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Does weight loss with GLP-1 receptor agonists weaken the pelvic floor? A mechanism-oriented disproportionality analysis of 336,826 reports in FAERS and Canada Vigilance

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Does weight loss with GLP-1 receptor agonists weaken the pelvic floor? A mechanism-oriented disproportionality analysis of 336,826 reports in FAERS and Canada Vigilance

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Keywords. Disproportionality analysis; GLP-1 receptor agonists; Pelvic floor; Pharmacovigilance; Semaglutide; Urinary incontinence

Abstract

Purpose. Rapid weight loss with GLP-1 receptor agonists removes lean mass, and whether this weakens the pelvic floor and causes incontinence is under prospective study. We tested this mechanism against spontaneous reports.

Methods. Disproportionality analysis of FAERS with validation in Canada Vigilance, using an active comparator set of diabetes and obesity drugs, adjusted reporting odds ratios (ROR), SGLT2 inhibitors as positive control, and tests of the competing pelvic floor and diabetic bladder hypotheses.

Results. In FAERS and Canada Vigilance, GLP-1 receptor agonists as a class were not disproportionately reported with lower urinary tract events (adjusted ROR 0.43 and 0.50). Without SGLT2 inhibitors in the comparator set, semaglutide and DPP-4 inhibitors showed modest excess reporting of lower urinary tract events and urinary tract infection, tirzepatide did not. Semaglutide showed an incontinence signal in women (1.44, 95% CI 1.14 to 1.81; sex interaction p 0.02). It was numerically less frequent with obesity than diabetes use (OR 0.66, 0.34 to 1.28) and with Wegovy than Ozempic (0.64, 0.36 to 1.16), showed no dose-related increase among injectable reports, began early (median 2 days in 23 reports with dates), and clustered with urinary tract infection and other lower urinary tract symptoms, not with weight loss.

Conclusion. The semaglutide incontinence signal was early in onset, more frequent in diabetes-indicated reports and embedded in a urological cluster. This pattern is more compatible with diabetes-related urinary morbidity than with pelvic floor weakening, although spontaneous reports cannot settle mechanism, and does not support withholding treatment for fear of incontinence.

1 Introduction

Incretin-based drugs have changed the treatment of obesity. Semaglutide and the dual GIP and GLP-1 receptor agonist tirzepatide produce mean weight losses of 15% to 20% in trials [1, 2]. Use has spread fast, and many new users have no diabetes. Their safety outside the gut therefore matters to a much wider group of clinicians.

The lower urinary tract is one such area, and the question has become specific. Obesity is a strong and reversible risk factor for urinary incontinence, and in the PRIDE trial intensive weight loss reduced incontinence episodes in overweight women [3]. Yet rapid weight loss also removes lean mass, and the pelvic floor is muscle. A prospective study is now testing the hypothesis that GLP-1 receptor agonist therapy worsens lower urinary tract symptoms through this route [4]. Patients ask urologists about it, and the two views predict opposite effects.

Evidence on this question is thin. A recent case report noted that urogenital and lower urinary tract effects of these drugs have received little study [5]. A TriNetX cohort of non-diabetic patients receiving onabotulinumtoxinA for overactive bladder found less urinary retention and infection with concurrent GLP-1 receptor agonist use [6]. A recent review of these drugs for urologists found no randomized trial with a urological primary outcome [7]. No study has addressed incontinence, storage or voiding symptoms in the wider population of users.

Other urological outcomes have been studied in spontaneous reporting data. Disproportionality analyses have described signals for nephrolithiasis with semaglutide and liraglutide [8], for erectile dysfunction with semaglutide [9] and for acute kidney injury [10], and have examined male sexual dysfunction with the class [11]. A recent FAERS analysis separated obesity and diabetes indications for semaglutide and liraglutide, but examined renal and urinary disorders only as a system organ class [25]. None focused on lower urinary tract

symptoms, none examined incontinence, storage or voiding symptoms by indication, and few tested their findings in a second database. A two-database design has been used for drug-induced urinary retention, where reports of antidiabetic drugs rose over time [12], but not for incretin therapies.

A spontaneous reporting database cannot measure risk, but it can weigh competing mechanistic predictions, because competing mechanisms predict different patterns of reporting. If incontinence arose from loss of pelvic floor muscle, reports should favour the stress type, obesity use and the 2.4 mg weight loss dose, should begin months after the first injection when lean mass has fallen, should travel with reports of weight loss and muscle weakness, and should appear with every agent that causes weight loss. If instead the signal reflected the diabetic bladder and the infection prone urinary tract of women with diabetes, reports should favour diabetes use and the lower diabetes doses, begin early, travel with urinary tract infection and other storage and voiding symptoms, and differ sharply between agents and user populations. We therefore examined lower urinary tract events with incretin-based therapies in FAERS, tested the findings in Canada Vigilance, and then set these two hypotheses against each other in FAERS.

2 Methods

2.1 Study design and data sources

This was a retrospective disproportionality analysis in two spontaneous reporting databases. The derivation source was FAERS. We used the quarterly ASCII files from the first quarter of 2018 to the second quarter of 2026, which gave 34 quarters, and the demographic, drug, reaction, indication and outcome tables. The validation source was the Canada Vigilance Adverse Reaction Online Database [13], using the full data extract updated to 31 May 2026

and restricted to reports received from 2018 onward. The study follows the READUS-PV reporting guideline [14] (ESM 1). Both databases are public and de-identified, so ethics approval was not required.

The study was not preregistered. The primary composite outcome was refined after exploratory analyses, and the original broader definition is reported as a sensitivity analysis and gave similar results. Because some reports could in principle enter both databases, for example cases forwarded by manufacturers, the two databases are best described as largely separate rather than fully independent. We did not attempt record linkage.

2.2 Deduplication

In FAERS, each update of a case is stored as a new report. For every case identifier we kept only the latest version, chosen by FDA receipt date and then by report identifier. In Canada Vigilance we kept the latest version of each adverse reaction report number.

2.3 Drug exposure

Drugs were identified by active ingredient and brand name. In FAERS a drug counted as exposure only when coded as primary or secondary suspect. In Canada Vigilance it counted when coded as suspect. The study drugs were semaglutide, tirzepatide, liraglutide, dulaglutide and exenatide. Comparator groups were SGLT2 inhibitors, DPP-4 inhibitors, metformin, insulin, sulfonylureas with pioglitazone, and other anti-obesity drugs (ESM 1, Table S1). A report naming more than one GLP-1 receptor agonist counted toward each drug and once toward the class. This applied to 3,728 FAERS reports and 9 Canadian reports.

Indication was taken from the indication table and linked to the same drug line. Use was classed as obesity when the indication named obesity, overweight or weight management

without diabetes, and as diabetes when it named diabetes without a weight term. Reports with both or neither were left out of the indication analyses.

2.4 Outcomes

Outcomes were defined with MedDRA preferred terms as coded in each database. MedDRA versions differ by report date and were not harmonized. The primary outcome was a lower urinary tract composite of three groups based on the standard symptom domains. Incontinence included urinary, stress, urge, mixed and overflow incontinence, incontinence and enuresis. Storage symptoms included nocturia, pollakiuria and micturition urgency. Voiding symptoms included urinary retention, urinary hesitation, urine flow decreased, residual urine volume increased and feeling of residual urine. Polyuria and dysuria were not part of the primary composite, because they reflect urine volume and pain rather than bladder storage or emptying. A broader composite that added them was used as a sensitivity analysis. Secondary outcomes were urolithiasis (nephrolithiasis, calculus urinary, ureterolithiasis, renal colic, calculus bladder) and erectile dysfunction, the latter in reports from men only. Urinary tract infection and hematuria were explored in FAERS only (ESM 1, Table S5).

2.5 Positive control

SGLT2 inhibitors cause glycosuria and osmotic diuresis, and their link to genitourinary infection and urinary frequency is well known [15]. We used them as a positive control to show that the method could detect a true urinary signal in each database. The control is most informative for storage symptoms, the domain driven by osmotic diuresis, and it does not show equal sensitivity for every drug and outcome pair.

2.6 Statistical analysis

All analyses were restricted to reports in which any study or comparator drug was a suspect. This active comparator set reduces confounding by indication and limits the masking that occurs when a drug with many unrelated reports is compared with the whole database [16]. Each drug group was compared with all other reports in the set.

