng et al., 2007). Women with HG are likely to have posttraumatic stress disorder or symptoms after childbirth (Christodoulou-Smith et al., 2011; Kjeldgaard et al., 2019; Mullin et al., 2012) as well as postnatal depression (Mitchell-Jones et al., 2020; Muchanga et al., 2020).

In light of evidence mentioned above, the necessity of psychological support is being discussed lately (van der Minnen et al., 2025). For example, the necessity of the assessment for people's mental health by professionals during pregnancy and of referring to psychological support. However, discussions about the symptomatology or taxonomy of emesis and depression have not been grown up much in the past. We need to make it up to the new perspective of relationship between emesis and depression.

Although there have been pieces of evidence suggesting an association between antenatal depression and emesis/HG, what remains to be studied is the relationship between antenatal depression and emesis/HG. There are at least three possibilities where two phenomena coexist. Firstly, one is resulted from another. Two are discrete and one of them is the cause of another. Secondly, the two phenomena are caused by a third variable. The third variable confounds the spurious association of the two phenomena. Finally, the two are aspects of a single construct. The two reflect different aspects of the same phenomenon. A main purpose of our report is to clarify the relationships between often coexisting antenatal depression and emesis/HG.

In our previous report, we distributed the Japanese version (Inagaki et al., 2013; Muramatsu & Kamijima, 2009) of the Patient Health Questionnaire-9 (PHQ-9 [Spitzer et al., 1999]:) to 382 women in the first trimester (Wakamatsu et al., 2021). Factor analyses of the PHQ-9 items revealed two factors: one with somatic symptoms (e.g., sleep change, appetite change, and fatigue) and another with non-somatic symptoms (e.g., depressed feeling and loss of interest). We then entered these two PHQ-9 subscale scores into a 2-step cluster analysis, yielding 3 clusters. Cluster 3 scored highly in the scores of the two PHQ-9 subscales and the two emesis scales. We thought that this was antenatal depression cluster. We were interested in each PHQ-9 item's capacity to identify this cluster. In the receiver operating characteristics (ROC) analysis, five items showed an area under curve (AUC) $>$ .80. In the graded response model (GRM) 4 items were with high information and particularly two items (loss of interest, and depressed mood) showed apparently the highest information. We thought that these two items were core symptoms of antenatal depression and that antenatal depression was highly accompanied by nausea and vomiting. Hence, we think that antenatal depression and emesis are two discrete but to some extent related aspects of a single clinical phenomenon which we tentatively call emesis-depression complex. It is of note that our main concern was the identification of a specific syndrome (a combination of symptoms): Aetiology and intervention would be beyond the scope of the paper. In order to examine our hypothesis and to provide supports for our proposal, we must present (a) depression and emesis are substantially correlated with one another among expectant women, (b) there is a single cluster of depression and emesis though depression and emesis construct two factors, (c) the two factors (depression and emesis) are associated almost equally with other variables that are reported to be linked to depression or emesis, and (d) when longitudinally followed up, depression at Time 1 does not predict the increase of emesis at Time 2 and vice versa.

Regarding external correlates, we hypothesised that both depression and emesis would be associated with disabilities in social functioning to a similar extent. Because infant bonding disorders are related to both depression and emesis (Mitchell-Jones et al., 2020), we hypothesise that both antenatal depression and emesis will be related to foetal bonding disorder. Finally, we expect that both depression and emesis will be associated with fear of childbirth (FOC) (Poursharif et al., 2007, 2008). For these research questions, we performed secondary analyses of our previous two studies.

2. Methods

2.1. Study procedures and participants

The data analysed in this study came from two sources: Studies 1 and 2. Study 1 was a secondary analysis of a longitudinal follow-up conducted at 1-week interval (Hada et al., 2021; Kitamura et al., 2023; Wakamatsu et al., 2021; Yamada et al., 2022). Briefly, we solicited approximately 1500 pregnant women from 10 to 13 weeks of gestation at the antenatal clinic of two general hospitals and four private clinics located in Tokyo, Chiba, Ibaraki, and Kagoshima Prefectures in Japan. The total respondents were 382 (approximately 25 %). They were provided with a set of the test and retest questionnaires and were asked to return the retest questionnaire one week later. Of them, 129 (34 %) returned the retest questionnaire. Questionnaires of the two-time occasions were matched by a predetermined number on the first page of the questionnaires (for the sake of participant anonymity). Excluded were those women (a) who were not fluent in Japanese, (b) who were aged under 20, (c) who had eating disorders, (d) who had symptoms of vaginal bleeding or abdominal pain, (e) who had a subchorionic hematoma, and (f) who had the experience of recurrent miscarriages. Most of them were married (94 %). The mean (SD) age of the participants was 31.9 (4.9) years and the mean age (SD) of their partner was 33.5 (5.5) years. Of them, 43.9 % were nulliparas and 54.8 % were multiparas. Parity was unknown about 6 women. This was a convenience sample. However, the sample consisted of those women receiving different types of obstetrical services in Japan. Data collection was conducted from January 2017 to May 2019.

Study 2 was a secondary analysis of a internet survey of pregnant women. The target was 696 pregnant women at 12–15 weeks' gestational age. They were recruited for two weeks, from December 7th to 21st, 2020, via internet application by Luna Luna and Luna Luna Baby (MTI Ltd., Tokyo, Japan). The participants enrolled came from almost all prefectures in Japan. The questionnaire contained an information page, with the aims of the study, affiliations, information about informed consent, and the address of the consultation desk for the research. As an incentive, participants received electronic money which could be used for Amazon shopping. We sent an e-mail to invite these 696 pregnant women to participate in a follow-up study about 10 weeks later. Of the pregnant women, 245 (35.2 %) responded to it. The questionnaires of the two occasions were matched by their e-mail address (anonymity was assured).

2.2. Measurements

2.2.1. Depression

We used the Japanese version (Inagaki et al., 2013; Muramatsu & Kamijima, 2009) of the PHQ-9 (Spitzer et al., 1999). This is a nine-item self-report measure of depression based on the Major Depressive Episode (MDE) criteria in the Diagnostic and Statistical Manual of Mental

Disorder-IV (DSM-IV). This was virtually the same as that in DSM-5. Each item asks the frequency of MDE symptoms over the previous two weeks with a 4-point Likert scale from 1 (not at all) to 4 (nearly every day). Factor structure and measurement invariance of the Japanese version of the PHQ-9 in this sample has already been reported (Wakamatsu et al., 2021). The full version of the PHQ-9 was used in Study1 whereas only the first two items (depressed mood and loss of interest, i.e., anhedonia) were used in Study 2. Research showed that this 2-item set identifies fairly accurately cases of depression (Bowling et al., 2005; Chochinov et al., 1997; Cutler et al., 2007; De Boer et al., 2004; Mishina et al., 2007, 2009; Richardson et al., 2010). Throughout Studies 1 and 2, we added the scores of depressed mood and loss of interest as an index of the severity of depression. In Study 1 only, the DSM-IV diagnosis of MDE was made as a reference according to Spitzer et al. (1999) by the existence of at least 5 symptoms of MDE (including either depressed mood or anhedonia) at least more than half of the days.

2.2.2. Emesis

We used the Japanese version (Hada et al., 2021) of the 24 h-Pregnancy-unique Quantification of Emesis and Nausea (PUQE-24; Ebrahimi et al., 2009): This is a self-measure rating used widely in clinical and research settings. It measures (a) nausea (the length of nausea in hours for the last 24 h), (b) vomiting (number of vomiting for the last 24 h), and (c) retching (the number of retching for the last 24 h) with a 5-point scale each. Higher scores indicate more severe emesis. The severe end of the emesis spectrum has serious clinical implications as it necessitates immediate interventions. The PUQE-24 has ability to identify and predict the occurrence of HG (Koot et al., 2020; Koren & Cohen, 2021). The PUQE-24 was translated into Japanese by M.M. and T.K. with permission from the original authors. This was back-translated and compared with the original English to verify wordings. The PUQE-24 was used in both Studies 1 and 2. As a concurrent measure of emesis, we used the Japanese version of the NVPQOL Questionnaire (Magee et al., 2002). This is a self-report measure of health-related quality of life for nausea and vomiting during pregnancy. The NVP QOL was used only in Study 1.

2.2.3. Psychosocial disability

We used the Japanese version (Yoshida et al., 2004) of the Sheehan Disability Scale (SDS: Sheehan, 1983). The SDS is a three-item self-report scale covering the domains of (a) work and schoolwork, (b) social and leisure activities, and (c) family life and home responsibility. Each item is rated from 0 to 10. Its psychometric validation has been reported (Arbuckle et al., 2009). The SDS was used only in Study 1.

2.2.4. Foetal bonding

We used the abridged version of the Scale of the Parent-to-baby Emotion (SPBE: Hada et al., 2022) to assess the participant's emotions towards the foetus (Hada et al., 2023). The full version of the SPBE is unique in that it has 6 basic and 4 self-conscious emotion subscales rated by 73 items with a 7-point scale. The instruction was "How strongly did you feel these emotions when you imagined your baby in your womb?" Under the rubric of basic emotions, the SPBE includes Happiness, Anger, Fear, Sadness, Disgust, and Sur-prise (Ekman, 1994; Ekman et al., 1983). Under the rubric of self-conscious emotions, the SPBE includes Shame, Guilt, and Alpha- and Beta-prides (Tangney, 1990). The full version of the SPBE confirms measurement invariances across parity and gender of child. Hada et al. (2023) developed a short version of the SPBE (SPBE-20) consisting of 20 items, each rated by two items of that construct was remaining the construct of the full version of the SPBE. The SPBE-20 was used only in Study 2.

2.2.5. Obsessive-compulsive symptoms

To measure obsessive and compulsive symptoms we used the Japanese version (Koike et al., 2020) of the Obsessive-Compulsive Inventory-Revised (OCI-R: Foa et al., 2002). This comprises 18 items with a 5-point scale. The grading was changed from 5-point to 7-point in this study.

2.2.6. Fear of childbirth (FOC)

As a measure of FOC, we used the Japanese version (Takegata et al., 2013) of the Wijma Delivery Expectancy/Experience Questionnaire (WDEQ) (Wijima et al., 1998). This instru-ment has 33 items rated on a 5-point scale. Higher scores indicate more severe fear of childbirth. Item 31 was erroneously deleted in the present study. The WDEQ was used only in Study 2.

