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DOI:

[10.1016/j.cpr.2017.12.002](https://doi.org/10.1016/j.cpr.2017.12.002)

Document Version

Peer reviewed version

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Citation for published version (APA):

Keyes, A., Gilpin, H. R., & Veale, D. (2017). Phenomenology, epidemiology, co-morbidity and treatment of a specific phobia of vomiting: A systematic review of an understudied disorder. *Clinical Psychology Review*, 60(1), 15-31. <https://doi.org/10.1016/j.cpr.2017.12.002>

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Accepted Manuscript

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PII: S0272-7358(17)30025-9
DOI: doi:[10.1016/j.cpr.2017.12.002](https://doi.org/10.1016/j.cpr.2017.12.002)
Reference: CPR 1663
To appear in: *Clinical Psychology Review*
Received date: 15 February 2017
Revised date: 3 December 2017
Accepted date: 10 December 2017

Please cite this article as: Alexandra Keyes, Helen R. Gilpin, David Veale , Phenomenology, epidemiology, co-morbidity and treatment of a specific phobia of vomiting: A systematic review of an understudied disorder. The address for the corresponding author was captured as affiliation for all authors. Please check if appropriate. Cpr(2017), doi:[10.1016/j.cpr.2017.12.002](https://doi.org/10.1016/j.cpr.2017.12.002)

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Phenomenology, Epidemiology, Co-morbidity and Treatment of a Specific Phobia of Vomiting: A Systematic Review of an Understudied Disorder

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Abstract

Specific Phobia of Vomiting (SPOV) is an under-researched disorder compared to other Specific Phobias. A systematic review was conducted to synthesise existing research across areas of phenomenology, aetiology, epidemiology, co-morbidity, assessment measures and treatment.

Online databases (Psychinfo, Embase, Medline, Pubmed and Cochrane Library) were searched using terms related to SPOV and 'emetophobia'. A manual search of reference lists of included papers was also conducted. In total, 385 articles were found and 24 were included in the review. The review was registered on the PROSPERO register (CRD42016046378).

The review presents a qualitative synthesis of identified studies exploring the features of SPOV including locus of fear, feared consequences of vomiting, and common safety and avoidance behaviours. It also identified articles describing aetiological factors involved in the development of SPOV, co-morbid disorders and the epidemiology of the disorder. Further studies focused on valid and reliable measures to assess SPOV, and treatments that are effective at reducing symptomatology of SPOV and psychological distress.

There are relatively few published research articles on SPOV, and particularly high quality studies exploring effective treatment options for SPOV. Further research should focus on RCTs for comparing different approaches to reducing symptomatology and distress in people with SPOV.

Keywords: specific phobia vomiting; SPOV; emetophobia; anxiety disorders; cognitive behavioral therapy; fear of vomiting

Funding sources

This research did not receive any specific grant from funding agencies in the public, commercial, or not-for-profit sectors.

Introduction

SPOV: An Overview

Specific Phobia of Vomiting (SPOV), also known as ‘emetophobia’, is categorized as a ‘Specific Phobia: Other’ subtype in DSM-V, involving a persistent fear of vomiting which is disproportional to the threat or danger posed by such an outcome (American Psychiatric Association, 2013; World Health Organization, 1992). Fear of vomiting will often lead to persistent avoidance of vomit or nausea-related activities or situations (World Health Organization, 1992). Individuals with SPOV typically fear themselves vomiting more than other people (Lipsitz, Fyer, Paterniti, and Klein, 2001; Veale & Lambrou, 2006); and a proportion fear vomiting in public as well as vomiting alone (Holler, van Overveld, Jutglar, & Trink, 2013; Veale & Lambrou, 2006). The reported prevalence rate of SPOV varies; however, it is commonly thought to be rare in community samples (Becker et al., 2007).

SPOV is conceptualised as a Specific Phobia; however, there are ways in which it differs to other phobias. For example, SPOV is widely recognised to be more prevalent in women across the majority of studies. The reported prevalence rate of SPOV and a fear of vomiting varies; however, community prevalence rates also suggest that SPOV is relatively rare compared to other Specific Phobias (Becker et al., 2007). However, clinically many more people with SPOV may present to services. Additionally there is significant overlap between the features of SPOV and other disorders, such as OCD, health anxiety and disordered eating (Veale, Costa, Murphy, & Ellison, 2012; Veale, Murphy, Ellison, Kanakam, & Costa, 2013). SPOV may therefore be more difficult to recognise and diagnose compared to other phobias, and therefore the path to specialist treatment may be hindered. This may further explain the underestimation of prevalence rates in community and clinical samples (Boschen, 2007;

Veale, 2009). Furthermore, the feared stimuli central to SPOV are often interoceptive cues that occur daily such as gastric complaints or nausea. This may have implications regarding the development of SPOV and the degree of interference in daily life compared to phobias of external cues that can more easily be avoided. Lastly, SPOV is generally considered by clinicians as hard to treat. The evidence-based treatment of choice for a specific phobia is graded exposure (Wolitzky-Taylor, Horowitz, Powers & Telch, 2008). However, a survey by Lipsitz, Fyer, Paterniti, and Klein (2001) found that only 6% of individuals with fear of vomiting were willing to try exposure; 54% definitely would not try it and 36% were unsure. Treatment of SPOV may be further complicated by complex features such as rituals or compulsions, disordered eating and low BMI, other misdiagnoses, high dropout rates and difficulties with repeated exposure to vomiting (van Hout & Bouman, 2012; Veale, 2009; Veale & Lambrou, 2006).

Objectives

SPOV can be considered different to other Specific Phobias with regard to aetiology, complexity and treatment options. However, due its conceptualisation as a 'Specific Phobia: Other', research into the clinical features and treatment options specific to fear of vomiting is limited, with only one RCT to date. This review is therefore needed to highlight gaps and limitations in the current literature, in order to provide recommendations for further research.

The review will include a narrative synthesis of existing literature across the following domains:

- a) What is currently known about the phenomenology of SPOV?
- b) What is the prevalence rate of SPOV?
- c) What are the aetiological factors associated with SPOV?
- d) Which disorders are commonly comorbid with SPOV?

- e) Are there any valid and reliable measures for assessing SPOV?
- f) Which treatments are effective at reducing the symptomatology of SPOV?

Methods

Design

A systematic review of the literature was conducted and a qualitative synthesis of the results are presented. The review was registered on the PROSPERO register CRD42016046378. http://www.crd.york.ac.uk/PROSPERO/display_record.asp?ID=CRD42016046378

Search criteria

Search terms for all databases were “specific phobia of vomit*”, “emetophob*”, “fear of vomit*”, “phob* of vomit*” and “vomit* phob*”.

Selection procedure

Databases included in the search were Pubmed, Psychinfo, Embase, Medline and the Cochrane library. The final search was undertaken on 9th May 2016. All research studies on SPOV that were published in English from 1846 to May 2016 were eligible for inclusion in the review. The population of studies included in the review were people of any age with a diagnosis of or presenting with symptoms of SPOV, or fear of vomiting. We included case series, cohort studies and controlled trials. Included outcome measures were measures of SPOV symptomatology (self-reported symptoms e.g. visual analogues scales), psychological symptoms or measures of distress, measures of avoidance behaviours and body mass index. Intervention studies for all types of psychological intervention were included.

Titles, abstracts and full articles were screened in stages by two independent reviewers. Inter-rater agreement between reviewers across stages was 96.1%. Disagreement was resolved by a

third party (DV). A manual review of reference lists of final included papers was also conducted to identify additional papers for inclusion (n=3).

Data collection

Data was extracted by the same two independent reviewers and entered separately into forms with variables including study design, patient characteristics, mean age, intervention (where relevant), measures and main findings. Data was reviewed and collated into tables by the first author (AK).