We calculated crude reporting odds ratios with 95% confidence intervals and the lower bound of the information component (IC025), a Bayesian shrinkage measure [17, 18]. Adjusted RORs came from logistic regression with frequency weights. In FAERS the model included age group (under 18, 18 to 44, 45 to 64, 65 and over, missing), sex, reporter type (health professional, consumer, unknown), report year and country (United States, other, missing). The Canadian model used the same covariates without country. Missing values were kept as their own category. Adjustment for report year partly accounts for time-varying publicity but cannot remove stimulated reporting. An adjusted ROR was estimated only when at least five exposed cases were present. A signal was defined as a lower 95% confidence limit above 1. Because many drug and outcome pairs were tested, we controlled the false discovery rate with the Benjamini and Hochberg method across the GLP-1 receptor agonist estimates in the primary table [19] and report q values.

Erectile dysfunction was analyzed in reports from men, and incontinence and the composite were also analyzed separately in women and men. These models did not include sex. To test whether indication modified reporting, we compared obesity use directly with diabetes use within each drug in a single logistic model, adjusted as above, and report the odds ratio for obesity use.

2.7 Sensitivity analyses

In FAERS we repeated the crude analysis among reports from health professionals and after removing every report that contained a common gastrointestinal event (nausea, vomiting, diarrhea, constipation, abdominal pain, decreased appetite, dyspepsia, abdominal distension, eructation, reflux). We also compared tirzepatide directly with semaglutide among reports that named only one of the two, and repeated the main analysis with the broader composite.

2.8 Mechanism analyses

To weigh pelvic floor weakening against diabetic bladder dysfunction we wrote down seven predictions before running these analyses, although they were not preregistered, and tested each in FAERS, the only database with enough cases. First, incontinence subtype, using the preferred terms stress urinary incontinence, urge incontinence and mixed incontinence against the unspecified term. Second, indication, comparing obesity with diabetes use within semaglutide in women for each outcome. Third, indication by brand, comparing Wegovy (2.4 mg, obesity) with Ozempic (0.25 to 2 mg, diabetes) and Rybelsus (oral) with Ozempic among reports that named only one brand, and Zepbound with Mounjaro for tirzepatide, with the same adjustment as the main models. Fourth, time to onset, the interval from the start date of the suspect drug to the event date when both were complete, restricted to 0 to 1,095 days and summarised as median, interquartile range and proportion within 90 days, with the shape parameter of a Weibull distribution and a bootstrap confidence interval, where a shape below 1 indicates reporting concentrated early after exposure [22]; this describes the timing of reports, not a clinical hazard. Fifth, co-reporting, comparing the proportion of incontinence reports and of other semaglutide reports that also named weight decreased, muscle weakness or atrophy, pelvic organ prolapse, hyperglycaemia or dehydration, gastrointestinal events, urinary tract infection, storage symptoms and voiding symptoms, with odds ratios and Fisher

tests. Sixth, heterogeneity of crude reporting odds ratios across the five agents, with Cochran Q and I^2. Seventh, the crude reporting odds ratio for semaglutide and incontinence by calendar year, to test whether the signal rose with the obesity use and publicity of 2023 onward. Eighth, recorded dose. Because oral semaglutide is dosed daily at 3 to 14 mg and injectable semaglutide weekly at 0.25 to 2.4 mg, we restricted the dose analysis to injectable reports (Ozempic, Wegovy or no brand, excluding Rybelsus and any oral route), tabulated incontinence, the composite and urinary tract infection by labelled injectable dose band, and tested for trend across bands with the Cochran-Armitage test. Oral reports were tabulated separately. Dose was recorded in about half of reports, and the lowest bands include the dose escalation weeks, so dose and time since initiation are partly confounded.

These analyses used the same deduplicated FAERS extract as the main analysis. The comparator drug list for these models included a few additional brand synonyms, so the active comparator set held 686,363 reports rather than 684,794, a difference of 0.2%, with identical counts for the GLP-1 receptor agonist class (331,693) and semaglutide (82,112). The semaglutide incontinence estimate in women in these models was 1.44 (1.15 to 1.82).

Because the positive control is also part of the comparator set, and SGLT2 inhibitors carry many urinary reports, their presence can lower the estimates for every other drug. We therefore repeated the adjusted models after removing SGLT2 inhibitor reports from the comparator set, and again after removing both SGLT2 and DPP-4 inhibitor reports, leaving metformin, insulin, sulfonylureas, pioglitazone and anti-obesity drugs as comparators. We tested whether the semaglutide incontinence signal differed by sex with a drug by sex interaction term in reports with known sex. We tabulated the completeness of indication coding for each GLP-1 receptor agonist. The mechanism analyses were exploratory, and we report Benjamini and Hochberg q values across the 23 indication, brand and co-reporting tests.

Analyses used DuckDB, Python 3 and statsmodels. The authors used a large language model, Claude (Anthropic), to help draft analysis code and edit the language of the manuscript. The authors checked all code, results and text and take full responsibility for the content.

3 Results

3.1 Reports and their characteristics

FAERS held 12,305,041 unique reports after deduplication. Of these, 684,794 formed the active comparator set, and 331,693 named a GLP-1 receptor agonist, including 153,761 for tirzepatide and 82,112 for semaglutide (Fig. 1). Canada Vigilance held 690,166 unique reports received from 2018 onward. Its active comparator set contained 15,487 reports, of which 5,133 named a GLP-1 receptor agonist, including 3,617 for semaglutide, 1,204 for liraglutide and 212 for tirzepatide.

Reporters differed sharply between drug groups in FAERS (Table 1). Tirzepatide users were the youngest (median 55 years) and most often women (76.0%), and consumers filed 80.1% of tirzepatide reports. DPP-4 inhibitor users were the oldest (median 70 years), and most of their reports came from health professionals. Age was missing in 31.6% to 57.6% of FAERS reports.

3.2 Primary outcome

In FAERS the positive control behaved as expected. SGLT2 inhibitors had a strong signal for the lower urinary tract composite (adjusted ROR 5.03, 95% CI 4.73 to 5.35) (Table 2, Fig. 2a). GLP-1 receptor agonists as a class had no signal (0.43, 0.40 to 0.46). Tirzepatide had the lowest estimate (0.34, 0.30 to 0.38) and semaglutide was neutral (0.94, 0.85 to 1.04).

Liraglutide, dulaglutide and exenatide were all below 1. Results with the broader composite were almost identical (ESM 1, Table S2).

Adjustment mattered for DPP-4 inhibitors. Their crude ROR for the composite was 1.48 (1.31 to 1.68), but the adjusted value was 0.93 (0.82 to 1.06). Their older age explained the crude excess.

In Canada Vigilance the class result was reproduced (adjusted ROR 0.50, 0.35 to 0.72), and semaglutide (0.62, 0.42 to 0.91) and liraglutide (0.42, 0.19 to 0.90) were also below 1 (Table 3, Fig. 2a). The positive control again showed a signal (1.64, 1.16 to 2.31), driven by storage symptoms (1.99, 1.34 to 2.97). Tirzepatide had too few Canadian cases for analysis.

3.3 Components of the composite

Among the components in FAERS, semaglutide showed a weak signal for incontinence (adjusted ROR 1.25, 1.03 to 1.51, q 0.028) and a borderline signal for voiding symptoms (1.25, 1.01 to 1.56, q 0.050). It showed none for storage symptoms (0.78, 0.68 to 0.88). Tirzepatide was below 1 for every component. In sex-restricted models the semaglutide incontinence signal was present in women (1.44, 1.14 to 1.81, 93 reports) and absent in men (0.82, 0.55 to 1.24) (Fig. 3a). The semaglutide composite in women was neutral (1.09, 0.96 to 1.25).

In Canada Vigilance the semaglutide incontinence estimate pointed the same way but was imprecise, both overall (1.37, 0.68 to 2.77, 13 reports) and in women (1.53, 0.62 to 3.77, 9 reports) (Fig. 2b). Voiding symptoms had too few Canadian cases to estimate.