2.2.7. Borderline personality traits

We measured borderline personality traits by the short version (IPO-SV: Yamada et al., 2022) of the Inventory of Personality Organisation (IPO: Kernberg & Clarkin, 1995). The IPO originally had 83 items rated from 0 (never true) to 4 (always true), covering primitive defences (PD: 16 items), identity diffusion (ID: 21 items), and reality testing (RT: 20 items). Clarkin et al. (2001) added Aggression (18 items) and Moral Values (8 items), plus extra items in PD and ID. The IPO-SV has 9 items on a 7-point scale. It has 3 subscales: Primitive Defence (PD), Identity Diffusion (ID), and Reality Testing (RT) disturbance. The IPO-SV was used only in Study 2.

2.2.8. Demographic variables

We examined (a) participant's age, (b) partner's age, and (c) parity.

2.3. Analytic design

Each analytic aim and the matched analytic method were showed in Supplementary Table 1. We selected depressed mood and loss of interest as symptoms of depression during pregnancy. This is because we used only these two symptoms to identify MDE in Study 2 as well as because some MDE symptoms were cast doubt as such (Bowling, 2005). For example, loss of appetite or loss of energy as indicators of MDE may reflect emesis among expectant women. We, then, examined the degree of correlation (Pearson product moment correlation coefficient) between depression and emesis symptoms followed by the identification of factors. This is because we speculated that depression and emesis would reflect different aspects of the same phenomenon. We thought that cluster analysis would give us an insight about hypotheses we proposed in Introduction. If depression and emesis, though often coexisting, were discrete clinical entities, we would find three clusters: depression, emesis, and healthy clusters (Supplementary Fig. 1). If emesis were an independent category and depression were another independent one usually accompanied by nausea and vomiting, we would find again three clusters: emesis, depression with emesis, and healthy clusters (Supplementary Fig. 2). If, on the other hand, depression and emesis were independent clusters and, in addition, there were another cluster characterised by both depression and emesis, we would find four clusters (Supplementary Fig. 3). If depression and emesis consisted of a single category, there would be two clusters: healthy cluster and cluster with emesis and depression (Supplementary Fig. 4). The clusters thus identified were then examined in their associations with depression score, prevalence of MDE, and emesis scores (PUQE-24 and NVP QOL) (criterion validity), their associations with clinical variables including social disability, foetal bonding disorder, obsessive compulsive symptoms, FOC, and borderline personality trait (construct validity) as well as demographic features. We also thought that, when such clusters were identified, we would further check whether they were taxonic or dimensional structure via taxometrics. Finally, we examined temporal relationships between emesis and depression in a cross-lagged design of structural equation modelling.

2.3.1. Factor structure of depression and emesis

In order to identify the factor structure of the two depression and three emesis items, we divided the samples of both Studies 1 and 2 into two at random: one (Group A) for exploratory factor analyses (EFAs) and

another (Group B) for confirmatory analyses (CFAs). Using Group A, we calculated mean, SD, skewness, and kurtosis of each depression and emesis item. We used the Kai-ser-Meyer-Olkin (KMO) index and Bartlett's sphericity test (Burton & Mazerolle, 2011) to conform the data of Studies 1 and 2 would be suitable for EFAs. A series of EFAs were performed by the maximum-likelihood method with PROMAX rotation: an oblique rotation. An oblique rotation was preferred than an orthogonal rotation because the resulting factors of psychological measures are usually correlated with each other to some extent. This was started from a single-factor structure model progressing to models with a greater number of factors (i.e., two- and three-factor structures, and so on). In order to identify the best fit model of the factor structure, these models were compared in a series of CFAs among Group B. The fitness of the models was expressed in terms of chi-squared, comparative fit index (CFI), and root mean square of error approximation (RMSEA). A good fit would be indicated by $\chi^2/df < 2$, CFI >.97, and RMSEA <.05, and an acceptable fit by $\chi^2/df < 3$, CFI >.95, and RMSEA <.08 (Hu & Bentler, 1999; Schermelleh-Engel, 2003). Comparison of factor structure models derived from EFAs was performed as cross validation (Cliff, 1983; Cudeck & Browne, 1983; Romera et al., 2008) using the second halved sample, Group B. Starting with the single-factor model, the subsequent model was judged as 'accepted' if χ^2 decreased significantly for the difference of *df*. This was repeated until we reached the best model. The scores of subscales derived from EFAs were separately correlated with the scores of SDS, abridged version of the SPBE, OCI-R, FOC, and IPO-SV. Because of multiple correlations, we thought that we should set the Type 1 error at $p < .001$. In factor analysis, the ideal sample size depends on data-related conditions like high communalities and strong factor loadings, which can reduce the need for larger samples (Hu & Bentler, 1999; Preacher & MacCallum, 2002; Reise et al., 2000). However, many experts recommend a range from $N = 100$ to 250 or more for initial structure exploration, with larger samples generally leading to more reliable results. In our study, 5 items were input to the EFA and CFA, and all the items have many large factor loadings (the lowest factor loading = .47). Despite the modest sample size of Study 1, we conducted EFA and CFA, hypothesising that this sample size would still be capable of recovering a population factor pattern.

2.3.2. Cluster analysis of the participants

Next, we subjected the two PHQ-9 (depressed mood and loss of interest) and three PUQE-24 items to a two-step cluster analysis. We chose to retain the cluster analysis for several reasons. First, targeted variables used in our research were continuous variables, not categorical response variables. In latent class analysis (LCA), cross-tabulations are used as the input information. Continuous variables are not used for LCA. Second, in cluster analysis, variable means are used to define "nearness" of cases and clear-cut assignments. On the other hand, in LCA, probabilities of class membership are obtained, not clear-cut assignments (Weller et al., 2020). Finding a clear-cut group was appropriate for providing support for our proposal. Thus, we choose cluster analysis. Cluster analysis is a means to classify participants into groups that are homogenous within themselves and heterogenous between each other. This is based on the characteristics of symptoms in question (Borgen & Barnett, 1987). Group created is a cluster. As compared to other cluster techniques such as k-mean and hierarchical cluster analyses, two-step cluster analysis has advantages in creating clusters based on both categorical and continuous variables (Satish & Bharadhwaj, 2020). On the other hand, k-mean and hierarchical cluster analyses only deal with continuous variables. The selection of the number of clusters is predetermined by the researcher in k-mean analysis. In hierarchical cluster analysis, while sequentially combining the nearest cases the occurrence of a big increase in the distance between the cluster from one stage to another is the sign that the number of clusters just before that big 'jump' is the best cluster model. In contrast, the two-step cluster analysis selects the number of clusters automatically. It starts with the construction of a cluster features tree that creates 'nodes' containing multiple cases. In the second step, agglomerative clustering is used to produce a range of solutions. Two-step cluster analysis automatically confirms the possible maximum number of clusters. This is followed by the determination of the best cluster model in terms of the highest distance increase (measured by Schwarz's Bayesian Criterion) between the two closest cluster models during each stage of the hierarchical clustering (Sarstedt & Mooi, 2014). Silhouette coefficients were also calculated to assess discreteness of clusters.

As noted later, we found two clusters of the participants therefore we were concerned about the cut-off point of the total scores of two PHQ-9 and three PUQE items to distinguish the two cluster. We performed a receiver operating characteristics (ROC) analysis. We calculated area under curve (AUC) as an index of psychometric property of such a cut-off point.

In cluster analysis, there is no consensus or recommendations regarding sample size among researchers. Kaufman and Rousseuw (2009) stated as follows:

The size of the samples depends on the number of clusters. For a clustering into k clusters, the size of the samples is given by 40 + 2k (p.145).

The latest research also showed that sampling at least $N = 20$ to 30 observations per expected subgroup resulted in satisfactory statistical power (Dalmaijer et al., 2022). Therefore, we judged that our findings of cluster analysis satisfied the sample size.

2.3.3. Taxometric analysis of depression and emesis

Taxometrics is often used to determine whether a construct of interest is categorical or dimensional in the nature. Various taxometric procedures are applied to elicit a taxon. Mean Above Minus Below A Cut (MAMBAC; Meehl & Yonce, 1994), MAXimum COVariance (MAXCOV; Meehl & Yonce, 1996), MAXimum EIGenvalue (MAXEIG; Waller & Meehl, 1998), and Latent Mode (L-Mode; Waller & Meehl, 1998) were included in the taxometrics methods. Three hundred or more sample size is recommended for the taxometric analysis. A sample size of both Study 1 ($N = 382$) and Study 2 data ($N = 696$) was appropriate for taxometric analysis. Analysis was conducted through the same procedures using both Studies 1 and 2 samples. MAXEIG, and L-Mode requires three or more indicators. Depressed mood, loss of interest, nausea, vomiting, and retching were candidates for taxometric analysis. However, Depressed mood and loss of interest were 4-point Likert scale (from 1 [not at all] to 4 [nearly every day]) in Study 2. Forming the composite variable has the benefit that the resulting input indicator may contain a larger range of variables that provide more reliable rank-ordering cases. Therefore, a sum of scores of depressed mood and loss of interest was used as an indicator for taxometric analysis. Comparison Curve Fit Index (CCFI) is useful to specify and evaluate several operalisations of consistency testing, which examines whether the empirical data are a closer match to those for the taxonic or dimensional comparison data. CCFI values can range from 0 (strongest support for dimensional structure) to 1 (strongest support for taxonic structure), with .50 representing the most ambiguous outcome (Ruscio et al., 2010, 2018). CCFI profile is thus a summary index of series of taxometric analysis procedures (i.e., MAMBAC, MAXEIG, and L-Mode). We used Rtaxometrics package (Ruscio & Wang, 2021) for all taxometric analysis procedures. We examined whether our data were acceptable for taxometric analysis in terms of Cohen's d, within-group correlation for the putative taxon, and within-group correlation for putative complement with *checkdata* function before conducting taxometric analysis.

2.3.4. Temporal relationship between depression and emesis

We set up a structural equation model separately using the follow-up data from Studies 1 and 2. In this cross-lagged model, it was posited that both depression and emesis at Time 1 would predict its counterpart at Time 2. In addition, depression at Time 1 would predict emesis at Time 2 while emesis at Time 1 would predict depression at Time 2. This classical model is called cross-lagged panel model and is known to converge well with the data (Orth et al., 2021). As an alternative model, we tried

non-recursive SEM model (Klein et al., 2005). Here, we set paths from Emesis to Depression and vice versa without paths from one at Wave 1 to another at Wave 2. Recursive and non-recursive models are equivalent in goodness-of-fit. Stability of non-recursive model was checked by stability test which, if not less than 1.0 indicates good stability (Bentler & Freeman, 1983; Fox, 1980).