Risk of bias

Two instruments were used to assess risk of bias across studies: one for observational/epidemiological studies and one for intervention studies. An 8-point tool was developed by Matcham et al. (2014) based on the Strengthening of Observational Studies in Epidemiology (STROBE) statement to assess observational studies. This tool assessed and allocated points to each study based on the method of sampling used, the sample size, participation rate and the eligibility criteria for participation. Articles were scored using the following overall scale of low (0-2), medium (3-5) and high (6-8) quality. A similar tool was adapted for use in this review, with additional criteria based on methods used to detect Specific Phobia. This tool was scored overall out of 10 and the following scale was used: low (0-2), medium (3-5) and high (6-10) quality (Appendix A). Risk of bias was assessed by two independent reviewers, with an agreement rate of 91.7% for global ratings across both assessment tools. Disagreements were discussed and agreed by consensus. For intervention studies, the EPHPP Quality Assessment Tool for Quantitative Studies was used (Appendix B). Studies were rated weak, moderate or strong across 6 domains: selection bias, study design, confounders, blinding, data collection methods and withdrawals and dropout. Studies with two or more weak ratings were given a global rating of weak; studies with one weak

rating was given a moderate rating and a strong rating was given for studies with no weak ratings. Quality ratings for each study can be seen in Table 1a&b.

Results

Articles were split into three categories and presented accordingly: 1) diagnosis and phenomenology, 2) epidemiology, aetiology and comorbidity and 3) assessment and treatment of SPOV. Two further tables present data for common features of SPOV (Table 3) and co-morbid disorders (Table 5) across studies. Where papers cover more than one topic, data have been added separately into relevant tables. Weighted averages of percentages were calculated across studies and sample sizes.

Quality assessment

Scores for each domain and global scores for observational studies are presented in Table 1a, and intervention studies in Table 1b. Across observational studies, only 2 scored in the high quality range (Becker et al., 2007; Norris et al., 2014). The majority of studies were rated as medium quality (n=12) and n=6 were rated low quality. Notably, many studies exploring the phenomenology of SPOV used surveys of community or internet samples. n=8 studies scored 0 for sampling methodology, suggesting samples may not be likely to be representative of the target population. The majority of observational studies used relatively small sample sizes (n=19). There were n=20 single case intervention studies that were excluded from the review as quality could not be rated based on the criteria used. Only two of the included treatment studies scored in the moderate range (Ahlen, Edberg, Di Schiena, & Bergström, 2015; Riddle-Walker et al., 2016) and the other two scored in the weak range (Klonoff, Knell, & Janata, 1984; Philips, 1985), demonstrating the lack of high quality research exploring effective interventions for SPOV.

Results of individual studies

Diagnosis and phenomenology of SPOV

Two papers explored the validity of the SPOV diagnosis (Himle, McPhee, Cameron, & Curtis, 1989; Lelliott, McNamee, & Marks, 1991) (Table 2). These studies were conducted prior to the change in name to Specific Phobia. Four diagnostic categories of Simple Phobia were supported by significant between group differences in clinical and epidemiological variables, such as gender, age of onset and family history of Simple Phobia. One study found that fewer patients with fears of vomiting or incontinence are assigned to a correct diagnosis compared to those with Social Phobia or Agoraphobia (Lelliott et al., 1991). People with SPOV were also found to differ from the clinical and demographic profiles of those with other phobias e.g. younger age of onset; more likely to be female and greater restrictions in terms of use of public transport (Lelliott et al., 1991).

Ten studies explored the phenomenology of SPOV and found that increased nausea, intrusive imagery of vomiting, disgust and locus of control were significant features of SPOV (Davidson, Boyle, & Lauchlan, 2008; Holler et al., 2013; Lelliott et al., 1991; Lipsitz et al., 2001; Price, Veale, & Brewin, 2012; van Hout & Bouman, 2012; van Overveld, de Jong, Peters, van Hout, & Bouman, 2008; Veale & Lambrou, 2006; Verwoerd, van Hout, & de Jong, 2016; Wu, Rudy, Arnold, & Storch, 2015) (Table 2). 80.6% of SPOV patients reported intrusive imagery about vomiting including intrusive early memories of vomiting (31%) and flash-forwards e.g. imagining worst case scenarios (17%) (Price et al., 2012). Imagery in SPOV was associated with higher SPOV symptomatology, food restriction, obsessive-compulsive symptoms, health anxiety and significant impairment in several areas of adaptive functioning (Price et al., 2012).

Locus of fear

Seven studies explored the locus of the fear in individuals with SPOV (Holler et al., 2013; Lipsitz et al., 2001; Price et al., 2012; van Hout & Bouman, 2012; Veale & Lambrou, 2006; Veale, Murphy, et al., 2013; Wu et al., 2015) (Tables 2 and 4). The rate of fear of self-vomiting across all SPOV samples was 47.3% (n=366); fear of others vomiting was 12.7% (n=331) and equal fear of both outcomes was 35.5% (n=699) (Table 3). Fears of other people vomiting may be due to fears that vomiting in others may be contagious which may lead to vomiting themselves (van Hout & Bouman, 2012). Fear around vomiting in public vs. private situations were less consistently studied (n=3). Fear of vomiting in public was found in 47.9% of all SPOV samples (n=409); vomiting in private was 3% (n=166) and equal fear of both situations was 55.6% across samples (n=188). A SPOV sample were also found to score significantly higher on internal loss of control across both general and health domains compared to phobic (not SPOV) and nonphobic controls, suggesting that individuals with SPOV may fear vomiting in the context of a fear of losing control (Davidson et al., 2008).

Feared consequences of vomiting

Three studies explored the feared consequences of vomiting in SPOV samples (Holler et al., 2013; van Hout & Bouman, 2012; Veale, Murphy, et al., 2013) (Tables 2 and 4). Feared outcomes included fear of getting contaminated and becoming ill (50.5%, n=113); fear of nausea and vomiting (100%, n=19); fear of a heart attack (30.4%, n=128); fear of panic (29.4%, n=34); fear of losing control (19.1%, n=165); the features of vomit (e.g. sight [72%], sound [71%], taste [4.8%] or smell [66%]); self-disgust (33%), n=131; suffocation (37.3%, n=131) and gagging (83.8%, n=131) (Table 3).

Safety seeking behaviours

Six papers reported data on safety seeking behaviours in SPOV samples (Lipsitz et al., 2001; Price et al., 2012; van Hout & Bouman, 2012; Veale et al., 2012; Veale, Hennig, & Gledhill,

2015; Veale & Lambrou, 2006) (Tables 2 and 4). In an attempt to reduce the likelihood of vomiting, 64.9% (n=296) checked expiry dates on food; 42.1% (n=183) washed their hands excessively; 16% (n=100) checked the state of their own health; 80.8% (n=83) checked the state of other peoples' health. 44.9% (n=211) of females with SPOV avoided or postponed pregnancy; 5.3% (n=5) of females with SPOV reported terminating a pregnancy; 34% (n=32) avoided anaesthesia or surgery; 62.4% (n=94) reported over-cooking their food; 40.3% (n=233) described engaging in eating rituals; 52.7% (n=83) reassured themselves and 30% (n=183) sought reassurance from others due to fear of vomiting (Table 3).

Avoidance behaviours

Four studies presented data on people or situations that are commonly avoided by people with SPOV (Holler et al., 2013; Price et al., 2012; van Hout & Bouman, 2012; Veale & Lambrou, 2006) (Table 2). These include people at risk of vomiting e.g. ill people (80.8%, n=119), drunk people (85.9%, n=119), foreign countries (71.1%, n=119), alcohol (65.6%, n=119), food (84.6%, n=167), illegal substances (92.3%, n=100), travel by boat (89.3%, n=100), plane (68.7%, n=100) or public transport (64.4%, n=100) (Table 3).

Three papers explored avoidance behaviours specifically around food (Holler et al., 2013; Veale et al., 2012; Veale & Lambrou, 2006) (Tables 2 and 4). 63.1% (n=100) of people with SPOV avoided eating from salad bars or buffets; 54.1% (n=100) avoided eating in restaurants; and 55.7% (n=100) avoided pubs. People with SPOV also avoided specific types of foods due to their fears of vomiting e.g. foreign foods (32.1%, n=194), shellfish (65.7%, n=194), meat (45.6%, n=325), fish (14.4%, n=131), dairy (17.6%, n=325) or eggs (22.3%, n=225) (Table 3).