3.4 Obesity versus diabetes use

In the direct comparison within each drug, semaglutide use for obesity was not associated with a different composite reporting than use for diabetes (OR 0.98, 0.73 to 1.32) (Table 4,

Fig. 3b). Tirzepatide use for obesity showed slightly lower reporting (0.70, 0.49 to 0.99). For the class, the composite did not differ clearly (0.82, 0.67 to 1.01), but incontinence was reported less often with obesity use (0.46, 0.29 to 0.73). In Canada Vigilance these comparisons had too few cases for precise estimates (ESM 1, Table S3).

3.5 Secondary outcomes

In FAERS, semaglutide had a urolithiasis signal (adjusted ROR 1.64, 1.45 to 1.86), as did liraglutide (1.35, 1.04 to 1.74), while tirzepatide did not (0.66, 0.57 to 0.76) (Fig. 2c). This signal was not reproduced in Canada Vigilance, where the estimates were 0.76 (0.46 to 1.26) for semaglutide and 0.70 (0.45 to 1.11) for the class.

Among FAERS reports from men, semaglutide had an erectile dysfunction signal (1.94, 1.55 to 2.43), as did liraglutide (2.03, 1.34 to 3.06), while tirzepatide did not (0.72, 0.52 to 0.98). Within semaglutide, reporting of erectile dysfunction was higher with obesity use than with diabetes use (OR 2.54, 1.35 to 4.77). Canada Vigilance contained a single semaglutide case, so this outcome could not be tested there.

3.6 Sensitivity analyses

In FAERS the composite findings held among health professional reports and after removal of gastrointestinal reports (ESM 1, Table S4). In the direct comparison, tirzepatide reports mentioned the composite less often than semaglutide reports (ROR 0.33, 0.29 to 0.38).

3.7 Mechanism analyses

Incontinence subtype could not be tested. Of 93 semaglutide reports of incontinence in women, 91 used the unspecified term urinary incontinence, none used stress urinary incontinence and two used urge or mixed incontinence, and the comparator drugs showed the

same coding (508 of 523 unspecified). Within semaglutide use in women, incontinence was reported less often with obesity than with diabetes use (15 versus 33 cases, adjusted OR 0.66, 0.34 to 1.28), as was urinary tract infection (83 versus 209 cases, 0.57, 0.43 to 0.76), while the composite did not differ (0.90, 0.62 to 1.32) (Table 5, Fig. 4a).

Among semaglutide reports, 52,803 named Ozempic, 19,474 Wegovy and 6,039 Rybelsus. Compared with Ozempic, Wegovy was reported less often with incontinence (adjusted ROR 0.64, 0.36 to 1.16), the composite (0.77, 0.58 to 1.01), storage symptoms (0.68, 0.45 to 1.01) and urinary tract infection (0.67, 0.53 to 0.84). Oral semaglutide was reported more often than Ozempic with the composite (1.42, 1.03 to 1.96) and storage symptoms (1.73, 1.15 to 2.59). For tirzepatide, Zepbound was reported less often than Mounjaro with the composite (0.53, 0.40 to 0.71), storage symptoms (0.52, 0.37 to 0.72) and urinary tract infection (0.53, 0.40 to 0.71).

A dose was recorded in 42,006 semaglutide reports, 38,307 injectable and 3,699 oral. Among injectable reports, incontinence fell rather than rose with dose, from 0.40% at 0.25 mg or less (34 of 8,425) to 0.19% at 1.7 to 2 mg (8 of 4,307) and 0.04% at 2 to 2.4 mg (1 of 2,376), with a decreasing trend (Cochran-Armitage p 0.001). The composite (0.87% to 0.17%) and urinary tract infection (0.78% to 0.42%) followed the same direction. Among 2,241 reports that recorded the Wegovy maintenance dose of 2.4 mg there was one incontinence report (0.04%), against 35 of 23,024 (0.15%) at Ozempic doses of 1 mg or less. Oral semaglutide had four incontinence reports among 3,699 (ESM 2, Table S9). Because the lowest bands include the dose escalation weeks, the decreasing trend should be read as the absence of a dose-related increase rather than as protection.

Time to onset was available for 16,919 semaglutide reports, including 23 of incontinence. Incontinence began a median of 2 days after the first dose (interquartile range 0 to 33), with

87% of cases within 90 days and 96% within 180 days, and a Weibull shape of 0.48 (0.41 to 0.62). The timing did not differ from other semaglutide events (median 14 days, 0 to 85, p 0.16) and was no later than reports of weight decreased (median 7 days, 0 to 68, 80% within 90 days, n 536). Storage symptoms (median 0 days, n 68), voiding symptoms (12 days, n 22) and urinary tract infection (16 days, n 124) followed the same early pattern. For the positive control, SGLT2 inhibitor incontinence began at a median of 14 days (2 to 94, n 83) and urinary tract infection at 63 days (12 to 242, n 898).

Of 130 semaglutide incontinence reports in both sexes, 71.5% came from women, 28.5% concerned people aged 65 or over, 38.5% came from health professionals and 18.5% were serious, all with hospitalisation. Compared with other semaglutide reports, these reports more often also named urinary tract infection (7.7% versus 0.8%, OR 11.0, 5.8 to 20.7), storage symptoms (6.9% versus 0.3%, 25.1, 12.8 to 49.1), voiding symptoms (5.4% versus 0.1%, 53.2, 24.8 to 114) and gastrointestinal events (37.7% versus 26.1%, 1.72, 1.21 to 2.45). They did not more often name weight decreased (3.8% versus 5.8%, 0.72, 0.31 to 1.69) or hyperglycaemia and dehydration terms (8.5% versus 6.7%, 1.34, 0.73 to 2.45). Muscle weakness or atrophy terms were present in six incontinence reports (4.6% versus 0.6%, 8.5, 3.9 to 18.9) and pelvic organ prolapse in two (Fig. 4b).

Reporting differed strongly between the five agents for the composite (I^2 99%, Q 268.5, $p < 0.001$), incontinence (97%), storage symptoms (97%), voiding symptoms (96%) and urinary tract infection (99%). The crude semaglutide incontinence ROR by calendar year was 1.99 (1.01 to 3.88) in 2020 and 2.05 (1.23 to 3.39) in 2021, before the obesity indication was widely used, and 1.15, 1.29, 1.28 and 0.78 (0.48 to 1.27) in 2023, 2024, 2025 and the first half of 2026, while semaglutide reports rose from 3,078 to more than 20,000 a year. Urinary tract infection and haematuria were reported less often with every GLP-1 receptor agonist than

with comparators (semaglutide 0.81, 0.74 to 0.88, and 0.47, 0.33 to 0.68; class 0.37 and 0.41) and more often with SGLT2 inhibitors (5.96, 5.67 to 6.27, and 2.22, 1.90 to 2.58).

3.8 Sensitivity and interaction analyses

Removing the 89,504 SGLT2 inhibitor reports from the mechanism analysis set of 686,363 reports changed the picture for semaglutide but not for the class (Table 6). The class estimate for the composite remained below 1 (adjusted ROR 0.79, 0.72 to 0.86), as did tirzepatide (0.47, 0.41 to 0.54) and dulaglutide (0.83, 0.72 to 0.95). Semaglutide, however, moved above 1 for the composite (1.44, 1.29 to 1.60), incontinence (1.77, 1.44 to 2.17), voiding symptoms (1.67, 1.32 to 2.12), storage symptoms (1.21, 1.05 to 1.39) and urinary tract infection (1.49, 1.36 to 1.64), and its incontinence estimate in women rose to 1.97 (1.54 to 2.51). DPP-4 inhibitors, which do not cause weight loss, showed the same pattern (incontinence 1.60, 1.26 to 2.04; urinary tract infection 1.76, 1.58 to 1.95). With both SGLT2 and DPP-4 inhibitors removed, semaglutide remained above 1 for the composite (1.37, 1.22 to 1.52) and incontinence (1.43, 1.14 to 1.79), tirzepatide remained below 1 (0.47 and 0.24) and the class estimate was 0.76 (0.69 to 0.83).