In a series of recursive cross-lagged structured equation model (SEM), sample size was calculated by the "A-priori Sample Size Calculator for Structural Equation Models" (Soper, 2025). When we set anticipated effect size = .3, desired statistical power level = .8, number of latent variables = 4, number of observed variables = 10, and probability level = .05, the calculator suggested that the minimum sample size was 288. Accordingly, the minimum sample size was met in both Study 1 and Study 2.

2.3.5. Ethical consideration

Study 1 was approved by the Institutional Review Board (IRB) of Kitamura Institute of Mental Health Tokyo (No. 2015052301) and Kagoshima University (No.170247). Study 2 was approved by Institutional Review Board (IRB) of Kitamura Institute of Mental Health Tokyo (No. 2020101501).

3. Results

In Study 1, most of the participants were married (94 %). The mean (SD) age of the participants was 31.9 (4.9) years and the mean age (SD) of their partner was 33.5 (5.5) years. Of them, 43.9 % were nulliparas and 54.8 % were multiparas. Parity was unknown about 6 women. In Study 2, the mean (SD) age of the participants was 31.7 (4.5) years. The mean (SD) gestational age was 13.4 (1.14) weeks. Of them, 73.6 % were nulliparae and 26.4 % were multiparae. Most of them (99 %) were married (99 %).

We calculated means, SDs, skewnesses, and kurtosises of the two depressive and three emesis items in the halved samples from Studies 1 and 2 (Table 1). Except for vomiting, skewness and kurtosis were all within normal ranges for all the variables studied. Thus, all the variables seemed normally distributed. The five variables were all correlated significantly with each other.

EFAs of these 5 symptom items were performed for Group A in both Studies 1 and 2. Data were factorable for both Studies 1 and 2: KMO = .688 and .632 in Studies 1 and 2, respectively; Bartlett's sphericity χ^2 (10) = 243.054 and 470.808, $p < .001$, in Studies 1 and 2, respectively. All the variables showed factor loadings >.33 in a 1-factor model, except for nausea and retching in Study 2 data set (Table 2). In a 2-factor model, high factor loadings were observed for depressed mood and lack of interest in one factor and the three PUQE-24 items in another factor separately.

In Group B from Study 1, the fit indices of the 1-factor model were poor: $\chi^2/df = 13.445$, CFI = .755, RMSEA = .251. Those of the 2-factor model were significantly much better: $\chi^2/df = .579$, CFI = 1.000, RMSEA = .000. Similarly in Group B from Study 2, the fit indices of the 1-factor model were poor: $\chi^2/df = 32.651$, CFI = .635, RMSEA = .303. Those of the 2-factor model were significantly much better: $\chi^2/df = 1.828$, CFI = .992, RMSEA = .049. Therefore, the 2-factor model was the best in both Studies 1 and 2. Then, we created two composite scores (Depression and Emesis) by adding the scores of the 2 PHQ-9 and 3 PUQE-24 items, respectively.

When correlating the Depression and Emesis scores with the other variables among all the samples (N = 382 and 696 for Studies 1 and 2, respectively), they differ only in a few areas (Table 3). Thus, Depression was correlated with low happiness and fear and surprise towards the

Table 2
Exploratory factor analyses of depression and emesis variables in the first halved sample of Study 1 (n = 184) and Study 2 (n = 350).

Items	1-factor	2-factor	
	I	I	II
depressed mood	**.52**	−.03	**.68**
	.83	**.75**	.04
loss of interest	**.66**	.05	**.92**
	.87	**.96**	−.01
nausea	**.66**	**.60**	.11
	.27	−.08	**.84**
vomiting	**.57**	**.53**	.06
	.33	.12	**.47**
retching	**.66**	**.89**	−.10
	.31	−.05	**.61**

Note. Upper and lower values are those in Studies 1 and 2, respectively. Factor loadings >.3 are in bold.

Table 3
Correlations of Depression and Emesis with social dysfunction, foetal bonding, obsessive compulsive symptoms, fear of childbirth, IPO, and own and partner's age in Studies 1 and 2.

Correlates	Study 1 (N = 382)		Study 2 (N = 696)	
	Depression	Emesis	Depression	Emesis
SDS	.59***	.39***		
Foetal bonding; happiness			−.37***	−.05
Foetal bonding; anger			.30***	.14***
Foetal bonding; fear			.32***	.08*
Foetal bonding; sadness			.37***	.17***
Foetal bonding; disgust			.36***	.23***
Foetal bonding; surprise			.11**	−.03
Foetal bonding; shame			.42***	.26***
Foetal bonding; guilt			.35***	.11**
Foetal bonding; alpha pride			−.25***	−.04*
Foetal bonding: beta pride			−.34***	−.08*
Obsessive compulsive symptoms			.39***	.14***
Fear of childbirth			.41***	.15***
IPO total score			.40***	.10**
Age	.07	.07	−.09*	−.02
Partner's age	.14**	.06		

Note. *$p < .05$; **$p < .01$; ***$p < .001$.

Table 1
Means, SDs, skewness, kurtosis, and correlations of 7 items in the first halved sample of Study 1 (n = 184) and Study 2 data sets (n = 350).

Item	Mean	SD	skewness	kurtosis	1	2	3	4
1: depressed mood	1.52	.73	1.53	2.37	–			
	1.62	.80	1.33	1.39				
2: loss of interest	1.70	.87	1.18	.74	.63***	–		
	1.64	.75	1.23	1.50	.73***			
3: nausea	3.10	1.50	−.05	−1.36	.22***	.41***	–	
	2.70	1.45	.38	.13	.19***	.19***		
4: vomiting	1.27	.70	3.23	11.57	.26***	.31***	.37***	–
	1.25	.60	2.69	8.07	.23***	.26***	.40***	
5: retching	2.18	1.33	.94	−.31	.19**	.35***	.54***	.45***
	1.97	1.24	1.25	.13	.21***	.25***	.50***	.33***

Note. Upper and lower values are those in Studies 1 and 2, respectively.

foetus but this was not the case for Emesis. The two types of maternal Pride were all correlated negatively with Depression but not with Emesis. Otherwise, Depression and Emesis scores were correlated with the other variables in a very similar manner. Thus, both Depression and Emesis were associated with social disability (Study 1). The two were also associated with Anger, Sadness, Disgust, Shame, Guilt towards the foetus, obsessive compulsive symptoms, fear of childbirth, and borderline personality traits (Study 2). Hence, Depression and Emesis were not distinguishable in divergent validity.

Two-step cluster analyses showed 2-cluster solutions in both Studies 1 and 2. Silhouette coefficients were .6 in both Studies 1 and 2. About 36 % and 31 % of the women in Studies 1 and 2 belonged to the first cluster, which is a minority of the participants ($n = 134$ and 215 in Studies 1 and 2). When comparing the women belonging to the second cluster in Studies 1 and 2, we found that the women of the first cluster were significantly higher in Depression in both Studies 1 and 2 (Table 4). In Study 1, the prevalence MDE was 32.8 % and .4 % for the first and second clusters, respectively. This was significant contrast (Fisher exact probability $p < .001$). The two clusters also differed in terms of emesis. The total scores of the PUQE-24 were significantly higher in the first cluster than the second cluster both in Studies 1 and 2. In Study 1, the total scores of the NVP QOL were significantly higher in the first cluster than the second cluster. Hence, it was thought that the first cluster was characterised by *both* depression and emesis whereas the second cluster was free from both of them. The two clusters differed in terms of clinical correlates including foetal bonding disorder, obsessive compulsive symptoms, fear of childbirth, and borderline personality traits in Study 2 (Table 5).

A clinical requirement is to identify the group of women who need nursing care and treatment, n this study, the cluster of women with both depression and emesis. The capacity of the total score of depression, loss of interest, and the three PUQE-24 items showed a remarkable area under curve (AUC) of .991 in Study 1. Sensitivity and specificity of the cut-off 9/10 were 1.000 and .77, respectively. Those of the cut-off 10/11 were .98 and .92, respectively. Those of the cut-off 11/12 were .84 and .1.00, respectively. Of the Study 1 participants, 30 % of them were scored 11 or higher in this score. Similarly, in Study 2, the capacity of the total score of depression, loss of interest, and the three emesis items showed a remarkable AUC of .996. Sensitivity and specificity of the cut-off 8/9 were 1.000 and .72, respectively. Those of the cut-off 9/10 were .99 and .88, respectively. Those of the cut-off 10/11 were .95 and .1.00, respectively. Of the Study 2 participants, 30 % of them were scored 10 or higher in this score.

For taxometric analysis, as the criteria of the distributional characteristics of indicators, Cohen's $d > 1.25$ and within-group correlations $<.3$ are recommended for accurate and informative conclusions (Ruscio et al., 2006). In the pre-taxometric analysis, our data met all requirements except for within-group correlation for putative complement (*r*Com) of Study 1 sample (Table 5). A number of simulation studies showed that failure to meet one or more criteria may be offset by especially favourable characteristics on other cri-teria in the same data set (Ruscio et al., 2011). Our data were, therefore, appropriate for taxometric analysis.

CCFI values supported a dimensional structure for Depression and Emesis in both studies 1 and 2. CCFI MAMBAC = .325 and .252, CCFI MAXEIG = .473 and .315, CCFI L-Mode = .463 and .374, and CCFI mean = .403 and 303, for samples of Studies 1 and 2, respectively. In the graphical outputs, CCFI profiles were well below .50, and the curves of the base rate estimates showed nearly flat lines (Figs. 1 and 2).

These findings suggested that the symptoms of depression and emesis

Table 4
Demographic and clinical characteristics of clusters in Studies 1 and 2.