Impairment/quality of life

Two papers reported the percentage of patients who reported a negative impact of SPOV symptomatology on quality of life and mean interference out of 10 across several life

domains (Lipsitz et al., 2001; Veale & Lambrou, 2006). People with SPOV reported impairments in social functioning e.g. avoiding parties where there may be alcohol (62%, $m=6.7$, $SD=2.8$), occupational functioning e.g. having to leave work frequently (19.6%, $m=5.4$, $SD=3.6$) education e.g. skipping classes (9%), leisure e.g. difficulty with travel or going to new places (70%), and home marital life e.g. postponing/avoiding pregnancy or being left alone with young children (34%, $m=4.8$, $SD=3.4$) (Lipsitz et al., 2001; Veale & Lambrou, 2006) (Table 2).

Epidemiology, Aetiology and Comorbidity

Epidemiology

All studies reported higher rates of female participants across samples (83.2%, $n=1738$). Three studies explored prevalence rates of SPOV and a fear of vomiting in community samples (Becker et al., 2007; van Hout & Bouman, 2012; Wu et al., 2015) (Tables 2 and 4). A lifetime prevalence rate of 0.2% was reported (Becker et al., 2007). Compared to other Specific Phobias, this estimate is significantly lower (animals 4.5, heights 1.7, blood injection injury 1.9, situational 2.2) (Becker et al., 2007). Point prevalence rates of *fear of vomiting* (not a phobia) were found to be 1.8% for men and 7% for women (van Hout & Bouman, 2012) and in an adolescent sample, 7.5% were found to have elevated SPOV symptoms (Wu et al., 2015).

Aetiology

Four papers explored aetiological factors in the development of SPOV (Himle et al., 1989; Lipsitz et al., 2001; Veale, Murphy, et al., 2013; Verwoerd et al., 2016) (Tables 2 and 4). Memories of aversive experiences of self or others vomiting were found to be significant factors in the development of SPOV (Lipsitz et al., 2001; Veale, Murphy, et al., 2013). Higher SPOV symptoms were found to be associated with higher disgust propensity and

sensitivity (Verwoerd et al, 2016). Furthermore, disgust and anxiety based emotional reasoning was found to significantly predict high and low fear of vomiting, suggesting that disgust and emotional reasoning may play a role in the development of SPOV (Verwoerd et al, 2016).

Co-morbidity

Four studies explored comorbidity between SPOV and other Axis I disorders (Sykes, Boschen, & Conlon, 2015) and specifically Eating Disorders (Norris et al., 2014; Veale et al., 2012), OCD (Veale et al., 2015) and Health Anxiety (Veale et al., 2015) (Table 4). Co-morbidity rates for Axis 1 disorders found across all samples of SPOV are presented in Table 5.

Assessment measures and treatment

Measures

Two self-report measures have been validated for use in the assessment of SPOV (Boschen, Veale, Ellison, & Reddell, 2013; Veale, Ellison, et al., 2013) (Table 6). The Specific Phobia of Vomiting Inventory (SPOVI) and the Emetophobia Questionnaire (EmetQ) were found to be reliable and valid measures of SPOV symptoms, with good internal consistency, test-retest reliability (Boschen et al., 2013). The EmetQ was found to have good sensitivity and specificity in determining cases of SPOV (Boschen et al., 2013; Veale, Ellison, et al., 2013). Similarly, the SPOVI demonstrated good sensitivity to change over time, and a clinical cut-off score of 10 was identified (Veale, Ellison, et al., 2013).

A Behavioural Avoidance Test (BAT) was developed to measure ability to approach a vomit-like stimulus (Boschen et al, 2013). Participants were asked to approach a fake vomit mixture and scored on level of approach (e.g. 0=able to immerse both hands and smell the vomit

stimulus to 10=avoids the task after it is described). Higher scores reflected higher levels of avoidance. No observer rated measures of SPOV have been developed.

Past treatment

Five studies explored the treatment histories of patients with SPOV (Holler et al., 2013; Lipsitz et al., 2001; van Hout & Bouman, 2012; Veale et al., 2012; Veale & Lambrou, 2006) (Tables 2 and 4). The majority of cases sought medical advice from their GP (74.5%, n=231); and over one third had been prescribed anti-nausea or anti-depressant medication (38.7%, n=156). 67% (n=100) of patients with SPOV had been referred to a psychologist or psychiatrist and only 25.8% (n=175) had received some form of psychotherapy (17.9% CBT, 20.3% BT and 35% hypnotherapy, n=100) (Table 3).

Treatment effectiveness

Only four treatment studies were included in the review (Ahlen et al., 2015; Klonoff et al., 1984; Philips, 1985; Riddle-Walker et al., 2016) (Table 6). Twenty published single case studies were identified in the search and excluded. There is only one published RCT (Riddle-Walker et al., 2016). Two studies explored the effectiveness of group CBT (Ahlen et al., 2015; Philips, 1985); one explored individual CBT including imagery rescripting (Riddle-Walker et al., 2016) and one explored contingency management, parent training and relaxation (Klonoff et al., 1984). All studies reported reductions in SPOV symptomatology over time, which were maintained at follow up (Ahlen et al., 2015; Klonoff et al., 1984; Philips, 1985). Both group and individual CBT were associated with clinical significant and reliable change, and reductions in associated anxiety and depression (Ahlen et al., 2015; Riddle-Walker et al., 2016). Group CBT was found to be associated with high client satisfaction (Ahlen et al., 2015). Effect sizes for reductions in SPOV symptomatology were strong and significant (EmetQ: 0.85-1.52 treatment phase, 1.18 follow up; SPOVI 1.52 treatment phase) (Ahlen et al., 2015; Riddle-Walker et al., 2016).

Discussion

Phenomenology of SPOV

Most included studies exploring clinical features used clinic, internet and community samples (n=10). Almost half of individuals with SPOV fear mainly themselves vomiting and roughly one third fear themselves and others vomiting equally. In the latter cases, it may be that fear of others vomiting is due to exposure to the vomit itself or the fear of infection from others that may increase the risk of self-vomiting (van Hout & Bouman, 2012). SPOV was linked to a high degree of anxiety and distress (Lipsitz et al., 2001; van Hout & Bouman, 2012; Veale & Lambrou, 2006). Individuals with SPOV report gastric complaints (van Hout & Bouman, 2012) and experience nausea almost every day (Holler et al., 2013; Veale & Lambrou, 2006), especially when anxious (Holler et al., 2013). Nausea is not reported to lead to actual episodes of vomiting; however, it is associated with high levels of distress and anxiety (Holler et al., 2013; Veale, 2009). This may be due to the appraisal of nausea as a signal of impending threat i.e. an episode of vomiting; which leads to anxiety and safety seeking behaviours to reduce the likelihood of vomiting occurring (Veale, 2009). Individuals with SPOV were found to have higher disgust propensity and disgust sensitivity (van Overveld et al., 2008); higher internal locus of control, particularly relating to health (Davidson et al., 2008), and higher disgust based emotional reasoning (Verwoerd et al, 2016). Individuals with SPOV may therefore associate vomiting with losing control of one's bodily functions and/or lack of perceived control over their physical health.

Three studies explored the feared consequences of vomiting (Holler et al., 2013; van Hout & Bouman, 2012; Veale, Murphy, et al., 2013). van Hout and Bouman (2012) developed 8 categories of feared consequences of vomiting and found that the most frequent fears included getting contaminated and becoming ill; loss of control and panic. All participants agreed to 'fear of vomiting and nausea' as a feared consequence. However, it remains unclear

whether this is an evaluation of the awfulness of the experience of vomiting, or an actual feared consequence of vomiting. It may be that people with SPOV find it hard to describe their fears in relation to vomiting. In addition, individuals with SPOV may be encouraged to rationalise or ascribe their fears to pre-determined categories i.e. for research or during treatment. This post-hoc description of feared outcomes may be difficult to distinguish between feared consequences of vomiting and the evaluations of vomiting itself.

Fear of vomiting is linked to intrusive memories of early aversive experiences of vomiting (Price et al., 2012; Veale, Murphy, et al., 2013). Similar to a cognitive model of trauma, old memories of vomiting may be 'triggered' in individuals with SPOV and experienced with a sense of 'nowness', which maintains a current sense of threat in relation to vomiting (Veale, 2009). Almost a third of individuals with SPOV experience intrusive imagery of early experiences of vomiting, and almost one half experience imagery with a sense of 'nowness' (Price et al., 2012). Thus the role of imagery may be important in maintaining SPOV, in that flashbacks of sounds, smells and physical sensations associated with early aversive memories may maintain the fear of vomiting. Two models may therefore explain the maintenance of SPOV, one is similar to panic in that normal bodily sensations are misinterpreted as an impending episode of vomiting and losing control. In addition, the evaluation of vomiting is of extreme awfulness. In contrast, for those that experience intrusive imagery, the fear may be triggered by an association with fragments of past aversive memories of vomiting.