The semaglutide incontinence signal differed by sex. The adjusted ROR was 1.44 (1.15 to 1.82) in women and 0.79 (0.53 to 1.19) in men, with a drug by sex interaction odds ratio of 1.71 (1.08 to 2.69, p 0.022). Indication was recorded in 98% of semaglutide reports (obesity only 19.1%, diabetes only 32.3%, both 4.0%, another indication 42.8%) and in 97% to 99% of tirzepatide, liraglutide and dulaglutide reports, but was missing in 29.9% of exenatide reports. After false discovery rate correction across the 23 mechanism tests, the obesity versus diabetes difference for incontinence in women was not significant (q 0.30), whereas the differences for urinary tract infection ($q < 0.001$), the Zepbound versus Mounjaro comparisons for the composite, storage symptoms and urinary tract infection ($q < 0.001$), the

Rybelsus versus Ozempic comparison for storage symptoms (q 0.018) and the co-reporting of urinary tract infection, storage symptoms, voiding symptoms, muscle weakness and gastrointestinal events (all $q < 0.01$) remained significant. The Wegovy versus Ozempic comparisons for the composite and storage symptoms had q values of 0.10 (ESM 2, Tables S11 to S14).

4 Discussion

In two largely separate pharmacovigilance databases, incretin-based therapies were not linked to excess reporting of lower urinary tract events. In FAERS the class estimate was 0.43 and in Canada Vigilance it was 0.50. The same method detected a signal for SGLT2 inhibitors in both databases. This makes it less likely that the absence of a signal simply reflects an insensitive method, although it cannot rule out under-reporting or masking for specific drugs and outcomes, and the control speaks mainly to storage symptoms.

The question matters because two plausible mechanisms point in opposite directions, and our main contribution is to set them against each other. Weight loss lowers intra-abdominal pressure and improves continence [3], whereas rapid loss of lean mass could, in theory, weaken the pelvic floor [4]. Spontaneous reports cannot measure either effect, but the two mechanisms predict different reporting patterns, and in FAERS the reporting patterns did not provide affirmative support for the pelvic floor mechanism. The semaglutide incontinence signal was numerically less frequent with obesity use than with diabetes use and with Wegovy than with Ozempic, although neither difference reached conventional significance, and among injectable reports incontinence fell rather than rose with dose, with one report among 2,241 at the 2.4 mg Wegovy dose that produces the largest weight loss. In the 23 reports with onset dates it began a median of 2 days after the first dose, not after the months needed to lose muscle, and no later than any other semaglutide event. It did not travel with reports of weight

loss. It travelled instead with urinary tract infection, urgency, nocturia and retention, the cluster that urologists recognise in women with long-standing diabetes [23, 24]. It differed sharply between agents, and it was present in 2020 and 2021, when semaglutide was almost only a diabetes drug, and did not rise when obesity use expanded. Body composition data showing that lean mass is largely preserved with semaglutide point the same way [20]. These are comparisons between reporting patterns, several of the estimates are imprecise, and the databases hold no measure of diabetes duration, glycaemic control, neuropathy or pelvic floor function, so we can say which explanation the patterns are more compatible with, not which mechanism operates.

The alternative reading is that the signal is a feature of the population rather than of the drug. Women with type 2 diabetes have a high baseline prevalence of urgency incontinence and of urinary tract infection [23, 24], and a new injectable therapy prompts contact with health services and manufacturers, during which existing bladder symptoms are recorded against the new drug. The early onset, the clustering with infection and other lower urinary tract symptoms, and the absence of the signal in women treated for obesity all fit this reading. Two observations do not fit cleanly. Muscle weakness or atrophy terms accompanied six incontinence reports, and pelvic organ prolapse two. These are small numbers in a database of 82,000 semaglutide reports, and muscular weakness is a common nonspecific term, but we report them because they are the only findings in the direction of the pelvic floor hypothesis. The prospective study now under way, with pelvic floor symptom outcomes collected before and during treatment, remains the right instrument to settle the question [4]. Our data suggest it should stratify by diabetes status and by baseline urgency, because that is where the reports are.

The gap between tirzepatide and semaglutide was consistent in FAERS. Part of it is likely artifact. Tirzepatide reports came mostly from younger consumers, who tend to report

gastrointestinal events and expected effects. Adjustment narrowed the gap but did not remove it, and the small number of Canadian tirzepatide reports did not allow replication. Within tirzepatide, Zepbound carried about half the lower urinary tract and infection reporting of Mounjaro, which repeats the semaglutide pattern of fewer reports with obesity use. The finding that oral semaglutide was reported more often than the injection with storage symptoms most likely reflects its older and more exclusively diabetic user population and should not be read as a formulation effect. A pharmacological difference between agents cannot be judged from these data.

The sensitivity analysis without SGLT2 inhibitors deserves emphasis, because it changes how the null class result should be read. With the positive control in the comparator set, semaglutide looked neutral for lower urinary tract events. Without it, semaglutide showed a modest excess for the composite, incontinence, voiding symptoms and urinary tract infection, while tirzepatide stayed well below 1 and the class estimate stayed below 1 because tirzepatide supplies nearly half of the class reports. The null class result therefore means that incretin therapies as a group are not reported with lower urinary tract events more often than other diabetes and obesity drugs, not that no single agent is. Two features of the semaglutide excess argue that it belongs to the population rather than to the molecule. It was shared by DPP-4 inhibitors, which cause no weight loss and whose users are older people with diabetes, and it was absent for tirzepatide, Wegovy and Zepbound, the drugs and brands used mainly for obesity. A drug effect on the bladder would be expected to follow the molecule across indications, and a weight loss effect to follow the drugs that produce the most weight loss. Neither pattern was seen. The sex interaction test shows that the semaglutide incontinence signal is stronger in women, although an effect in men cannot be excluded, and women with diabetes are the group in which urgency incontinence and urinary tract infection are most prevalent [23, 24].

The semaglutide urolithiasis signal in FAERS agrees with an earlier FAERS analysis [8], and a large cohort study has linked GLP-1 receptor agonists to a higher risk of nephrolithiasis [21]. Yet the signal did not replicate in Canada Vigilance. It may be specific to FAERS reporting, or the Canadian data may have been too small to detect it. We therefore present it as unconfirmed. This discordance illustrates the value of a second database before a signal is described as established.

The erectile dysfunction signal with semaglutide confirms a recent FAERS report [9]. An earlier FAERS analysis reported a low class-level ROR for male sexual dysfunction [11], which fits the null class-level estimate we found (1.20, 0.99 to 1.46). Our drug-level and indication-level analyses show heterogeneity that a class-level estimate hides. The new observation is that the semaglutide signal was stronger with obesity use than with diabetes use in a direct comparison. Younger men treated for obesity may be more likely to notice and report sexual change, and rapid weight loss, mood change and expectation could also play a part. Canada Vigilance had too few cases to test this, so it remains a single-database finding.

The DPP-4 inhibitor results show why adjustment is needed. Their crude excess for the composite disappeared after adjustment for age. Unadjusted disproportionality can mislead when user populations differ, as they do sharply between these drug classes.

4.1 Strengths and limitations

The study used eight and a half years of FAERS reports, external validation in a second national database, an active comparator design, a positive control, adjusted estimates, correction for multiple testing, a direct comparison of indications, and a set of mechanism tests defined before they were run, although not preregistered, that used the internal structure of the reports, indication, brand, dose, timing and co-reported events, rather than the signal alone.

The limits are those of spontaneous reporting. Neither database has a denominator, so incidence and risk cannot be estimated. Reporting depends on publicity, expectation and who reports, and tirzepatide reports in FAERS came almost entirely from consumers. Canada Vigilance was about 45 times smaller than the FAERS active comparator set and held few tirzepatide reports, which limited the power of the validation for secondary outcomes and ruled out mechanism tests there. The positive control signal was weaker in Canada than in FAERS. The databases may share some reports, and we did not link records. We had no data on treatment duration, diabetes control, body mass index or concurrent drugs that affect the bladder, such as diuretics and antimuscarinics, so confounding by indication within diabetes use cannot be excluded. Time to onset was recorded in only 23 of 130 semaglutide incontinence reports, and FAERS dates of onset are subject to recall. Incontinence subtype was coded in 2 of 93 reports, so the stress versus urgency prediction could not be tested. Brand is an imperfect proxy for dose and indication because Ozempic is also used off label for weight loss. Dose was recorded in about half of reports, and dose bands partly track time since initiation because of dose escalation, so the dose analysis can show the absence of an increase but cannot separate dose from treatment duration. Co-reporting odds ratios describe which terms appear together in a report, not a causal sequence. The mechanism tests were exploratory, and after false discovery rate correction the obesity versus diabetes difference for incontinence was not significant, so the indication and brand findings are directions of effect rather than established differences. The heterogeneity statistic across agents treats the five estimates as independent, although they share a comparator group, so I^2 is approximate. The main estimates depend on the comparator set, as the sensitivity analysis without SGLT2 inhibitors shows, and we present both. Age was missing in up to 58% of FAERS reports, and indication was often missing. Outcome terms were chosen by us, and some events may be

coded under other terms. Many comparisons were made, so isolated signals may arise by chance despite correction. Reports from different countries and years may not be comparable.