	Study 1 ($N = 382$)			Study 2 ($N = 696$)		
	Cluster I ($n = 134$)	Cluster II ($n = 240$)	*t*-test (df)/χ^2	Cluster I ($n = 215$)	Cluster II ($n = 481$)	*t*-test (df)/χ^2
Criterion validity						
Depression score (depressed mood + loss of interest)	4.84 (1.64)	2.60 (.75)	15.0 (164.250) ***	4.38 (1.82)	2.63 (.79)	13.5 (251.022) ***
Major Depressive Episode (MDE)	44 (32.8 %)	1 (.4 %)	Fisher exact probability $p < .001$			
PUQE-24 total score	8.96 (2.27)	5.13 (1.79)	16.9 (226.586) ***	5.83 (2.28)	1.65 (1.51)	24.6 (301.843) ***
NVP QOL total score	142.0 (29.1)	84.4 (33.8)	16.7 (300.849) ***			
Construct validity						
SDS	12.99 (6.98)	5.73 (5.69)	10.3 (232.545) ***			
Foetal bonding; happiness				9.48 (2.17)	10.30 (1.76)	4.9 (345.350) ***
Foetal bonding; anger				1.09 (1.99)	.43 (1.30)	4.4 (298.705) ***
Foetal bonding; fear				5.61 (2.89)	4.44 (2.74)	5.1 (694) ***
Foetal bonding; sadness				2.22 (2.73)	.97 (1.87)	6.1 (307.316) ***
Foetal bonding; disgust				2.58 (3.06)	1.06 (2.02)	6.7 (300.546) ***
Foetal bonding; surprise				4.04 (3.13)	3.79 (3.23)	1.0 (694) ^{NS}
Foetal bonding; shame				2.88 (2.84)	1.21 (1.91)	7.9 (303.840) ***
Foetal bonding; guilt				2.14 (2.86)	1.03 (2.00)	5.2 (310.810) ***
Foetal bonding; alpha pride				3.91 (2.55)	4.67 (2.54)	3.7 (694) ***
Foetal bonding: beta pride				8.27 (2.77)	9.33 (2.56)	4.8 (384.087) ***
Obsessive compulsive symptoms				33.8 (17.1)	25.2 (15.7)	6.4 (694) ***
Fear of childbirth				69.5 (22.9)	57.9 (19.1)	6.9 (694) ***
IPO total score				17.3 (9.6)	12.9 (9.3)	5.7 (694) ***
Demographic features						
Age	32.6 (4.5)	31.6 (5.0)	1.9 (364) ^{NS}	31.6 (4.5)	31.8 (4.5)	.6 (694) ^{NS}
Husband's age	34.4 (5.0)	33.0 (5.6)	2.4 (304.393) *			
Nulliparae	55 (41.4 %)	111 (46.3 %)	χ^2 (df) = .64 (1) ^{NS}			

Note. *$p < .05$; **$p < .01$; ***$p < .001$.

Table 5
Descriptive statistics of indicators for taxometrics analysis.

		*r*Tax				*r*Com			
	Cohen's *d*	1:	2:	3:	4:	1:	2:	3:	4:
Study 1 ($N = 382$)									
intdicator 1: Depression	1.70	–				–			
indicator 2: nausea	1.59	−.20	–			.20	–		
indicator 3: vomiting	1.39	−.14	.18	–		.07	.22	–	
indicator 4: retching	2.28	−.40	.11	.02	–	.05	.40	.13	–
Study 2 ($N = 696$)									
intdicator 1: Depression	1.26	–				–			
indicator 2: nausea	1.95	−.14	–			−.06	–		
indicator 3: vomiting	1.35	.08	.13	–		−.10	.21	–	
indicator 4: retching	2.10	−.28	−.07	.11	–	−.08	.29	.17	–

Note. *r*Tax, within-group correlation for the putative Taxon; *r*Com, within-group correlation for putative Complement.

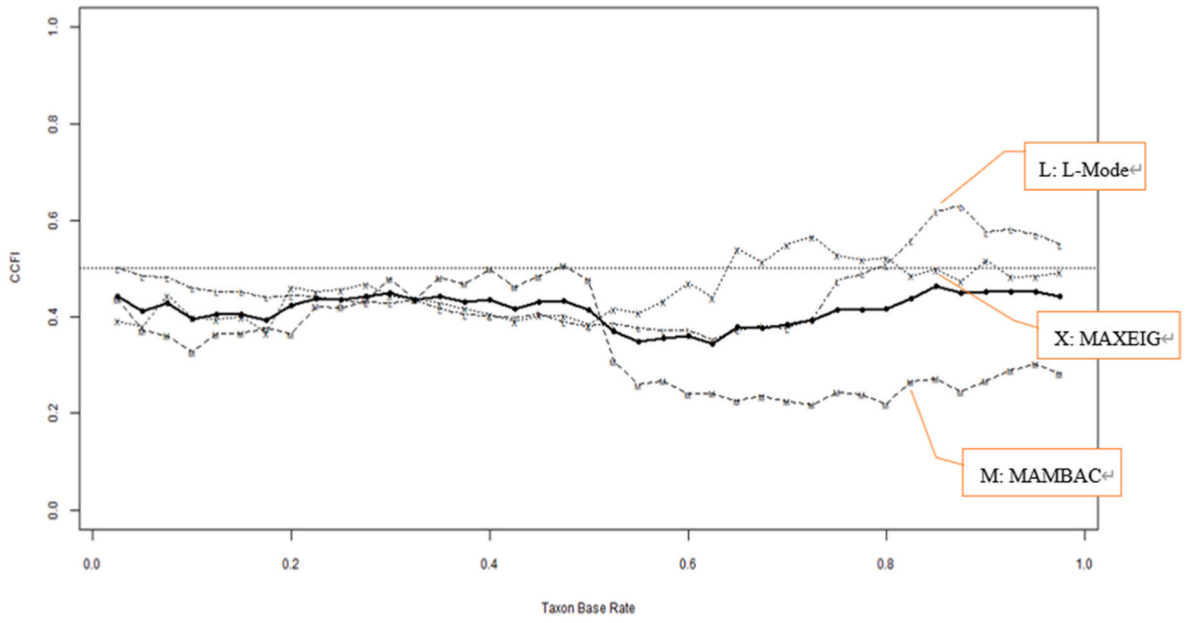

Fig. 1. CCFI profile for Study 1 ($N = 382$). *Note.* CCFI profiles are labelled as M for MAMBAC (mean above minus below a cut), X for MAXEIG (MAXimum EIGenvalue), and L for L-Mode (latent mode). Solid data points represent the mean CCFI profile.

during pregnancy consist of two factors (Depression and Emesis) but they were substantially correlated to each other and did not differ markedly in terms of associations with relevant clinical correlates. We found only two clusters one of which is characterised by coexistence of both depression and emesis. Hence, we speculate existence of group of pregnant women suffering from symptoms in *both* physical and psychological domains simultaneously; nausea and vomiting in the physical domain and depression in psychological domain. However, distinction between the two clusters was not so clear that we could not identify an observable taxon with the nature, therefore, being more dimensional than taxonic. There appeared no clear-cut boundary between severe cases of depression and emesis and cases of milder severity.

A final enquiry was the causal relationships between depression and emesis: Which of them leads to another? We constructed a series of recursive cross-lagged structured equation model (SEM). In both Study1 (Fig. 3) and Study 2 (Fig. 4), depression and emesis at Time 1 significantly predicted their counterparts at Time 2 whereas there was no significant prediction of one at Time 1 to another at Time 2. Therefore, there were no causal relationships between depression and emesis. Additional analyses were conducted using non-recursive models. Stability tests of Studies 1 and 2 were .036 and .028, respectively, indicating acceptable stability. In Study 1, standardised coefficient from Emesis at Wave 2 to Depression at Wave 2 was .21 ($p > .05$) and that from Depression at Wave 2 to Emesis at Wave 2 was −.17 ($p > .05$). In Study 2, standardised coefficient from Emesis at Wave 2 to Depression at Wave 2 was −.11 ($p > .05$) and that from Depression at Wave 2 to Emesis at Wave 2 was .25 ($p = .031$).

4. Discussion

Our study started with a hypothesis that antenatal depression and emesis were discrete as symptomatic factors but would reflect two different aspects of the same phenomenon that we should like to propose to term emesis-depression complex. It is of note that the finding that both emesis and depression consisted of one cluster does not directly indicate that the phenomenon is a discrete category. Indeed, our taxometric analysis indicated dimensionality. Combination of emesis and depression is dimensional rather than taxonic. Hence, we prefer the term complex (implying dimension) rather than syndrome. This hypothesis seemed to be supported. This phenomenon has been seen by perinatal psychiatrists and psychologists as 'antenatal depression' and by obstetricians and midwives as 'emesis' or, when severe, HG. The two kinds of professionals naturally have been approaching and providing with intervention and support to pregnant women with this clinical picture from different perspectives.

Our conclusion may be counter intuitive for many perinatal health

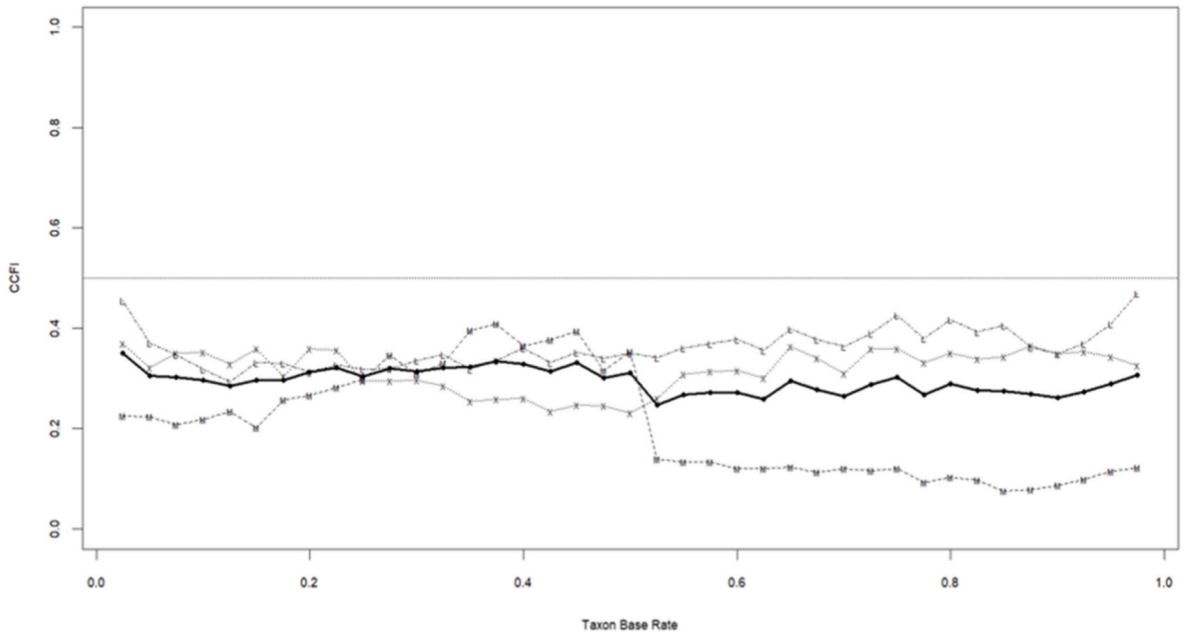

Fig. 2. CCFI profile for Study 2 (N = 696). *Note*. CCFI profiles are labelled as M for MAMBAC (mean above minus below a cut), X for MAXEIG (MAXimum EIGenvalue), and L for L-Mode (latent mode). Solid data points represent the mean CCFI profile.