In order to cope with nausea and fear of vomiting, individuals often develop various safety seeking and avoidance behaviours to reduce the likelihood of their self or others vomiting or the intolerance of uncertainty about whether they may vomit. These include food restriction; excessive checking of expiration dates before eating; frequent hand washing and cleaning; reassurance seeking; using mints or antacids to reduce nausea; avoiding drunk or sick people, pregnancy, travel or holidays abroad, (Lipsitz et al., 2001; Price et al., 2012; van Hout &

Bouman, 2012; Veale et al., 2012; Veale & Lambrou, 2006; Veale, Murphy, et al., 2013). Fear and avoidance of anxiety-provoking situations can be chronic and disabling with profound disruption to daily life e.g. work, leisure, social relationships and home life (Davidson et al., 2008; Lipsitz et al., 2001; Veale & Lambrou, 2006).

Due to a lack of research on SPOV phenomenology, more experimental studies are needed to identify the processes that maintain fear of vomiting. Specifically, research may explore how safety seeking and avoidance behaviours maintain or increase this fear. For example, further research may help to clarify the function of certain behaviours, which have a lot of similarities to obsessive compulsive disorders e.g. checking on the likelihood of the threat (of vomiting), undoing or reversing the threat of vomiting (like compulsive washing), or avoiding/preventing vomiting, and how these contribute to the maintenance of SPOV.

Epidemiology

All studies found a higher proportion of female participants with SPOV (83.2%, ratio 4.95:1). This gender ratio is higher compared to a reported ratio of between 2 and 4:1 found in Specific Phobias (Bekker & van Mens-Verhulst, 2007; Somers, Goldner, Waraich, & Hsu, 2006). To date, little is known regarding the higher female prevalence of SPOV compared to other phobias. In contrast to Specific Phobias, prevalence rates of SPOV vary; however, in one study it was found to be rare in community samples, compared to other Specific Phobias (Becker et al., 2007). In children and adolescents, reported prevalence rates of Specific Phobias varies from 0.22% (Costello, Mustillo, Erkanli, Keeler, & Angold, 2003) to 23.9% (Muris, Schmidt, & Merckelbach, 1999). It is therefore difficult to compare prevalence rates between SPOV and Specific Phobias in this age group.

Despite variations in reported rates, community rates may be at odds with what is seen clinically. For example, Vandereycken (2011) found that 48.5% of eating disorder clinicians

had encountered SPOV in their patients. This suggests that there may be higher prevalence of SPOV in clinical samples, and that patients with SPOV may be mis-diagnosed with other disorders such as AN, OCD or health anxiety (Vandereycken, 2011; Veale, Murphy, et al., 2013). For accurate diagnoses, it is important for clinicians to understand the motivations behind avoidance and safety behaviours such as food restriction or compulsive washing. A SPOV must be clearly distinguished from other disorders as a fear of vomiting as the main presenting problem. Avoidance and safety behaviours may be driven by the same motivation to keep safe from feared outcomes across all disorders. However, the content of the fear may be broader for other diagnoses compared to SPOV e.g. fear of gaining weight in AN, contamination from dirt and germs in OCD, and contracting any serious illness in health anxiety, not just in the context of vomiting. The temporal history of fears may also differ in these disorders compared to SPOV. For example, a person with a SPOV fears contamination and/or illness in relation to likelihood of vomiting only, whereas individuals with health anxiety may have a history of fearing a wider range of illness in the past.

Aetiology

Two models explain the importance of aversive memories, internal cues and other maintenance factors in the development of SPOV. Boschen (2007) suggests that individuals learn to interpret internal cues such as nausea as an indication of imminent vomiting which leads to increased anxiety and GI symptoms. This vicious circle is then maintained by changes in attentional biases towards internal cues, worry and avoidance behaviours (Boschen, 2007). Another model emphasises the importance of aversive memories of vomiting that become associated with fear, which leads to a re-experiencing of various cues as if these memories are about to be repeated (Veale, 2009). The core appraisal in this model is that nausea is suggestive of an imminent vomiting episode of extreme threat and awfulness, which leads to anxiety and further nausea. Similar to Boschen's model, the fear of vomiting

is then maintained by avoidance, hypervigilance to threat cues, self-focussed attention and self-monitoring, worry, self-assurance, safety behaviours and an over-inflated sense of responsibility of control over vomiting (Veale, 2009). Furthermore, disgust and emotional reasoning may play a role in the development of SPOV. Verwoerd et al (2016) found that higher SPOV symptoms were associated with higher disgust propensity and sensitivity. In addition, emotional reasoning used to determine risk of becoming ill was found to be most pronounced in a more severe SPOV group. These findings suggest that a higher sensitivity to disgust and disgust based emotional reasoning may play a role in the development of persistent and erroneous beliefs regarding vomiting in SPOV (Verwoerd et al, 2016), and may add to existing conceptual models of SPOV. Relatively few included studies explore developmental factors in SPOV (n=4). An internet survey by Lipsitz et al. (2001) showed that individuals with fear of vomiting present with past experiences of self (29%) and others (59%) vomiting which were distressing. Aversive memories of vomiting were also shown to be significantly more distressing in individuals with SPOV and may be a significant aetiological factor in its development (Veale, Murphy, et al., 2013). However, both studies were rated as low (Lipsitz et al., 2001) and medium (Veale, Murphy, et al., 2013) quality. Therefore, more experimental research is needed to support developmental models, replicate findings and improve generalizability in patients diagnosed with SPOV.

Co-morbidity

Research into comorbidity is important as SPOV is often mis-diagnosed in clinical settings due to significant overlap in clinical features with other presentations. However, relatively few papers exploring co-morbidity in SPOV exist (n=4). Axis I disorders associated with SPOV include anxiety disorders (panic disorder, social phobia, agoraphobia and OCD), depression and eating disorders (Becker et al., 2007; Davidson et al., 2008; Lipsitz et al.,

2001; Norris et al., 2014; Sykes et al., 2015; van Hout & Bouman, 2012; Veale, Murphy, et al., 2013).

One paper explored the overlap between clinical features of SPOV and OCD (Veale et al., 2015) e.g. compulsive washing, reassurance seeking and checking. Verwoerd et al (2016) found that vomit fearful subjects use emotional response information such as disgust and anxiety to infer heightened risk of contamination and risk of becoming ill. Fears of contamination have also been reported in people with SPOV, in relation to catching illnesses that may make vomiting more likely (Veale & Lambrou, 2006). Compulsive behaviours similar to those seen in OCD are then employed to reduce the likelihood of vomiting (Veale et al., 2015; Veale & Lambrou, 2006). The overlap between features suggests that there is a continuum between pure specific phobias at the mild end of the spectrum to OCD at the more severe end. However, it is important to distinguish true cases of OCD i.e. whether features are solely in the context of a fear of vomiting or relevant to a broader range of fears such as contamination in the context of dirt or germs. Co-morbid OCD is only likely in the event that there are additional obsessions and compulsions not related to fear of vomiting.

Panic attacks related to fear of vomiting are also experienced by individuals with SPOV. Certain fears reported in SPOV are similar to those with Panic Disorder e.g. fears of choking, fainting or dying after vomiting (Veale & Lambrou, 2006). However, an additional diagnosis of Panic disorder is only indicated if panic attacks occur in situations not related to fear of vomiting. Lastly, a proportion of individuals with SPOV fear vomiting in public more than vomiting alone, suggesting that these individuals fear negative evaluation, shame and rejection from others which is commonly seen in people with Social Anxiety Disorder (McNally, 1997; Veale & Lambrou, 2006). These fears are best conceptualised as a SPOV if the main feared outcome is vomiting in front of others, and no other performance-related concerns are evident.