5 Conclusions

In FAERS and in Canada Vigilance, incretin-based therapies as a class were not associated with disproportionate reporting of lower urinary tract events, although semaglutide showed a modest excess for lower urinary tract events and urinary tract infection once SGLT2 inhibitors were removed from the comparator set, a pattern shared with DPP-4 inhibitors and absent for tirzepatide. Semaglutide showed an incontinence signal that was stronger in women and pointed the same way in both databases, but its pattern, early in onset, without a dose-related increase among injectable reports, numerically more frequent in diabetes-indicated reports and embedded in a cluster of urinary tract infection and other lower urinary tract symptoms, was more compatible with diabetes-related urinary morbidity than with pelvic floor weakening from lean mass loss, although competing explanations could not be distinguished definitively. The urolithiasis signal seen in FAERS did not replicate, and the erectile dysfunction signal in men was stronger with obesity use.

For urologists, these data do not justify withholding incretin therapy for fear of incontinence, and they do not support attributing new incontinence in a woman losing weight on semaglutide to her pelvic floor before infection, poor glycaemic control and pre-existing overactive bladder have been excluded. New lower urinary tract symptoms in the first weeks of treatment deserve a urinalysis and a review of diabetes control before the drug is blamed or stopped. The findings describe reporting patterns in two large national systems rather than individual risk, and should be tested in prospective cohorts that record diabetes status, body composition and continence.

Statements and Declarations

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Conflicts of interest. Ahmet Selimoğlu, Akif Türk and Mete Ucdal have no conflicts of interest that are directly relevant to the content of this article.

Ethics approval. This study used public, de-identified data from FAERS and Canada Vigilance. Ethics approval was not required because no individual patient could be identified.

Consent to participate. Not applicable.

Consent for publication. Not applicable.

Availability of data and material. The data analyzed in this study are publicly available. The FAERS quarterly ASCII data files for the first quarter of 2018 to the second quarter of 2026 are available from the US Food and Drug Administration at https://fis.fda.gov/extensions/FPD-QDE-FAERS/FPD-QDE-FAERS.html. The Canada Vigilance data extract (updated to 31 May 2026) is available from Health Canada at https://www.canada.ca/en/health-canada/services/drugs-health-products/medeffect-canada/adverse-reaction-database/canada-vigilance-online-database-data-extract.html. No new datasets were generated.

Code availability. The analysis scripts are available from the corresponding author on reasonable request.

Author contributions. M.U. conceived and designed the study, acquired and analyzed the data, prepared the figures and tables, and wrote the first draft of the manuscript. A.S. and A.T. contributed to the clinical interpretation of the urological outcomes and revised the

manuscript critically for important intellectual content. All authors read and approved the final manuscript and agree to be accountable for all aspects of the work.

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Tables

Table 1. Characteristics of FAERS reports by drug group, active comparator set

Drug group	Reports, n	Age, median (IQR), y	Age missing, %	Women, %	Health professional, %	Consumer, %	United States, %	Serious, %	Death, %
Semaglutide	82,112	61 (50 to 70)	46.7	67.6	26.6	53.3	77.9	22.2	1.3
Tirzepatide	153,761	55 (45 to 65)	31.6	76.0	5.2	80.1	87.3	7.2	0.5
Liraglutide	15,255	59 (49 to 68)	39.2	68.2	32.2	61.5	66.3	30.6	4.4
Dulaglutide	65,978	63 (54 to 71)	57.6	58.0	11.4	85.3	92.7	11.6	1.5
Exenatide	18,912	66 (58 to 72)	45.5	53.7	11.8	74.4	74.0	8.2	2.2
All GLP-1 RA	331,693	59 (48 to 68)	41.8	68.4	13.3	73.7	84.3	12.4	1.1
SGLT2 inhibitors	88,973	65 (55 to 74)	41.6	44.6	48.2	36.8	48.4	48.7	12.5
DPP-4 inhibitors	23,992	70 (60 to 78)	32.8	50.3	57.5	36.4	40.6	46.0	8.6

Women, % is among reports with known sex. Serious means death, life-threatening event, hospitalization, disability, congenital anomaly or required intervention.

Table 2. Adjusted reporting odds ratios (95% CI) in FAERS, active comparator set

Outcome	Semaglutide	Tirzepatide	Liraglutide	Dulaglutide	Exenatide	All GLP-1 RA	SGLT2 inhibitors	DPP-4 inhibitors
LUT composite	0.94 (0.85 to 1.04) [468]	0.34 (0.30 to 0.38) [311]	0.70 (0.56 to 0.86) [85]	0.54 (0.47 to 0.61) [267]	0.33 (0.26 to 0.42) [73]	0.43 (0.40 to 0.46) [1,197]	5.03 (4.73 to 5.35) [2,284]	0.93 (0.82 to 1.06) [259]
Incontinence	1.25 (1.03 to 1.51) [130]	0.19 (0.14 to 0.27) [41]	0.63 (0.39 to 1.03) [17]	0.47 (0.34 to 0.64) [41]	0.29 (0.16 to 0.53) [11]	0.41 (0.35 to 0.49) [238]	2.98 (2.59 to 3.43) [379]	1.22 (0.96 to 1.56) [75]
Storage symptoms	0.78 (0.68 to 0.88) [263]	0.35 (0.30 to 0.41) [228]	0.66 (0.50 to 0.87) [53]	0.56 (0.48 to 0.64) [214]	0.34 (0.26 to 0.44) [59]	0.40 (0.36 to 0.43) [814]	7.17 (6.65 to 7.73) [1,711]	0.92 (0.78 to 1.09) [149]
Voiding symptoms	1.25 (1.01 to 1.56) [100]	0.47 (0.34 to 0.64) [49]	0.85 (0.53 to 1.36) [18]	0.49 (0.33 to 0.75) [24]	Not estimable [3]	0.63 (0.53 to 0.75) [192]	2.08 (1.79 to 2.42) [317]	0.78 (0.59 to 1.02) [57]
Urolithiasis	1.64 (1.45 to 1.86) [325]	0.66 (0.57 to 0.76) [279]	1.35 (1.04 to 1.74) [61]	1.14 (0.96 to 1.35) [157]	1.15 (0.86 to 1.53) [51]	1.19 (1.07 to 1.32) [860]	1.31 (1.15 to 1.48) [353]	0.86 (0.68 to 1.09) [78]
Erectile dysfunction, men	1.94 (1.55 to 2.43) [105]	0.72 (0.52 to 0.98) [52]	2.03 (1.34 to 3.06) [24]	0.62 (0.40 to 0.94) [23]	Not estimable [4]	1.20 (0.99 to 1.46) [203]	0.99 (0.80 to 1.23) [123]	2.08 (1.58 to 2.74) [62]

Adjusted for age group, sex, reporter type, report year and country, with sex omitted for erectile dysfunction. Numbers in brackets are exposed cases. Not estimable means fewer than five exposed cases. False discovery rate q values for the GLP-1 receptor agonist estimates are given in ESM 1, Table S2. LUT, lower urinary tract.