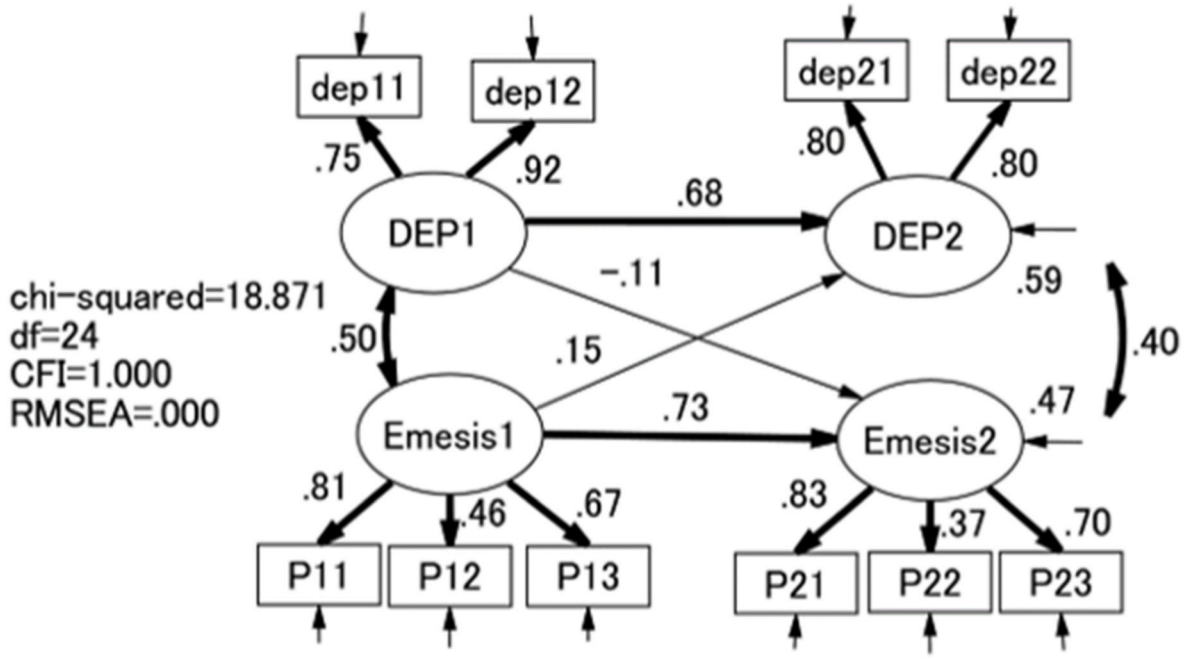

Fig. 3. Recursive structured equation model in Study 1. *Note*. dep11, depressed mood at Time 1; dep12, loss of interest at Time 1; dep21, depressed mood at Time 2; dep22, loss of interest at Time 2; DEP1, Depression at Time 1; DEP2, Depression at Time 2; P11, nausea at Time 1; P12, vomiting at Time 1; P13, retching at Time 1; P21, nausea at Time 2; P22, vomiting at Time 2; P23, retching at Time 2. Statistically significant paths are in bold. Correlations of error terms of each item between Time 1 and Time 2 are calculated but not shown for the sake of visibility.

professionals. For example, nausea and vomiting occur in most of pregnant women while it is only a handful of them who have an onset of antenatal depression. This disparity alone makes it hard to understand how emesis and depression could be strongly linked. This kind of argument is based on the categorical assumption of emesis and depression. In reality, however, these two are of linear nature. We assessed them as continuous variables. Of course, there is a group of pregnant women with emesis but without depression (Kitamura et al., 2023. However, this does not refute a possible link between the two as well as an existence of cluster categorized by both emesis and depression. What remain are the total mechanism of emesis. They include multiple factors such as genetic, endocrine and infectious ones (Borner et al., 2024; Bustos et al., 2017).

It is easily arguable that a person who is ill is likely to feel psychological down. Our focus was weather depression preceded emesis or vice versa during pregnancy period. This was discussed in our final enquiry. Here, in addition to a recursive model of structural equation model, we performed a non-recursive model, a direct feedback loop between

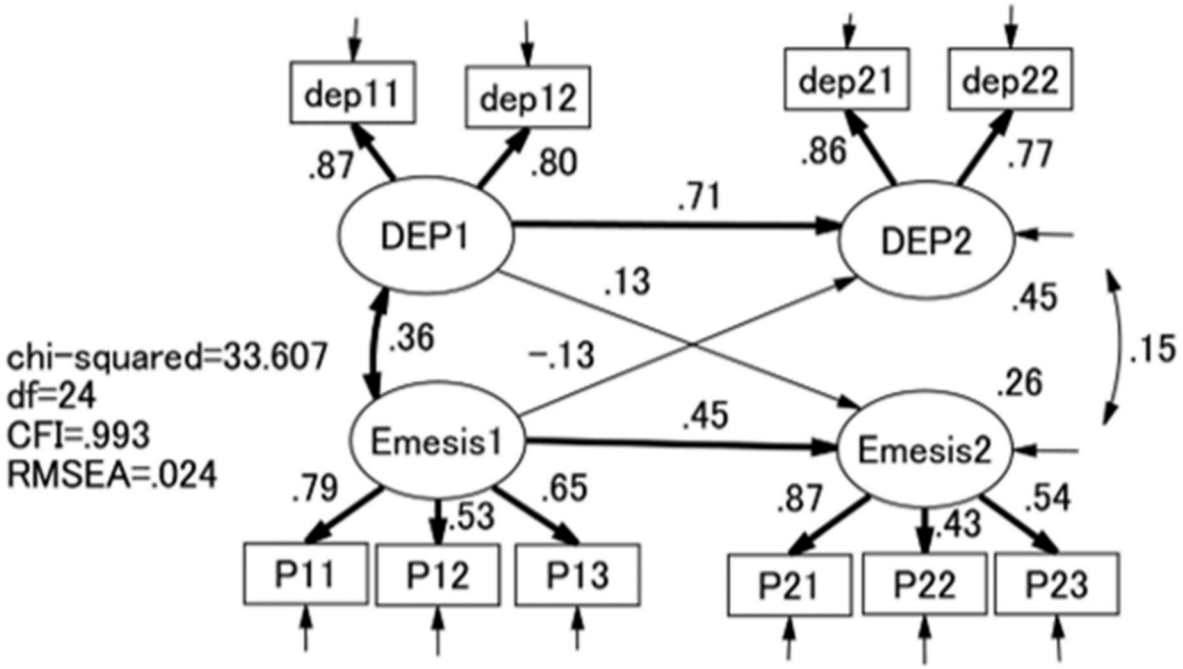

Fig. 4. Recursive structured equation model in Study 2. *Note.* dep11, depressed mood at Time 1; dep12, loss of interest at Time 1; dep21, depressed mood at Time 2; dep22, loss of interest at Time 2; DEP1, Depression at Time 1; DEP2, Depression at Time 2; P11, nausea at Time 1; P12, vomiting at Time 1; P13, retching at Time 1; P21, nausea at Time 2; P22, vomiting at Time 2; P23, retching at Time 2. Statistically significant paths are in bold. Correlations of error terms of each item between Time 1 and Time 2 are calculated but not shown for the sake of visibility.

depression and emesis at Time 2. This is a "snapshot" of an ongoing dynamic process assuming equilibrium (Klein, 2005) confirmed by good stability test (<1.00). The results indicated that, though weakly, depression influenced emesis but not the other way round at Time 2. Regardless of possible existence of depression starting before pregnancy, it is depression that worsens emesis during pregnancy.

Another criticism may come from use of the PHQ-9. One may choose the Edinburgh Postnatal Depression Scale (Cox et al., 1987) as a measure of antenatal depression (Jomeen & Martin, 2007; Soyemi et al., 2022; Suenaga, 2022). Although the EPDS is world widely used, its factor structure is still debatable (Kozinszky et al., 2017) and doubt has been cast on its measurement invariance (Fujita & Otsuki, 2024; Kubota et al., 2018). On the other hand, the PHQ-9 is occasionally used for pregnant women (Stefana et al., 2023) and we also excluded depression items (from the PHQ-9) that may come from emesis.

Another important aspect of our results is that emesis-depression complex has no taxon but is a continuous phenomenon. Analogy may be functional dyspepsia that is characterized by somatic symptoms (pain, fullness, bloating, early satiety, nausea, vomiting, epigastric burning, and belching) but at the same time is linked to somatization. The functional dyspepsia symptoms are in favour of a dimensional structure among functional dyspepsia patients (van Oudenhove et al., 2016).

There are differences between the present and our previous reports. We analysed Study 1 sample and reported a 3-cluster structure (Kitamura et al., 2023) while the present study reported a 2-cluster structure. The variables that were entered into cluster analysis were the two PHQ-9 subscale scores (Somatic and Non-somatic) in our previous analyses whereas two MDE symptom scores (depressed mood and loss of interest) in the present analyses. The second cluster of our previous study was characterized by emesis symptoms but was not accompanied by depression symptoms. Due to dimensional nature of emesis-depression complex, the 3-cluster structure in our previous analyses may reflect simply difference of severity of emesis-depression complex. Emesis itself is less clear in terms of its symptomatic boundary (Koot et al., 2020) and has no evidence, at least to the best of our knowledge, of its taxonicity. It may be more appropriate to look at the clinical picture from a dimensional perspective.