Research suggests that there may be significant overlap between SPOV and other Axis-I disorders. However, true comorbidities should only be diagnosed in cases where cognitions and behaviours are not related to fears of vomiting. The four studies on treatment included in the review are of medium to high quality; however, more research is required to explore similarities between features of SPOV and other disorders, to prevent misdiagnosis and improve access to specialist treatment.

Assessment and Treatment of SPOV

Two standardised measures were shown to be reliable and validated tools in the assessment of SPOV, with good inter-rater reliability, validity, sensitivity and specificity (Boschen et al., 2013; Veale, Ellison, et al., 2013). The SPOVI was shown to have a clinical cut off score of 10 (Veale, Ellison, et al., 2013). The development of standardised behavioural avoidance tests or other observer rated scales to improve methodology in SPOV research may be beneficial.

Research into the effectiveness of psychological treatments for SPOV is limited to mostly case reports and studies with small samples. To date, only one RCT has been published comparing the effectiveness of CBT to wait list control (Riddle-Walker et al., 2016). Most case reports suggest that SPOV can be treated successfully by CBT (Graziano, Callueng, & Geffken, 2010; Hunter & Antony, 2009; Kahana & Feeny, 2005; Kobori, 2011; Pollard, Tait, Meldrum, Dubinsky, & Gall, 1996; Whitton, Luiselli, & Donaldson, 2006), behavioral approaches (Faye, Gawande, Tadke, Kirpekar, & Bhave, 2013; Herman, Rozensky, & Mineka, 1993; Lesage & Lamontagne, 1985; Maack, Deacon, & Zhao, 2013; McFadyen & Wyness, 1983; Philips, 1985; Williams, Field, Riegel, & Paul, 2011); systemic behaviour therapy (O'Connor, 1983); psychotherapy (Manassis & Kalman, 1990); hypnotherapy (McKenzie, 1994; Ritow, 1979); Competence Imagery and imaginal coping (Moran &

O'Brien, 2005); a combination of behavioural approaches and hypnotherapy (Wijesing, 1974) and CBT plus parent training (Kahana & Feeny, 2005). A further two treatment studies showed group and online CBT to be effective at reducing SPOV symptomatology (Ahlen et al., 2015), Sykes et al 2015). Online CBT was also associated with reductions in depression, anxiety and stress, and improvements in quality of life (Sykes et al, 2015). Other case reports suggest trauma focussed approaches are effective in cases where exposure is not feasible (de Jongh, 2012; de Jongh, Ten Broeke, & Renssen, 1999); however, there may be publication bias in single cases.

Studies included in the current review suggest that CBT in group and individual format are effective at reducing SPOV symptomatology, anxiety and depression maintained at follow up with good effect sizes (Ahlen et al., 2015; Riddle-Walker et al., 2016). Group CBT was associated with clinically significant change in two thirds of participants at follow up, and high client satisfaction ratings (Ahlen et al., 2015). Repeated exposure and relaxation training (Philips, 1985) and parent contingency management were also associated with significant reductions in SPOV symptomatology maintained at follow up.

Interestingly, only 25% of the 67% of patients referred to a psychiatrist or psychologist received some form of therapy for their SPOV (Veale & Lambrou, 2006). This review also highlights the breadth of treatment approaches that are currently being offered to patients with SPOV. Despite the evidence base supporting exposure as the treatment of choice for SPOV, it appears that a higher proportion of patients may be offered non-evidence based treatments such as hypnotherapy compared to CBT (35% vs 17.9%). Research into the effectiveness of treatment approaches has been found to be limited due to small sample sizes, high dropout rates, high levels of comorbidity and heterogeneity of cases (van Hout & Bouman, 2012; Veale & Lambrou, 2006). Two of four studies exploring the effectiveness of treatments for SPOV included in the review had relatively weak design (Klonoff et al., 1984;

Philips, 1985). These studies were found to have limitations relating to sampling bias, data collection methods, blinding and confounders, which supports previous findings.

Treatment for SPOV currently focuses on graded exposure to internal cues such as nausea, vomit-related cues, or to activities that have previously been avoided (Veale, 2009). Due to heterogeneity in idiosyncratic fears in people with SPOV, it is essential that an individualised formulation is used to devise appropriate exposure tasks and behavioural experiments in order to target specific fears. SPOV may also require adapted treatment protocols compared to other phobias, due to difficulties with exposure to self-vomiting which is not easy to achieve, practical or evidence based. Furthermore, disgust may play a role in the development and maintenance of SPOV, as disgust is a universal reaction to vomiting, which in the case of SPOV may be amplified by fear. Therefore, interventions that target disgust as well as anxiety may be important at reducing symptomatology.

Evidence supporting specific treatment components is limited. For example, there are no reported studies on the effectiveness or practicality of actual vomiting by the person with SPOV or willingness by the person with SPOV to agree to this approach. Therefore, it remains unknown to date whether exposure to internal or external cues is most effective at reducing SPOV symptomatology. Further controlled studies with robust methodology and larger sample sizes are therefore needed to evaluate the effectiveness of adapted psychological treatments for SPOV, such as targeting disgust, exposure through virtual reality or imagery rescripting of early aversive memories. Further research may need to evaluate the format of treatment delivery, e.g. treatment as usual compared to time intensive programmes of treatment. Lastly, it may be helpful to compare such treatment protocols to other types of credible therapy being offered, such as hypnotherapy.

Limitations

Many of the included studies used community participants with self-reported fear of vomiting. For example, only one study exploring the phenomenology of SPOV used a reliable and valid diagnostic tool to assess participants. This suggests that participants may not be representative of treatment seeking samples, and therefore generalisability may be limited. Furthermore, the majority of the studies use relatively small sample sizes, which could affect the power and reliability of findings. Most studies were rated low quality (n=6) or weak (n=2) and medium quality (n=12) or moderate (n=2). Only two studies scored in the high quality range. Therefore the majority of the existing literature on SPOV may have high risk of bias in interpreting results. Lastly, there is a lack of randomised controlled treatment studies exploring the effectiveness of treatments for this patient group.

In terms of review limitations, some studies were excluded on the basis of the publication language not being English (n=11) and one study was unavailable at the time of the search. These studies were beyond the scope of the current review to include and may mean that important information on SPOV has been omitted.

Conclusions

Relative to other Specific Phobias, SPOV is an understudied disorder (van Hout & Bouman, 2012) and there is a lack of well-designed empirical studies across all areas of the literature. The current literature on SPOV includes relatively few studies based on community and internet samples, of low or medium quality. Furthermore, there are only four published treatment studies including one RCT, based on relatively small sample sizes. Future research is needed to explore the phenomenology of SPOV in representative and large samples. In particular, high quality RCTs are needed in order to address the gaps in knowledge regarding effectiveness of psychological treatments in reducing SPOV symptomatology and distress.

Role of Funding Sources

This review has been conducted and written up as part of a Thesis for the award of Doctorate in Clinical Psychology. No funding body had any role in the process of conducting or writing up of the review for publication.

Contributors

Authors A and C designed the systematic review questions. Author A conducted searches and both Authors A and B completed data extraction and quality assessment for 100% of included papers. Discrepancies were settled by Author C. Author A wrote the first draft of the manuscript and all authors contributed to and have approved the final manuscript.

Conflict of Interest

All authors declare that they have no conflicts of interest.

Acknowledgement

This study represents independent research part funded by the National Institute for Health Research (NIHR) Biomedical Research Centre at South London and Maudsley NHS Foundation Trust and King's College London.