Table 3. Adjusted reporting odds ratios (95% CI) in Canada Vigilance, active comparator set

Outcome	Semaglutide	Liraglutide	All GLP-1 RA	SGLT2 inhibitors	DPP-4 inhibitors
Reports, n	3,617	1,204	5,133	2,763	1,192
LUT composite	0.62 (0.42 to 0.91) [35]	0.42 (0.19 to 0.90) [7]	0.50 (0.35 to 0.72) [44]	1.64 (1.16 to 2.31) [54]	0.43 (0.22 to 0.85) [9]
Incontinence	1.37 (0.68 to 2.77) [13]	Not estimable [2]	1.07 (0.56 to 2.08) [16]	1.35 (0.65 to 2.81) [11]	1.56 (0.64 to 3.76) [6]
Storage symptoms	0.41 (0.25 to 0.68) [19]	Not estimable [4]	0.33 (0.21 to 0.52) [24]	1.99 (1.34 to 2.97) [42]	Not estimable [2]
Voiding symptoms	Not estimable [4]	Not estimable [1]	0.63 (0.23 to 1.74) [5]	0.77 (0.28 to 2.14) [5]	Not estimable [2]
Urolithiasis	0.76 (0.46 to 1.26) [22]	0.84 (0.40 to 1.78) [8]	0.70 (0.45 to 1.11) [31]	0.89 (0.51 to 1.56) [17]	Not estimable [0]
Incontinence, women	1.53 (0.62 to 3.77) [9]	Not estimable [2]	1.33 (0.58 to 3.06) [12]	Not estimable [3]	Not estimable [4]

Adjusted for age group, sex, reporter type and report year, with sex omitted for the women-only row. Numbers in brackets are exposed cases. Tirzepatide (212 reports), dulaglutide (106) and exenatide (3) had too few cases for any outcome, and erectile dysfunction could not be estimated for any GLP-1 receptor agonist.

Table 4. Direct comparison of obesity use with diabetes use within each drug, FAERS

Outcome	Semaglutide, OR (95% CI)	Tirzepatide, OR (95% CI)	All GLP-1 RA, OR (95% CI)
LUT composite	0.98 (0.73 to 1.32)	0.70 (0.49 to 0.99)	0.82 (0.67 to 1.01)
Incontinence	0.66 (0.36 to 1.19)	0.71 (0.27 to 1.90)	0.46 (0.29 to 0.73)
Urolithiasis	0.84 (0.60 to 1.19)	1.24 (0.84 to 1.85)	0.88 (0.71 to 1.10)
Erectile dysfunction, men	2.54 (1.35 to 4.77)	0.45 (0.19 to 1.09)	1.52 (0.95 to 2.43)

Odds ratio for obesity use compared with diabetes use among reports of the same drug, adjusted for age group, sex, reporter type, report year and country, with sex omitted for erectile dysfunction. An odds ratio below 1 means less reporting with obesity use.

Table 5. Predictions of the pelvic floor and diabetic bladder hypotheses and the observed pattern for the semaglutide incontinence signal in FAERS

Test	Pelvic floor hypothesis predicts	Diabetic bladder hypothesis predicts	Observed
Incontinence subtype	Stress type	Urgency or mixed type	Not testable. 91 of 93 reports in women coded as unspecified urinary incontinence
Indication, women	More with obesity use	More with diabetes use	OR obesity vs diabetes 0.66 (0.34 to 1.28); urinary tract infection 0.57 (0.43 to 0.76)
Brand as dose and indication proxy	Wegovy above Ozempic	Ozempic above Wegovy	Wegovy vs Ozempic 0.64 (0.36 to 1.16); composite 0.77 (0.58 to 1.01); Zepbound vs Mounjaro composite 0.53 (0.40 to 0.71)
Recorded dose, injectable reports	Rises with dose, highest at 2.4 mg	No increase with dose	Falls with dose, 0.40% at 0.25 mg or less to 0.04% at 2 to 2.4 mg (trend p 0.001); 1 of 2,241 Wegovy 2.4 mg reports
Time to onset	Late, after months of lean mass loss	Early, in the first weeks	Median 2 days (0 to 33) in 23 reports with onset dates; 87% within 90 days; Weibull shape 0.48 (0.41 to 0.62)
Co-reported terms	Weight decreased, muscle weakness, prolapse	Urinary tract infection, storage and voiding symptoms, glycaemic terms	Weight decreased OR 0.72 (0.31 to 1.69); urinary tract infection 11.0; storage 25.1; voiding 53.2; muscle weakness 8.5 (6 reports); prolapse 2 reports
Consistency across agents	Present with every weight loss agent	Specific to agent and population	I^2 97% for incontinence, 99% for composite
Drugs without weight loss	Absent with DPP-4 inhibitors	Present with DPP-4 inhibitors, whose users are older people with diabetes	DPP-4 incontinence 1.60 (1.26 to 2.04) and semaglutide 1.77 (1.44 to 2.17) with SGLT2 inhibitors excluded; tirzepatide 0.24
Calendar trend	Rises with obesity use from 2023	Stable or falling	Crude ROR 2.05 in 2021, 1.28 in 2025, 0.78 in 2026

Estimates for indication and brand comparisons are odds ratios from logistic models adjusted for age group, sex, reporter type, report year and country, with sex omitted in women-only models. Co-reporting odds ratios compare semaglutide incontinence reports with other semaglutide reports. OR, odds ratio; ROR, reporting odds ratio.

Table 6. Adjusted reporting odds ratios (95% CI) in FAERS after removing SGLT2 inhibitor reports from the active comparator set

Outcome	Semaglutide	Tirzepatide	All GLP-1 RA	DPP-4 inhibitors
LUT composite	1.44 (1.29 to 1.60) [447]	0.47 (0.41 to 0.54) [304]	0.79 (0.72 to 0.86) [1,117]	1.13 (0.99 to 1.30) [243]
Incontinence	1.77 (1.44 to 2.17) [124]	0.24 (0.17 to 0.34) [41]	0.60 (0.50 to 0.72) [227]	1.60 (1.26 to 2.04) [85]

Outcome	Semaglutide	Tirzepatide	All GLP-1 RA	DPP-4 inhibitors
Incontinence, women	1.97 (1.54 to 2.51) [92]	Not estimable	0.66 (0.53 to 0.83) [169]	Not estimated
Storage symptoms	1.21 (1.05 to 1.39) [244]	0.51 (0.43 to 0.60) [221]	0.80 (0.72 to 0.90) [745]	1.25 (1.04 to 1.51) [131]
Voiding symptoms	1.67 (1.32 to 2.12) [94]	0.60 (0.43 to 0.84) [49]	0.89 (0.72 to 1.09) [181]	0.76 (0.57 to 1.02) [53]
Urinary tract infection	1.49 (1.36 to 1.64) [602]	0.37 (0.32 to 0.41) [343]	0.72 (0.66 to 0.78) [1,379]	1.76 (1.58 to 1.95) [469]
With SGLT2 and DPP-4 inhibitors removed				
LUT composite	1.37 (1.22 to 1.52) [424]	0.47 (0.41 to 0.54) [304]	0.76 (0.69 to 0.83) [1,083]	Removed
Incontinence	1.43 (1.14 to 1.79) [101]	0.24 (0.17 to 0.34) [41]	0.49 (0.41 to 0.59) [200]	Removed

Sensitivity analyses used the mechanism analysis set of 686,363 reports (Sect. 2.8), which holds 89,504 SGLT2 inhibitor reports against 88,973 in the main set because of additional brand synonyms; removing them left 596,859 reports, and 571,643 after also removing DPP-4 inhibitor reports. Adjusted for age group, sex, reporter type, report year and country, with sex omitted in the women-only row. Numbers in brackets are exposed cases. Liraglutide, dulaglutide and exenatide estimates are in ESM 2, Table S11. LUT, lower urinary tract.