Our conceptualisation may enhance screening or early intervention for perinatal mood disorders. Additionally, it may be guide for an integrated biopsychosocial assessment for pregnant women presenting with emesis. Our study indicates that we should pay more attention to the psychological symptoms when a pregnant woman has gastrointestinal symptoms such as nausea and vomiting. As we discussed earlier, it may be recommended to assess those women with emesis carefully in psychiatric terms and to provide with psychological care for depressive symptoms in addition to treatment for nausea and vomiting. Therapeutic plans may come from understanding of psychological mechanisms of occurrence of emesis-depression complex. We can list several features as possible causes of antenatal de-pression: (a) obstetric factors (first pregnancy, first delivery, and past history of artificial abortion), (b) early experiences such as loss of father, (c) personality including Eysenck's high neuroticism, (d) negative attitudes towards the current pregnancy, (e) poor accommodation such as non-detached housing and expected crowdedness after childbirth, and (f) lack of social support such as low level of partner intimacy (Kitamura, Shima, et al., 1996; Salomonsson, 2018) psychodynamic treatment for pregnancy-related mental disorder is a possible treatment plan for emesis-depression complex. Sartori et al. (2018) reported that expectant fathers' anxiety was associated with their partner's severe nausea and vomiting, and they also expressed concerns about emotional changes in their partners. We, therefore, need to care for partners as well as pregnant women who have emesis-depression complex.

The present study is, of course, not without limitations. First, data collection methods differ in the two studies included in this research. Study 1 used in-person recruitment at clinics, while Study 2 relied on an internet survey with an incentive. These issues may cause biases based on motivation, response accuracy, or sampling. An analysis of the results of the two studies combined should be avoided due to the use of differing measures in studies 1 and 2. The findings needed to be interpreted carefully.

Second, we focused on the two time points. Some pregnant women

experience very prolonged emesis up to even the day of delivery. Trajectory of emesis and depression needs further enquiry. Pregnancy is a time when expectant women experience many other psychological dysfunctions such as those observed in Study 2. Factor structure as well as trajectory of all these psychological symptoms are another remaining topic of research. Biological changes accompanying emesis or depression including electrolytes disturbance, dehydration, anaemia (to name just a few) should be included in analyses in future studies. Postnatal consequences of emesis-depression complex may be another important clinical topic that should be cleared in future studies.

Another drawback of the present study was its high attrition rate in both Studies 1 and 2. It is likely that the sickest and/or most depressed did not participate in the first and follow-up survey. Future replication studies should take a face-to-face interview method for assessment. In the two data sets depression was measured only by self-rating questionnaires that enquired only about the current depression. Hence no attempt could be made to separate a new onset antenatal depression from depression that is simply carried over from before the woman conceived. There remains possibility that depression starting before pregnancy influenced emesis at Time 1. This was, however, expressed the covariance between depression and emesis at Time 1 in the structural equation model (Figs. 3 and 4).

Last but at least, future studies should focus on the aetiologies of emesis-depression complex. An amount of research was reported regarding clinical correlates of antenatal depression (Kitamura, Sugawara, et al., 1996). However, careful studies are needed to identify causes of emesis-depression complex. They may, of course, include demographic features such as marital and occupational conditions to name just a few.

5. Conclusion

In conclusion, our findings suggest that emesis and depression during pregnancy are two discrete aspects of a single clinical phenomenon (entity) that we propose to name emesis-depression complex. Also, the fact that similar trends in relation to emesis and depression were obtained from two different samples tells us the potential existence of an emesis-depression complex. The term complex may need reconsideration. Here we used 'complex' meaning a combination of several but related symptoms, i.e., syndrome. This is a proposal, neither confirming nor denying the existence of emesis-depression complex. It may be more balanced to conceptualize this as a dimensional co-expression or overlapping symptom cluster, rather than as a novel diagnostic entity. We are convinced that further investigation and examination are necessary in future research.

CRediT authorship contribution statement

Toshinori Kitamura: Writing – review & editing, Writing – original draft, Project administration, Formal analysis, Conceptualization. **Ayako Hada:** Writing – original draft, Formal analysis. **Yuriko Usui:** Formal analysis, Data curation. **Mizuki Takegata:** Project administration, Formal analysis. **Mariko Minatani:** Data curation, Conceptualization. **Mikiyo Wakamatsu:** Investigation. **Satoru Takeda:** Supervision, Conceptualization.

Ethics approval and consent to participate

Study 1 was approved by the Research Ethics Committee of the Kitamura Institute of Mental Health Tokyo, Tokyo, Japan (No. 2018052301). Study 2 was approved by the Research Ethics Committee of the Kitamura Institute of Mental Health Tokyo, Tokyo, Japan (No. 2020101501). All the participants gave written (Study 1) or electric (Study 2) informed consent after understanding the study rationale and procedure. The authors assert that all procedures contributing to this study comply with the ethical standards of the National and Institutional Committees on human experimentation and with the Helsinki Declaration of 1975 as revised in 2008.

Funding

Study 2 was funded by Health, Labour and Welfare Policy Research Grants: Special research: The Effects of Self-Restraint under the Novel Coronavirus Infection (Covid-19) Epidemic: A Survey on Unexpected Pregnancy, etc. and Research to Establish an Appropriate Support System for Women's Health (20CA2062; Principal Researcher-Tomoko Adachi).

Conflict of interests

The authors declare that they have no conflict of interests.

Acknowledgements

We are grateful for all of the participants and Japanese Red Cross Medical Centre, Endou Ladies Clinic, Kubonoya Women's Hospital, Tsuchiya Obsteric & Gynaecology Clinic, Aiiku Hospital, and Nakae Obstetiric & Gynaecology Clinic in Study 1. Gratitude is also due to all the net survey participants in Study 2.

Appendix A. Supplementary data

Supplementary data to this article can be found online at https://doi.org/10.1016/j.newideapsych.2025.101235.

Data availability

Data will be made available on request.

References

Aksoy, H., Aksoy, U., Karadağ, Ö. I., Hacimusalar, Y., Açmaz, G., Aykut, G., Çağli, F., Yücel, B., Aydin, T., & Babayiğit, A. (2015). Depression levels in patients with hyperemesis gravidarum: A prospective case-control study. *SpringerPlus, 4*, 34. https://doi.org/10.1186/s40064-015-0820-2

Arbuckle, R., Frye, M., Brecher, M., Paulsson, B., Rajagopalam, K., Palmer, S., & Innocenti, A. D. (2009). The psychometric validation of the sheehan disability scale (SDS) in patients with bipolar disorder. *Psychiatry Research, 165*(1–2), 163–174. https://doi.org/10.1016/j.psychres.2007.11.018

Bentler, P. M., & Freeman, E. M. (1983). Tests for stability in linear structural equation systems. *Psychometrika, 48*, 143–145.

Borgen, F. H., & Barnett, D. C. (1987). Applying cluster analysis in counseling psychology research. *Journal of Counseling Psychology, 34*(4), 456–468. https://doi.org/10.1037/0022-0167.34.4.456

Borner, T., Pataro, A. M., & De Jonghe, B. C. (2024). Central mechanisms of emesis: A role for GDF15. *Neuro-Gastroenterology and Motility, 37*(3), Article e14886. https://doi.org/10.1111/nmo.14886

Bowling, A. (2005). Just one question: If one question works, why ask several? *Journal of Epidemiology & Community Health, 59*(5), 342–345. https://doi.org/10.1136/jech.2004.021204

Burton, L. J., & Mazerolle, S. M. (2011). Survey instrument validity part I: Principles of survey instrument development and validity in athletic training education research. *Athletic Training Education Journal, 6*(1), 27–35. https://doi.org/10.4085/1947-380X-6.1.27, 1.

Bustos, M., Venkataramanan, R., & Caritis, S. (2017). Nausea and vomiting of pregnancy: What's new? *Autonomic Neuroscience: Basic and Clinical, 202*, 62–72. https://doi.org/10.1016/j.autneu.2016.05.002

Chochinov, H. M., Wilson, K. G., Enns, M., & Lander, S. (1997). Are you depressed?": Screening for depression in the terminally ill. *American Journal of Psychiatry, 154*(5), 674–676. https://doi.org/10.1176/ajp.154.5.674

Christodoulou-Smith, J., Gold, J. I., Romero, R., Goodwin, T. M., MacGibbon, K. W., Mullin, P. M., & Fejzo, M. S. (2011). Posttraumatic stress symptoms following pregnancy complicated by hyperemesis gravidarum. *Journal of Maternal-Fetal and Neonatal Medicine, 24*(11), 1307–1311. https://doi.org/10.3109/14767058.2011.582904

Clarkin, J. F., Foelsch, P. A., & Kernberg, O. F. (2001). *The inventory of personality organization. White plains.* NY: The Personality Disorders Institute. Weill College of Medicineof Cornell University.

Cliff, N. (1983). Some cautions concerning the application of causal modelling methods. *Multivariate Behavioral Research, 18*(1), 115–126. https://doi.org/10.1207/s15327906mbr1801_7

Cox, J. L., Holden, J. M., & Sagovsky, R. (1987). Detection of postnatal depression. Development of the 10-item Edinburgh postnatal depression scale. *British Journal of Psychiatry, 150*, 782–786. https://doi.org/10.1192/bjp.150.6.782

Cudeck, R., & Browne, M. W. (1983). Cross-validation of covariance structures. *Multivariate Behavioral Research, 18*(2), 147–167. https://doi.org/10.1207/s15327906mbr1802_2

Cutler, C. B., Legano, L. A., Dreyer, B. P., Fierman, A. H., Berkule, S. B., Lusskin, S. I., Tomopoulos, S., Roth, M., & Mendelsohn, A. L. (2007). Screening for maternal depression in a low education population using a two item questionnaire. *Archives of Women's Mental Health, 10*(6), 277–283. https://doi.org/10.1007/s00737-007-0202-z

Dalmaijer, E. S., Nord, C. L., & Astle, D. E. (2022). Statistical power for cluster analysis. *BMC Bioinformatics, 23*, 205. https://doi.org/10.1186/s12859-022-04675-1

de Boer, A. G., van Lanschot, J. J., Stalmeier, P. F., van Sandick, J. W., Hulscher, J. B., de Haes, J. C., & Sprangers, M. A. (2004). Is a single-item visual analogue scale as valid, reliable and responsive as multi-item scales in measuring quality of life? *Quality of Life Research, 13*(2), 311–320. https://doi.org/10.1023/B:QURE.0000018499.64574.1f

Ebrahimi, N., Maltepe, C., Bournissen, F. G., & Koren, G. (2009). Nausea and vomiting of pregnancy: Using the 24-hour pregnancy-unique quantification of emesis (PUQE-24) scale. *Journal of Obstetrics and Gynaecology Canada, 31*(9), 803–807. https://doi.org/10.1016/S1701-2163(16)34298-0

Ekman, P. (1994). All emotions are basic. In P. Ekman, & R. Davidson (Eds.), *The nature of emotion: Fundamental questions*. Oxford University Press.