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Table 1a. Quality assessment ratings across observational studies using tool adapted from STROBE

Paper	Area studied	Representativeness	Sample size	Participation rate	Criteria for SPOV	Eligibility criteria	Total	Quality rating
Daivison 2008	Features	0	0	0	0	0	0	Low
Himle 1988	Diagnosis	2	0	0	2	1	5	Medium
Holler 2013	Features	0	0	0	0	1	1	Low
Lelliott 1991	Features	2	0	3	0	0	5	Medium
Lipsitz 2001	Features	0	0	2	0	0	2	Low
Price 2012	Features	0	0	0	2	1	3	Medium
van Hout 2012	Features	2	0	3	0	0	5	Medium
van Overveld 2008	Features	0	0	2	0	1	3	Medium
Veale 2006	Features	0	1	0	0	1	2	Low
Verwoerd 2016	Features	0	0	0	0	0	0	Low
Wu 2015	Features	0	1	0	0	1	2	Low
Becker 2007	Epidemiology	2	2	2	2	1	9	High
Himle 1990	Aetiology	2	0	0	2	1	5	Medium
Veale 2013a	Aetiology	0	0	0	2	1	3	Medium
Norris 2014	Co-morbidity	2	0	3	0	1	6	High
Sykes 2015	Co-morbidity	0	0	2	2	1	5	Medium
Veale 2015	Co-morbidity	0	0	0	2	1	3	Medium
Veale 2012	Co-morbidity	0	0	0	2	1	3	Medium
Bosch 2013	Measures	0	0	0	2	1	3	Medium

Veale 2013b	Measures	0	0	0	2	1	3	Medi um
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Table 1b. Quality assessment rating across intervention studies using EPHP tool

Paper	Selection bias	Study design	Confounders	Blinding	Data collection methods	Withdrawals and dropouts	Global rating
Ahlen 2015	Moderate	Moderate	Strong	Weak	Strong	Strong	Moderate
Klonoff 2009	Moderate	Moderate	Weak	Moderate	Weak	Strong	Weak
Philips 1985	Weak	Moderate	Weak	Weak	Strong	Strong	Weak
Riddle - Walke 2016	Weak	Strong	Strong	Moderate	Strong	Strong	Moderate

Table 2. Studies exploring diagnosis and phenomenology of SPOV (n=12).

Author	Area studied	Study design/ Sample size	Participant s	Mean age (SD)	Measures	Main findings
Himle 1988	Diagnosis	Epidemiological study n=88 total n=8 choking-vomit phobia	Specific phobia patients (70.5% females, 29.5% males) Mean age of onset: Choking-vomit: 20.6 (SD=14.8)	Not stated	Age of onset Gender Family history of phobias Clinical assessment based on DSM criteria	See results section.
Lelliott 1991	Diagnosis / Features	Epidemiological study Total sample n=567 SPOV n=40	Phobia patients (70% female) Mean age of onset: 17 (SD=14)	Not stated	FQ WSAS	Gender differences: Greater proportion of women in SPOV (70%) vs Social Phobia (SocP) Age of onset: SPOV significantly lower than Agoraphobia (AgP) Clinical ratings: SPOV more disabled in using public transport and going into crowded shops than SocP
Lipsitz 2001	Features	Epidemiological study n=56	Online SPOV group (89.3% female, 10.7% male) Mean age of	31.4 (9.7)	Survey	Triggers: 45.2% of time fear triggered by external stimuli (e.g. sight of food) 40.5% internal

			onset: 9.2 years (SD=5.0) Mean illness duration 22 years (SD=11.4)			stimuli (e.g. acid stomach) 15% out of the blue
Price 2012	Features	Cross- sectional study N=36	SPOV patients (assessed by SCID) (94.4% females, 5.6% males) Mean age onset: 14.6 years (SD=7.3)	34.4 years (12.8)	PDSQ SCID-I SPOVI EmetQ DS-R Imagery interview	Clinical features: Mean days of nausea in last week = 3.1, SD=2.4 Imagery: 51.7% field perspective 3.4% observer perspective 44.8% both
van Hout 2012	Features	Cross- sectional study Vomit-fearful (VF) group n=19 Community fearful (CF) n=15 Community control (CC) n=156	Community groups VF 89.5% female, 10.5% male CF 80% female, 20% male CC 56.4% female, 43.6% male Age of onset (mode): 13-18 years	VF 47.4 years (14.6) CF 46.4 years (17.8) CC 25.2 years (4.3)	PDSQ Survey Emetophobi a Inventory (developed by authors)	Nausea 100% VF group experienced nausea or gastric complaint when anxious Prevalence: Women 4: 1 Men (significant difference)
Holler 2013	Features	Cross- sectional study n=131 Low and high nausea groups	Patients with SPOV (assessed by questionnaire) 96.6% female, 3.4% male Mean age of	26.47 years (6.7)	Survey (designed by the authors)	Nausea: 80.9% reported nausea 44.4% fear pre-dated nausea Situation nausea occurs:

			onset: 9.5 years (SD=6.4)			Stress 67.2% Eating certain foods 52.5% Health-related 52.3% Illness 46% Events at work 43.1%, relationships 41.6%, family 35.9% Eating behaviour and weight: 37.4% underweight (BMI<19) High level of nausea observed in underweight group compared to overweight group
Verwoerd 2016	Features	Cross-sectional study n=144 High fear of vomiting n=35 Low fear of vomiting n=38	Non-clinical participants (77% female, 23% male High: 89% female Low: 66% female)	22.62 years (7.12)	Online task 8 scripts of everyday scenarios relevant to SPOV, asked to rate danger, risk of contamination and becoming ill (0 low to 100 high) EmetQ DPSS-R	Disgust Higher SPOV symptoms associated with higher disgust propensity and sensitivity Emotional reasoning: Overall ER for risk of becoming ill most pronounced for high EQ group Effects of disgust- and anxiety-based ER on fear of vomiting: Disgust and anxiety based

						ER significantly predicted high and low fear of vomiting
Veale 2006	Features	Cross sectional study	SPOV (self-reported) (97% female, 3% male	SPOV 37.61 years (11.65) PD 36.21 years (12.98) Controls 41.75 years (14.72)	Vomit Questionnaire (versions for each group) Safety Behaviours Questionnaire Panic Cognitions Questionnaire BAI	Symptoms SPOV reported feeling significantly more nauseous and higher anxiety Safety seeking behaviours SPOV significantly more likely to look for an escape route, control behaviour, take medication, read, suck mints, move very slowly than PD PD significantly more body checking
		SPOV n=100	Panic Disorder 61% female, 39% male			
		Panic disorder (PD) n=28	Controls n=81			
			Mean age SPOV onset: 9.8 years (6.9) Mean illness duration: 25.9 years (13.9)			
van Overveld 2008	Features	Cross-sectional study	Internet SPOV group (self-report) 91.7% female, 8.3% male	SPOV 25.4 years, (SD=8.2) Control 24.7 years, (SD=5.9)	DPSS-R DQ DS Emetophobic Questionnaire	Emetophobic complaints SPOV group had significantly more emetophobic complaints and vomit-related avoidance behaviour, and significantly elevated levels of disgust
		SPOV n=133	Control n=43			
			Control 93% female, 7% men			

						propensity and sensitivity compared to controls Disgust sensitivity best predictor of SPOV complaints, and avoidance and consequences of vomiting scores
Davidson 2008	Features	Cross-sectional study SPOV n=51 Phobia controls (PC) n=48 Controls n=50	SPOV group (self-report) (100% female)	SPOV 31.56 years (range 15 -70) PC 23.44 years (range 17-57) Controls 20.89 years (range 17-57)	RLoCS HLoCS	SPOV group had significantly higher internal general and health-related LoCS score compared to two control groups
Wu 2015	Features	Cross-sectional study n=305	Caregivers of youths aged 4-17 years (Youths 58.4 % female)	Carers 34.94 years (8.59) Youths 8.63 years (3.42)	SPOVI BESS HAI OCI-CV	Incidence and phenomenology of SPOV 23.67% trying to prevent self-vomiting 9.63% avoid people 10.03% avoid situations or activities

SocP, Social Phobia; AgP, Agoraphobia; FQ, Fear Questionnaire; WSAS, Work and Social Adjustment Scale; PDSQ, Psychiatric Diagnostic Screening Questionnaire; SCID-I, Structured Clinical Interview for DSM-V; SPOVI, Specific Phobia of Vomiting Inventory; EmetQ, Emetophobia Questionnaire; DS-R, Disgust Scale Revised; DPSS-R, Disgust Propensity and Sensitivity Scale Revised; BAI, Beck Anxiety Inventory; DQ, Disgust Questionnaire; DS, Disgust Scale; BESS, Behavioural and Emotional Screening System; HAI, Health Anxiety Inventory; OCI-CV, Obsessive Compulsive Inventory – Child Version;

RLoCS, Rotter's Locus of Control Scale; HLoCS, Health Locus of Control Scale; ED, Eating Disorder

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Table 3. Phenomenology of SPOV reported across studies.