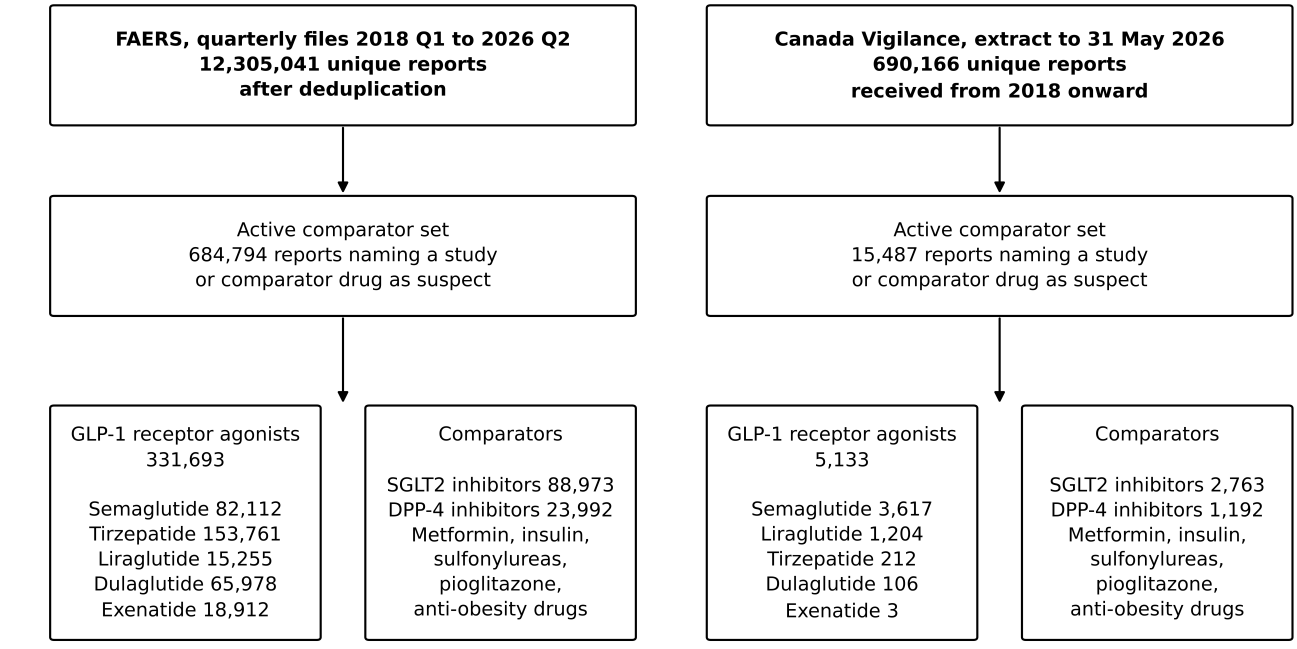
Figure legends

Fig. 1 Selection of reports in FAERS and Canada Vigilance. The active comparator set contains all reports that name a study or comparator drug as suspect. GLP-1 RA, GLP-1 receptor agonist. Counts for single drugs sum to more than the class total because a report may name more than one GLP-1 receptor agonist

Fig. 2 Adjusted reporting odds ratios in FAERS (squares) and Canada Vigilance (circles). (a) Lower urinary tract composite. (b) Incontinence. (c) Urolithiasis. Each group is compared with all other reports in the active comparator set of its database. Bars show 95% confidence intervals on a log scale. SGLT2 inhibitors are the positive control. n.e., not estimable because of fewer than five exposed cases. The dashed line marks no disproportionality

Fig. 3 Subgroup analyses in FAERS. (a) Adjusted reporting odds ratios for incontinence in women and men for semaglutide, all GLP-1 receptor agonists and SGLT2 inhibitors, from the sex-specific models of the interaction analysis (ESM 2, Table S12). (b) Adjusted odds ratios for obesity use compared with diabetes use within each drug. Bars show 95% confidence intervals on a log scale. The dashed line marks no difference

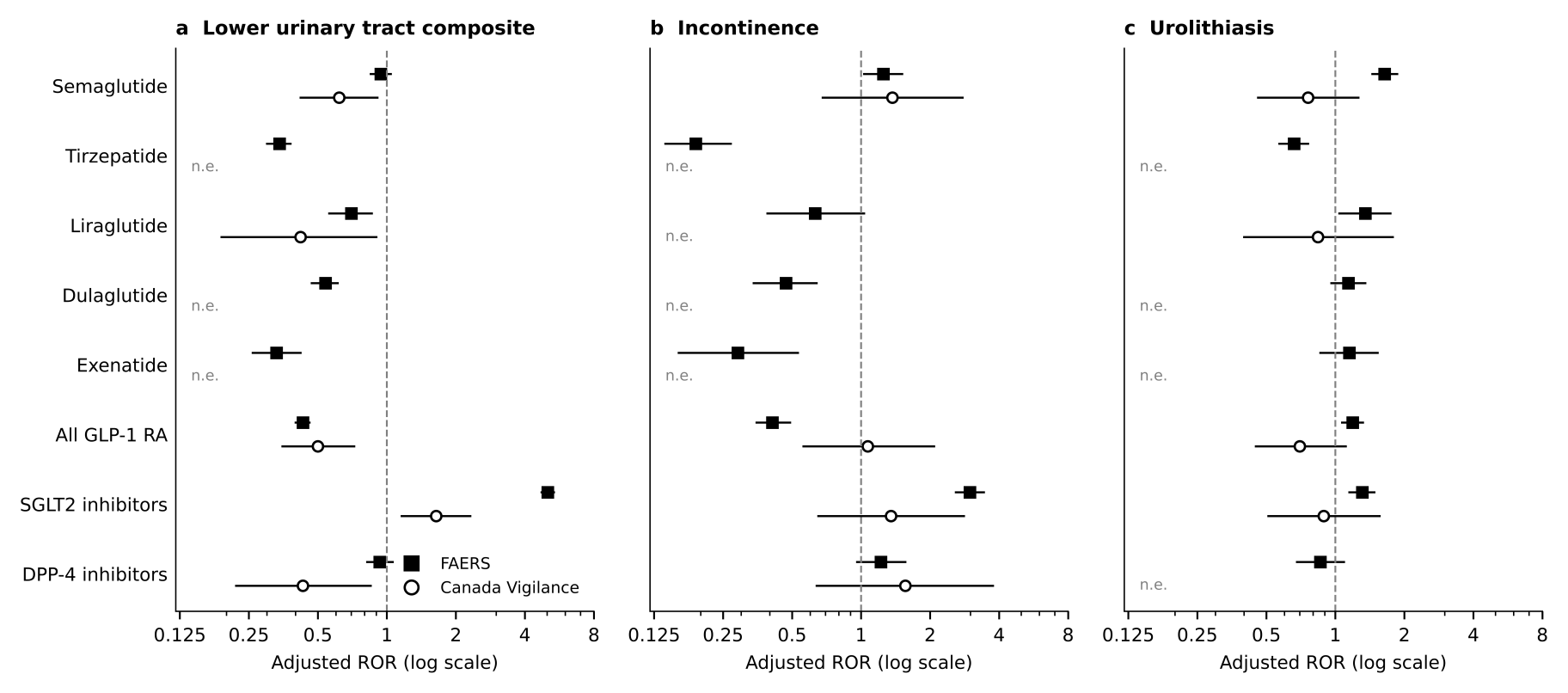
Fig. 4 Mechanism tests for the semaglutide incontinence signal in FAERS. (a) Adjusted odds ratios for obesity compared with diabetes use in women, for Wegovy compared with Ozempic, for Rybelsus compared with Ozempic and for Zepbound compared with Mounjaro, for incontinence, the lower urinary tract composite, storage symptoms and urinary tract infection. (b) Crude odds ratios for co-reporting of other terms in semaglutide incontinence reports compared with other semaglutide reports. Bars show 95% confidence intervals on a log scale. The dashed line marks no difference. LUT, lower urinary tract