Ekman, P., Levenson, R. W., & Friesen, W. V. (1983). Autonomic nervous system activity distinguishes among emotions. *Science), 221*(4616), 1208–1210. https://doi.org/10.1126/science.6612338

Fell, D. B., Dodds, L., Joseph, K. S., Allen, V. M., & Butler, B. (2006). Risk factors for hyperemesis gravidarum requiring hospital admission during pregnancy. *Obstetrics & Gynecology, 107*(2 Pt 1), 277–284. https://doi.org/10.1097/01.AOG.0000195059.82029.74

Foa, E. B., Huppert, J. D., Leiberg, S., Langner, R., Kichic, R., Hajcak, G., & Salkovskis, P. M. (2002). The obsessive-compulsive inventory: Development and validation of a short version. *Psychological Assessment, 14*(4), 485–496.

Fox, J. (1980). Effect analysis in structural equation models: Extensions and simplified methods of computation. *Sociological Methods & Research, 9*(1), 3–28. https://doi.org/10.1177/004912418000900101. Original work published 1980.

Fujita, K., & Otsuki, E. (2024). Factor structure and measurement invariance of the Edinburgh postnatal depression scale during the perinatal period: A longitudinal study of Japanese women. *Minerva Psychiatry, 65*, 43–50. https://doi.org/10.23736/S2724-6612.22.02379-X

Gadsby, R., Barnie-Adshead, A. M., & Jagger, C. (1993). A prospective study of nausea and vomiting during pregnancy. *British Journal of General Practice, 43*(371), 245–248.

Hada, A., Imura, M., & Kitamura, T. (2022). Development of a scale for parent-to-baby emotions: Concepts, design, and factor structure. *Psychiatry and Clinical Neurosciences, 1*(3), Article e30. https://doi.org/10.1002/pcn5.30

Hada, A., Minatani, M., Wakamatsu, M., Koren, G., & Kitamura, T. (2021). The pregnancy-unique quantification of emesis and nausea (PUQE-24): Configural, measurement, and structural invariance between nulliparas and multiparas and across two measurement time points. *Healthcare, 9*(11), 1553. https://doi.org/10.3390/healthcare9111553

Hada, A., Takeda, S., Imura, M., & Kitmamura, T. (2023). Development and validation of a short version of the scale for parent to baby emotions (SPBE-20): Conceptual replication among pregnant women in Japan. *Psychology, 14*, 1085–1110.

Hizli, D., Kamalak, Z., Kosus, A., Kosus, N., & Akkurt, G. (2012). Hyperemesis gravidarum and depression in pregnancy: Is there an association? *Journal of Psychosomatic Obstetrics and Gynaecology, 33*(4), 171–175. https://doi.org/10.3109/0167482X.2012.717129

Hu, L.-t., & Bentler, P. M. (1999). Cutoff criteria for fit indexes in covariance structure analysis: Conventional criteria versus new alternatives. *Structural Equation Modeling, 6*(1), 1–55. https://doi.org/10.1080/10705519909540118

Inagaki, M., Ohtsuki, T., Yonemoto, N., Kawashima, Y., Saitoh, A., Oikawa, Y., Kurosawa, M., Muramatsu, K., Furukawa, T. A., & Yamada, M. (2013). Validity of the patient health questionnaire (PHQ)-9 and PHQ-2 in general internal medicine primary care at a Japanese rural hospital: A cross-sectional study. *General Hospital Psychiatry, 35*(6), 592–597. https://doi.org/10.1016/j.genhosppsych.2013.08.001

Jomeen, J., & Martin, C. R. (2007). Replicability and stability of the multidimensional model of the Edinburgh postnatal depression scale in late pregnancy. *Journal of Psychiatric and Mental Health Nursing, 14*(3), 319–324. https://doi.org/10.1111/j.1365-2850.2007.01084.x

Kaufman, L., & Rousseuw, J. P. (2009). *Finding groups in data: An introduction to cluster analysis*. John Wiley & Sons, INC., Publication.

Kernberg, O. F., & Clarkin, J. F. (1995). *The inventory of personality organization (IPO)*. New York Hospital-Cornell Medical Center.

Kitamura, T., Shima, S., Sugawara, M., & Toda, M. A. (1996). Clinical and psychosocial correlates of antenatal depression: A review. *Psychotherapy and Psychosomatics, 65*(3), 117–123. https://doi.org/10.1159/000289062

Kitamura, T., Sugawara, M., Sugawara, K., Toda, M. A., & Shima, S. (1996). Psychosocial study of depression in early pregnancy. *The British Journal of Psychiatry, 168*(6), 732–738. https://doi.org/10.1192/bjp.168.6.732

Kitamura, T., Usui, Y., Wakamatsu, M., Minatani, M., & Hada, A. (2023). What are the core symptoms of antenatal depression? A study using patient health Questionnaire-9 among Japanese pregnant women in the first trimester. *Healthcare, 11*(10), 1494. https://doi.org/10.3390/healthcare11101494

Kitamura, T., Yoshida, K., Okano, T., Kinoshita, K., Hayashi, M., Toyoda, N., Ito, M., Kudo, N., Tada, K., Kanazawa, K., Sakumoto, K., Satoh, S., Furukawa, T., & Nakano, H. (2006). Multicentre prospective study of perinatal depression in Japan: Incidence and correlates of antenatal and postnatal depression. *Archives of Women's Mental Health, 9*(3), 121–130. https://doi.org/10.1007/s00737-006-0122-3

Kjeldgaard, H. K., Eberhard-Gran, M., Benth, J.Š., Nordeng, H., & Vikanes, Å. V. (2017). History of depression and risk of hyperemesis gravidarum: A population-based cohort study. *Archives of Women's Mental Health, 20*(3), 397–404. https://doi.org/10.1007/s00737-016-0713-6

Kjeldgaard, H. K., Eberhard-Gran, M., Benth, J.Š., & Vikanes, Å. V. (2017). Hyperemesis gravidarum and the risk of emotional distress during and after pregnancy. *Archives of Women's Mental Health, 20*(6), 747–756. https://doi.org/10.1007/s00737-017-0770-5

Kjeldgaard, H. K., Vikanes, Å., Benth, J.Š., Junge, C., Garthus-Niegel, S., & Eberhard-Gran, M. (2019). The association between the degree of nausea in pregnancy and subsequent posttraumatic stress. *Archives of Women's Mental Health, 22*(4), 493–501. https://doi.org/10.1007/s00737-018-0909-z

Klein, R. B. (2005). *Principles and practice of structural equation modelng* (2nd ed.). Guilford Press.

Koike, H., Tsuchiyagaito, A., Hirano, Y., Oshima, F., Asano, K., Sugiura, Y., Kobori, O., Ishikawa, R., Nishinaka, H., Shimizu, E., & Nakagawa, A. (2020). Reliability and validity of the Japanese version of the obsessive-compulsive inventory-revised (OCI-R). *Current Psychology, 39*, 89–95.

Koot, M. H., Boelig, R. C., Van't Hooft, J., Limpens, J., Roseboom, T. J., Painter, R. C., & Grooten, I. J. (2018). Variation in hyperemesis gravidarum definition and outcome reporting in randomised clinical trials: A systematic review. *International Journal of Obstetrics and Gynaecology, 125*(12), 1514–1521. https://doi.org/10.1111/1471-0528.15272

Koot, M. H., Grooten, I. J., van der Post, J. A. M., Bais, J. M. J., Ris-Stalpers, C., Leeflang, M. M. G., Bremer, H. A., van der Ham, D. P., Heidema, W. M., Huisjes, A., Kleiverda, G., Kuppens, S. M., van Laar, J. O. E. H., Langenveld, J., van der Made, F., van Pampus, M. G., Papatsonis, D., Pelinck, M. J., Pernet, P. J., van Rheenen-Flach, L., … Painter, R. C. (2020). Determinants of disease course and severity in hyperemesis gravidarum. *European Journal of Obstetrics & Gynecology and Reproductive Biology, 245*, 162–167. https://doi.org/10.1016/j.ejogrb.2019.12.021

Koren, G., & Cohen, R. (2021). Measuring the severity of nausea and vomiting of pregnancy; a 20-year perspective on the use of the pregnancy-unique quantification of emesis (PUQE). *Journal of Obstetrics and Gynaecology, 41*(3), 335–339. https://doi.org/10.1080/01443615.2020.1787968

Kozinszky, Z., Töreki, A., Hompoth, E. A., Dudas, R. B., & Németh, G. (2017). A more rational, theory-driven approach to analysing the factor structure of the Edinburgh postnatal depression scale. *Psychiatry Research, 250*, 234–243. https://doi.org/10.1016/j.psychres.2017.01.059

Kubota, C., Inada, T., Nakamura, Y., Shiino, T., Ando, M., Aleksic, B., Yamauchi, A., Morikawa, M., Okada, T., Ohara, M., Sato, M., Murase, S., Goto, S., Kanai, A., & Ozaki, N. (2018). Stable factor structure of the Edinburgh postnatal depression scale during the whole peripartum period: Results from a Japanese prospective cohort study. *Scientific Reports, 8*(1), Article 17659. https://doi.org/10.1038/s41598-018-36101-z

Magee, L. A., Chandra, K., Mazzotta, P., Stewart, D., Koren, G., & Guyatt, G. H. (2002). Development of a health-related quality of life instrument for nausea and vomiting of pregnancy. *American Journal of Obstetrics and Gynecology, 186*, S232–S238.

Meehl, P. E., & Yonce, L. J. (1994). Taxometric analysis: I. Detecting taxonicity with two quantitative indicators using means above and below a sliding cut (MAMBAC procedure). *Psychological Reports, 74*(3, Pt 2), 1059–1274.

Meehl, P. E., & Yonce, L. J. (1996). Taxometric analysis: II. Detecting taxonicity using covariance of two quantitative indicators in successive intervals of a third indicator (Maxcov procedure). *Psychological Reports, 78*(3, Pt 2), 1091–1227.

Mishina, H., Hayashino, Y., & Fukuhara, S. (2009). Test performance of two-question screening for postpartum depressive symptoms. *Pediatrics International: Official Journal of the Japan Pediatric Society, 51*(1), 48–53. https://doi.org/10.1111/j.1442-200X.2008.02659.x

Mitchell-Jones, N., Gallos, I., Farren, J., Tobias, A., Bottomley, C., & Bourne, T. (2017). Psychological morbidity associated with hyperemesis gravidarum: A systematic review and meta-analysis. *International Journal of Obstetrics and Gynaecology, 124*(1), 20–30. https://doi.org/10.1111/1471-0528.14180

Mitchell-Jones, N., Lawson, K., Bobdiwala, S., Farren, J. A., Tobias, A., Bourne, T., & Bottomley, C. (2020). Association between hyperemesis gravidarum and psychological symptoms, psychological outcomes and infant bonding: A two-point prospective case-control multicentre survey study in an inner city setting. *BMJ Open, 10*, Article e039715.