<i>Locus of fear</i>								
Self	Others	Self=others	Public	Private	Public=private			
47.3 (366)	12.7 (331)	35.5 (699)	47.9 (409)	3 (166)	55.6 (188)			
<i>Feared outcomes</i>								
Becoming ill	Nausea/vomiting	Heart attack	Panic	Lossing control	Vomit (sound, sight, smell taste)	Self-disgust	Suffocation	Gagging
50.5 (113)	23.9 (113)	30.4 (128)	29.4 (34)	19.1 (165)	71.5 (131)	33.6 (131)	37.3 (131)	83.8 (131)
					72.3 (131)			
					66.1 (131)			
					4.8 (131)			
<i>Safety seeking behaviours</i>								
Expiry dates	Hand washing	Checking health	Checking others' health	Postponing pregnancy	Overcooking food	Eating rituals	Reassure self	Reassurance seeking
64.9 (296)	42.1 (183)	16 (100)	80.8 (83)	44.9 (211)	62.4 (94)	40.3 (233)	52.7 (83)	30 (183)
<i>Avoidance behaviours</i>								
Sick people	Drunk people	Foreign countries	Alcohol	Food	Illegal substances	Travel by boat	Travel by plane	Public transport
80.8 (119)	85.9 (119)	71.1 (119)	65.6 (119)	84.6 (167)	92.3 (100)	89.3 (100)	68.7 (100)	64.4 (100)
<i>Food related avoidance</i>								
Salad bars/buffets	Restaurants	Pubs	Foreign foods	Shellfish	Meat	Fish	Dairy	Eggs
63.1 (100)	54.1 (100)	55.65 (100)	32.1 (194)	65.7 (194)	45.6 (325)	14.4 (131)	17.6 (325)	22.3 (225)
<i>Past treatment</i>								
GP	Medication	Referral to psychology/psychiatry	Psychotherapy	CBT	BT	Hypnotic therapy		
74.5 (231)	38.7 (156)	67 (100)	25.8 (175)	17.9 (100)	20.3 (100)	35 (100)		

CBT, Cognitive Behavioural Therapy; BT, Behavioural Therapy. NB: Averages in bold are weighted averages calculated across studies

Table 4. Studies exploring epidemiology, aetiology and comorbidity (n=7)

Author	Area studied	Study design	Participants	Mean Age (SD)	Measures	Main findings
Himle 1990	Aetiology	Epidemiological study n=84 total n=10 choking-vomit	Specific phobia patients (75% female, 25% male) Mean age of onset: 13.9 years	21.8 years	Mode of onset (realistic threat, vicarious learning, spontaneous, lifelong, gradual)	Mode of onset mode-of-onset: Realistic threat (n=38), vicarious learning (n=9), spontaneous (n=20), lifelong (n=5), gradual (n=6) Choking/vomit group realistic threat (67%)
Lipsitz 2001	Aetiology	Epidemiological study n=56	Online SPOV group (89.3% female, 10.7% male) Mean age of onset: 9.2 years (SD=5.0) Mean illness duration 22 years (SD=11.4)	31.4 (9.7)	Survey	Aetiology: 29% recalled severe or vivid bouts of vomiting 59% others vomiting 20% both vomiting on own and observing others
Veale 2013a	Aetiology	Cross-sectional study SPOV n=94 Control n=90	SPOV patients (identified by PDSQ & SCID) SPOV 93.6%	SPOV 32.3 years (11.7) Control 32.5	Self-report questionnaire recalling each episode vomiting (self or	Memories of vomiting No difference in number of memories of self-

			female, 6.4% male Control 96.7% female, 3.3% male Mean age onset: 15.7 years (SD=7.3)	years (11.0)	others)	vomiting before age of onset SPOV group recalled significantly less episodes of self-vomiting after age of onset, and significantly more of others vomiting before and after age of onset SPOV group rated memories as significantly more distressing
Verwoerd 2016	Aetiology	Cross-sectional study n=144 High fear of vomiting n=35 Low fear of vomiting n=38	Non-clinical participants (77% female, 23% male High: 89% female Low: 66% female)	22.62 years (7.12)	Online task 8 scripts of everyday scenarios relevant to SPOV, asked to rate danger, risk of contamination and becoming ill (0 low to 100 high) EmetQ DPSS-R	Disgust based ER may play a role in the development of SPOV e.g. using feelings of disgust to infer risk of becoming ill may contribute to the persistence of erroneous, phobic beliefs
Davidson 2008	Co-morbidity	Cross-sectional study SPOV n=51 Phobia	SPOV group (self-report) (100% female)	SPOV 31.56 years (range 15 -70) PC	RLoCS HLoCS	Co-morbidity Almost half reported additional mental

		controls (PC) n=48 Controls n=50		23.44 years (range 17-57) Controls 20.89 years (range 17-57)		health issues e.g. GAD and OCD (most common), panic disorder, depression, n=4 anorexia nervosa
Norris 2014	Co- morbidity	Retrospective review n=205 AN sample n=36	Adolescent ED patients Gender ARFID: 79% female, 21% male AN: 92% female, 8% male Mean illness duration: 12 years (SD=8)	ARFID : 13.7 (2.5) AN: 14.9 (1.9)	Clinical features (Diagnostic criteria)	5% met criteria for ARFID Among ARFID sample, 26.5% had fear of vomiting and 17% experienced nausea
Sykes 2015	Co- morbidity	Cross- sectional study n=64	SPOV participants (assessed by SCID) (85.9% female, 14.1% male)	32.2 years (8.1)	SCID	All 64 participants had SPOV diagnosis See Table 5 for co- morbidity rates
van Hout 2012	Co- morbidity	Cross- sectional study Vomit-fearful (VF) group n=19	Community groups VF 89.5% female, 10.5% male CF 80%	VF 47.4 years (14.6) CF 46.4 years	PDSQ Survey Emetophobia Inventory (developed by authors)	Rates of additional psychiatric complaints in vomit- fearful group significantly higher than

Community fearful (CF) n=15 female, 20% male CC 56.4% female, 25.2 years
Community control (CC) n=156 43.6% male (4.3) years
Age of onset (mode): 13-18 years

community groups

See Table 5 for co-morbidity rates

Veale 2012	Co-morbidity	Cross sectional study n=94 Restricting food (SPOV-R, n=32) Not restricting food (SPOV-NR, n=62)	SPOV patients (assessed by SCID) (93.6% female, 6.4% male)	Total 32.6 years (12.1) SPOV-R 32.5 years (11.3) SPOV-NR 32.7 years (12.6)	PDSQ Fear of vomiting questionnaire SPOVI DS-R OCI HAI PHQ-9 GAD-7 WSAS	100% had diagnosis of SPOV See Table 5 for co-morbidity rates. Restricters had significantly lower BMI 3.7% of total sample had BMI <17.5 Restricters reported more nausea, SPOV symptoms, avoidance of eating situations and foods, severity of anxiety & handicap
Veale 2015	Co-morbidity	Cross sectional study n=83	Patients with SPOV (assessed by SCID) 86.7% females, 13.3% males Mean age	29.42 years (10.42)	Scales to measure repetitive thinking and repetitive behaviours SPOVI EmetQ HAI	Health Anxiety Mean score above cut-off suggesting relationship between SPOV symptoms and health anxiety

			of onset 8.2 years (SD=5.21)			Repetitive thinking 62.5% severely preoccupied by worry of vomiting Correlations between severity of SPOV and frequency of hand washing Late onset associated with more frequent hand washing
			Mean illness duration 14.25 years (SD=11.6 9)			
Becker 2007	Epidemiolo gy	Prospective epidemiologic al study n=2064	Communi ty sample (aged 18- 24 years) 100% female Mean age of onset 7.5 years (SD=5.20) Mean illness duration: 12.75 years (SD=6.85)	Not stated	F-DIPS	Lifetime prevalence of SP = 12.8% SPOV prevalence rates: Lifetime 0.2% 12 month 0.2% Point 0.1%