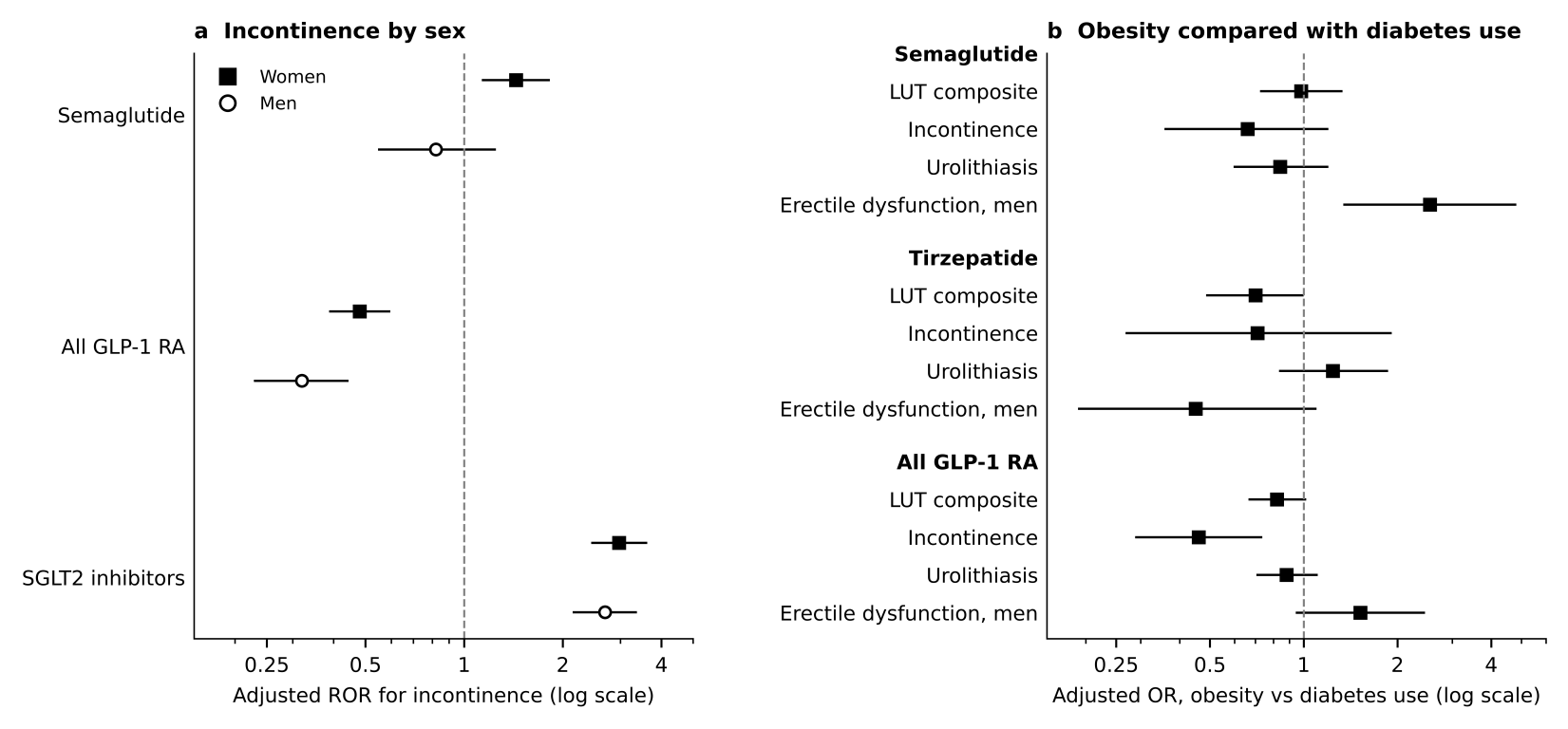


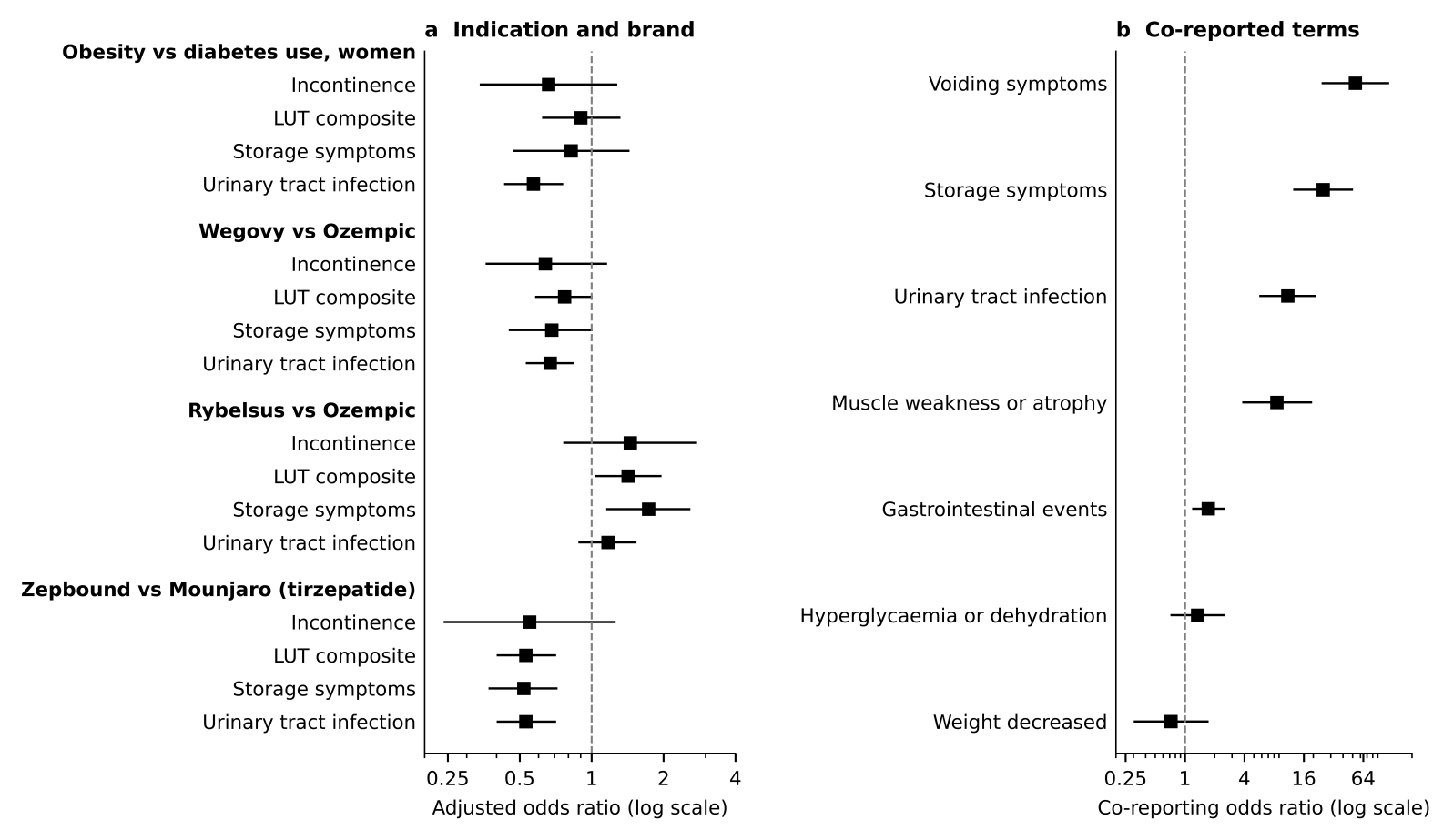
Derivation. Adjusted ROR, components, indication, mechanism tests

Validation. Class, drug and component estimates

Counts for single drugs sum to more than the class total because a report may name more than one GLP-1 receptor agonist


a Lower urinary tract composite
b Incontinence
c Urolithiasis
Semaglutide
Tirzepatide
Liraglutide
Dulaglutide
Exenatide
All GLP-1 RA
SGLT2 inhibitors
DPP-4 inhibitors
n.e.
FAERS
Canada Vigilance
0.125
0.25
0.5
1
2
4
8
Adjusted ROR (log scale)


a Incontinence by sex
Women
Men
Semaglutide
All GLP-1 RA
SGLT2 inhibitors
0.25
0.5
1
2
4
Adjusted ROR for incontinence (log scale)
b Obesity compared with diabetes use
Semaglutide
LUT composite
Incontinence
Urolithiasis
Erectile dysfunction, men
Tirzepatide
LUT composite
Incontinence
Urolithiasis
Erectile dysfunction, men
All GLP-1 RA
LUT composite
Incontinence
Urolithiasis
Erectile dysfunction, men
0.25
0.5
1
2
4
Adjusted OR, obesity vs diabetes use (log scale)


a Indication and brand
Obesity vs diabetes use, women
Incontinence
LUT composite
Storage symptoms
Urinary tract infection
Wegovy vs Ozempic
Incontinence
LUT composite
Storage symptoms
Urinary tract infection
Rybelsus vs Ozempic
Incontinence
LUT composite
Storage symptoms
Urinary tract infection
Zepbound vs Mounjaro (tirzepatide)
Incontinence
LUT composite
Storage symptoms
Urinary tract infection
0.25
0.5
1
2
4
Adjusted odds ratio (log scale)
b Co-reported terms
Voiding symptoms
Storage symptoms
Urinary tract infection
Muscle weakness or atrophy
Gastrointestinal events
Hyperglycaemia or dehydration
Weight decreased
0.25
1
4
16
64
Co-reporting odds ratio (log scale)

Supplementary Files

This is a list of supplementary files associated with this preprint. Click to download.

- ESM1combined.pdf