Muchanga, S. M. J., Eitoku, M., Mbelambela, E. P., Ninomiya, H., Iiyama, T., Komori, K., Yasumitsu-Lovell, K., Mitsuda, N., Tozin, R. R., Maeda, N., Fujieda, M., & Suganuma, N., for the Japan Environment and Children's Study Group. (2020). Association between nausea and vomiting of pregnancy and postpartum depression: The Japan environment and Children's study. *Journal of Psychosomatic Obstetrics and Gynaecology, 43*(1), 2–10.

Mullin, P. M., Ching, C.-Y., Schoenberg, F., MacGibbon, Romero, R., Goodwin, T. M., & Fejzo, M. S. (2012). Risk factors, treatments, and outcome associated with prolonged hyperemesis gravidarum. *Journal of Maternal-Fetal Neonatal Medicin, 25*(6), 632–636.

Muramatsu, K., & Kamijima, K. (2009). Puraimarikea shinnryou to utubyou sukuri-ningu tsuru: Patient health Questionnaire-9 nihongoban 'Kokoroto Karadano Shitsumonhyou' (Primary care and depression screening tool: The Japanese version of the Patient health Questionnaire-9 'Questionnaire of mind and body'). *Shindan to Chiryou, 97*, 1465–1473 (in Japanese).

Orth, U., Clark, D. A., Donnellan, M. B., & Robins, R. W. (2021). Testing prospective effects in longitudinal research: Comparing seven competing cross-lagged models. *Journal of Personality and Social Psychology, 120*(4), 1013–1034. https://doi.org/10.1037/pspp0000358

Pirimoglu, Z. M., Guzelmeric, K., Alpay, B., Balcik, O., Unal, O., & Turan, M. C. (2010). Psychological factors of hyperemesis gravidarum by using the SCL-90-R questionnaire. *Clinical & Experimental Obstetrics & Gynecology, 37*(1), 56–59.

Poursharif, B., Korst, L. M., Fejzo, M. S., MacGibbon, K. W., Romero, R., & Goodwin, T. M. (2008). The psychosocial burden of hyperemesis gravidarum. *Journal of Perinatology, 28*(3), 176–181. https://doi.org/10.1038/sj.jp.7211906

Poursharif, B., Korst, L. M., MacGibbon, K. W., Fejzo, M., Romero, R., & Goodwin, T. M. (2007). Elective pregnancy termination in a large cohort of women with hyperemesis gravidarum. *Contraception, 76*, 451–455.

Preacher, K. J., & MacCallum, R. C. (2002). Exploratory factor analysis in behavior genetics research: Factor recovery with small sample sizes. *Behavior Genetics, 32*(2), 153–161.

Reise, S. P., Waller, N. G., & Comrey, A. L. (2000). Factor analysis and scale revision. *Psychological Assessment, 12*(3), 287–297. https://doi.org/10.1037/1040-3590.12.3.287

Richardson, L. P., Rockhill, C., Russo, J. E., Grossman, D. C., Richards, J., McCarty, C., McCauley, E., & Katon, W. (2010). Evaluation of the PHQ-2 as a brief screen for detecting major depression among adolescents. *Pediatrics, 125*(5), e1097–e1103. https://doi.org/10.1542/peds.2009-2712

Romera, I., Delgado-Cohen, H., Prez, T., Caballero, L., & Gilaberte, I. (2008). Factor analysis of the zung self-rating depression scale in a large sample of patients with major depressive disorder in primary care. *BMC Psychiatry, 8*, 4.

Ruscio, J., Carney, L. M., Dever, L., Pliskin, M., & Wang, S. B. (2018). Using the comparison curve fit index (CCFI) in taxometric analyses: Averaging curves, standard errors, and CCFI profiles. *Psychological Assessment, 30*(6), 744–754.

Ruscio, J., Ruscio, A. M., & Carney, L. M. (2011). Performing taxometric analysis to distinguish categorical and dimensional variables. *Journal of Experimental Psychopatholgy, 2*(2), Article 170196.

Ruscio, J., Ruscio, A. M., & Haslam, N. (2006). *Introduction to the taxometric method: A practical guide (1st ed.* Routledge. https://doi.org/10.4324/9780203726549

Ruscio, J., Walters, G. D., Marcus, D. K., & Kaczetow, W. (2010). Comparing the relative fit of categorical and dimensional latent variable models using consistency tests. *Psychological Assessment, 22*(1), 5–21.

Ruscio, J., & Wang, S. B. (2021). RTaxometrics: Taxometric analysis. R package version 3.2. https://cran.r-project.org/package=RTaxometrics.

Salomonsson, B. (2018). *Psychodynamic interventions in pregnancy and infancy: Clinical and theoretical perspectives*. Routledge.

Sarstedt, M., & Mooi, E. (2014). *A concise guide to market research: The process, data, and methods using IBM SPSS statistics*. Springer.

Sartori, J., Petersen, R., Coall, D. A., & Quinlivan, J. (2018). The impact of maternal nausea and vomiting in pregnancy on expectant fathers: Findings from the Australian Fathers' Study. *Journal of Psychosomatic Obstetrics and Gynaecology, 39*(4), 252–258.

Satish, S. M., & Bharadhwaj, S. (2020). Information search behaviour among new car buyers: A two-step cluster analysis. *IIMB Management Review, 22*, 5–15.

Schermelleh-Engel, K., Moosbrugger, H., & Müller, H. (2003). Evaluating the fit of structural equation models: Tests of significance and descriptive goodness-of-fit measures. *Methods of Psychological Reseach Online, 8*(2), 23–74.

Seng, J. S., Schrot, J. A., van de Ven, C., & Liberzon, I. (2007). Service use data analysis or pre-pregnancy psychiatric and somatic diagnosis in women with hyperemesis gravidarum. *Journal of Psychosomatic Obstetrics and Gynaecology, 28*(4), 209–217.

Sheehan, D. V. (1983). *The anxiety disease*. Scribner.

Soper, D. S. (2025). A-priori sample size calculator for structural equation models [software]. Available from: https://www.danielsoper.com/statcalc.

Soyemi, A. O., Sowunmi, O. A., Amosu, S. M., & Babalola, E. O. (2022). Depression and quality of life among pregnant women in first and third trimesters in abeokuta: A comparative study. *South African Journal of Psychiatry, 28*, 1779. https://doi.org/10.4102/sajpsychiatry.v28i0.1779

Spitzer, R. L., Kroenke, K., & Williams, J. B. W. (1999). The patient health questionnaire primary care study group validation and utility of a self-report version of PRIME-MD: The PHQ primary care study. *JAMA, 282*(18), 1737–1744.

Stefana, A., Langfus, J. A., Palumbo, G., Cena, L., Trainini, A., Gigantesco, A., & Mirabella, F. (2023). Comparing the factor structures and reliabilities of the EPDS and the PHQ-9 for screening antepartum and postpartum depression: A multigroup confirmatory factor analysis. *Archives of Women's Mental Health, 26*(5), 659–668. https://doi.org/10.1007/s00737-023-01337-w

Suenaga, H. (2022). Comparison of response options and actual symptom frequency in the Japanese version of the Edinburgh postnatal depression scale in women in early pregnancy and non-pregnant women. *BMC Pregnancy and Childbirth, 22*(1), 937. https://doi.org/10.1186/s12884-022-05257-y

Takegata, M., Haruna, M., Matsuzaki, M., Shiraishi, M., Murayama, R., Okano, T., & Severinsson, E. (2013). Translation and validation of the Japanese version of the wijma delivery expectancy/experience questionnaire version A. *Nursing and Health Sciences, 15*, 326–332.

Tangney, J. P. (1990). Assessing individual differences in proneness to shame and guilt: Development of the self-conscious affect and attribution inventory. *Journal of Personality and Social Psychology, 59*(1), 102–111.

van der Minnen, L. M., Grooten, I. J., Dean, C., Trovik, J., & Painter, R. C. (2025). The impact and management of hyperemesis gravidarum: Current and future perspectives. *International Journal of Gynecolgy and Obstetrics, 00*, 1–9. https://doi.org/10.1002/ijgo.70165

van Oudenhove, L., Jasper, F., Walentynowicz, M., Witthöft, M., van den Bergh, O., & Tack, J. (2016). The latent structure of the functional dyspepsia symptom complex: A taxometric analysis. *Neurogastroent Motil, 28*(7), 985–993.

Wakamatsu, M., Minatani, M., Hada, A., & Kitamura, T. (2021). The patient health Questionnaire-9 among first-trimester pregnant women in Japan: Factor structure and measurement and structural invariance between nulliparas and multiparas and across perinatal measurement time points. *Open Journal of Depression, 10*, 121–137.

Waller, N. G., & Meehl, P. E. (1998). *Multivariate taxometric procedures: Distinguishing types from continua*. Sage Publications.

Weller, B. E., Bowen, N. K., & Faubert, S. J. (2020). Latent class analysis: A guide to best practice. *Journal of Black Psychology, 46*(4), 287–311. https://doi.org/10.1177/0095798420930932

Wijma, K., Wijma, B., & Zar, M. (1998). Psychometric aspects of the W-DEQ, A new questionnaire for the measurement of fear of childbirth. *Journal of Psychosomatic Obstetrics and Gynaecology, 19*, 84–97.

Wood, H., McKellar, L. V., & Lightbody, M. (2013). Nausea and vomiting in pregnancy: Blooming or bloomin' awful? A review of the literature. *Women and Birth, 26*(2), 100–104.

Yamada, F., Kataoka, Y., & Kitamura, T. (2022). Development and validation of a short version of the primary scales of the inventory of personality organization: A study among Japanese university students. *Psychology, 13*, 872–890.

Yoshida, T., Otsubo, T., Tsuchida, H., Wada, Y., Kamijima, K., & Fukui, K. (2004). Sheehan disability scale (SDISS) nihongoban no sakusei to shinraisei oyobi datousei no kentou (the Japanese version of the sheehan disability scale (SDISS): Development, reliability and validity). *Japanese Journal of Clinical Psychopharmacology, 7*(10), 1645–1653 (in Japanese).