PDSQ, Psychiatric Diagnostic Screening Questionnaire; ED, Eating Disorder; AN, Anorexia Nervosa; ARFID, Avoidant and Restrictive Feeding Disorder; F-DIPS, “Diagnostisches Interview bei Psychischen Störungen—Forschungsversion” (translation: Diagnostic Interview for Mental Disorders—Research Version); SP, Specific Phobia; SCID, Structured Clinical Interview for DSM; F-DIPS

Table 5. Comorbidity rates reported across studies

Author	Average %	n
None	59.5	348
One	27.7	414
Two or more	15.9	414
Specific Phobia	4.1	581
Agoraphobia	5.5	486
Panic disorder	10.2	600
Major depressive disorder	13.6	636
Bipolar disorder	0	64
Social phobia	10.1	542
Obsessive compulsive disorder	9.6	617
Childhood separation anxiety	57	56
Generalised anxiety disorder	14.1	478
Health anxiety	2.8	319
Somatisation disorder	7.3	497
Hypochondriasis	5.9	159
Post traumatic stress disorder	1.4	147
Body dysmorphic disorder	1.6	64
Personality disorder	2.4	83
Eating disorder	1.1	177

NB: Averages in bold are weighted averages of percentages calculated across studies

Table 6. Studies exploring assessment measures and effectiveness of psychological treatments for SPOV (n=6)

Author	Area studies	Study design/ Sample size	Participants	Mean age (SD)	Type of measure	outcome	Intervention (type, dose, duration and frequency vs placebo type dose duration and frequency)	Main findings
Boschen 2013	Assessment measures	Cross-sectional study SPOV n=95 Healthy control (HC) n=90 Anxious control (AC) n=20	SPOV patients (diagnosed by SCID) (93.7% female) HC (95.6% female) AC (100% female)	SPOV 32.61 years (12.09) HC 32.45 years (11.0) AC 29.01 years (7.13)	Behavioural test assessing ability to approach a vomit-like stimulus SPOVI EmetQ-13 DS-R OCI PHQ-9 GAD-7 HAI WSAS		N/A	Emet-Q found to have good internal consistency, good test re-test reliability, good sensitivity and diagnostic specificity
Veale 2013b	Assessment measures	Longitudinal study SPOV n=95 Community n=90	SPOV group (assessed by SCID) 93.7% female, 6.3% male Community 96.7% female,	Mean age SPOV: 32.61 years (12.09) Community: 32.47 years (11.0)	SPOVI EmetQ-13 DS-R OCI HAI PHQ-9 GAD-7 WSAS		N/A	SPOVI was found to have good internal consistency, test re-test reliability, concurrent and convergent

			3.3% male					nt validity, and sensitivity to change during treatment.
Ahlen 2015	Treatment	Longitudinal cohort design	23 SPOV patients (assessed by MINI) (96% female) Mean age of onset 16 years (SD = 8.4) Mean illness duration 15 years (SD = 10.6)	32.3 years (8.1)	EmetQ BAI MADRS-S CSQ-8		Format: Group Content : CBT Intensity: weekly 2.5 hr sessions, 10 weeks, one follow up session.	Symptoms Significant reduction in SPOV symptoms, anxiety and depression over time Clinical significance 48% clinically significantly improved 67% clinically significantly improved at follow-up.
Klönoff 2009	Treatment	Longitudinal cohort study	5 SPOV patients (80% female,	10.5 years	Parents & child symptom frequency ratings		Content : Contingency	All patients symptom-free

			20% male)			manage ment, parent training and relaxation	post treatment, maintained at follow-up (6 to 18 months).
Philips 1985	Treatment	Longitudinal cohort design	7 SPOV patients (71.4% female, 28.6% male) Mean age of onset 8.5 years Mean illness duration 17.4 yrs.	29.9 years	Behaviour tests Approach simulated patch of vomit, and watching film sequence of someone vomiting. FSS FNE BDI	Format: Group Content : ERP and relaxation Intensity: weekly 1 hr sessions, 8-13 weeks.	Symptoms Reduction in fear and depression over time Improvements maintained at 6 month follow-up.
Riddle-Walker 2016	Treatment	RCT	12 SPOV patients (CBT group) 12 SPOV patients (Control group)	CBT group 35 years (8) Wait list 32 years (17)	SPOVI EmetQ HAI ASI PHQ-9 SDS	Format: individual Content : CBT, imagery rescripting Intensity: 12x 60 minute sessions	Group differences Significantly lower SPOVI & EmetQ, and in CBT group than control group post-treatment Clinical significance Significantly more participa

nts in
CBT
group
achieved
reliable
improve
ment and
clinically
significant
in
SPOV
symptoms
compared
to
those in
wait list
group

DS-R, Disgust Sensitivity Revised; OCI, Obsessive Compulsive Inventory; PHQ-9, Patient Health Questionnaire; GAD7, Generalised Anxiety Disorder Questionnaire; HAI, Health Anxiety Inventory; WSAS, Work and Social Adjustment Scale; ASI, Anxiety Sensitivity Index; FSS, Fear Survey Schedule; FNE, Fear of Negative Evaluation; ERP, Exposure and Response Prevention; SDS, Sheehan Disability Scale; SCID, Structured Clinical Interview for DSM-IV; MINI, Mini-international neuropsychiatric interview; EmetQ, Emetophobia Questionnaire; SPOVI, Specific Phobia of Vomiting Inventory; BAI, Beck Anxiety Inventory; MADRS-S, Montgomery-Åsberg Depression Rating Scale—self assessment; BDI, Beck Depression Inventory; CSQ-8, Client Satisfaction Questionnaire

Appendix A.

Paper:		Score
Reviewer:		
Representativeness		
1. What kind of recruitment strategy has been used?	Randomized/consecutive (2)	
	Non-randomized/convenience (0)	
	Not stated (0)	
Sample size		
2. What is the sample size?	50-149 (0)	
	150-399 (1)	
	400+ (2)	
Participation rate		
3. Is the participation rate reported?	Yes (2)	
	No (0)	
4. Is participation rate >75%?	Yes (1)	
	No (0)	
Criteria for Specific Phobia		
5. How has specific phobia been detected?	Structured/semi structured clinical interview (2)	
	Screening tool (0)	
Eligibility criteria		
6. Have eligibility criteria been specified?	Yes (1)	
	No (0)	
Total		
Overall rating		

Appendix B.

Author/year:		
Reviewer:		
COMPONENT RATING		
A. Selection bias		
1. Are the individuals selected to participate in the study likely to be representative of the target population?		
2. What percentage of selected individuals agreed to participate?		
Section rating		
B. Study Design		
1. Indicate the study design		
2. Was the study described as randomized? If NO, go to Component c.		
3. If YES, was the method of randomization described?		
4. If YES, was the method appropriate?		
Section rating		
C. Confounders		
1. Were there important differences between groups prior to intervention?		
2. If YES, indicate the percentage of relevant confounders that were controlled (either in design or analysis)		
Section rating		
D. Blinding		
1. Was (were) the outcome assessor(s) aware of the intervention or exposure status of participants?		
2. Were the study participants aware of the research question?		
Section rating		
E. Data collection methods		
1. Were data collection tools shown to be valid?		
2. Were data collection tools shown to be reliable?		
Section rating		
F. Withdrawals and dropouts		

1. Were withdrawals and drop-outs reported in terms of numbers and/or reasons per group?		
2. Indicate the percentage of participants completing the study (if % differs by group, report the lowest)		
Section rating		
G. Intervention integrity		
1. What percentage of participants received the allocated intervention or exposure of interest?		
2. Was the consistency of the intervention measured?		
3. Is it likely that subjects received an unintended intervention (contamination or co-intervention) that may influence results?		
H. Analyses		
1. Indicate the unit of allocation		
2. Indicate the unit of analysis		
3. Are the statistical methods appropriate for the study design?		
4. Is the analysis performed by intervention allocation status (i.e. intention to treat) rather than the actual intervention received?		

GLOBAL RATING	
A. Selection bias	
B. Study design	
C. Confounders	
D. Blinding	
E. Data collection method	
F. Withdrawals and dropouts	
GLOBAL RATING

Figure 1. PRISMA (2009) Flow Diagram

Highlights

- The first systematic review of existing literature on Specific Phobia of Vomiting
- Lack of research compared to other phobias, especially into effective interventions
- RCTs needed to evaluate effective treatments and comparison to other approaches