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Summary

Background: Trans and nonbinary ('trans') people experience a disproportionate HIV burden but use fewer HIV prevention strategies, including pre-exposure prophylaxis (PrEP), relative to the general population. Emerging literature suggests an association between gender affirming hormone therapy (GAHT) and PrEP uptake, however the evidence is mixed and limited to cross-sectional analyses of transfeminine people on estradiol-based GAHT, with no data in transmasculine people on testosterone-based GAHT.

Methods: In this quasi-experimental study, we analysed linked, whole-of-population administrative health records (2018-2025) for 5,796 transmasculine and 8,079 transfeminine Australians who initiated testosterone-based GAHT and estradiol-based GAHT. Using a stacked event-study design, we compared changes in monthly PrEP uptake (supply of any PrEP script) in the 36 months before and 24 months after GAHT initiation with contemporaneous changes among people of a similar age who initiated the same regimen in the future. Effects were estimated separately for transfeminine and transmasculine people and compared to uptake 13 to 18 months pre-GAHT.

Findings: For both transfeminine and transmasculine people, PrEP uptake did not significantly vary relative to the reference period and was stable over time (<1% uptake). In the six months following GAHT initiation, PrEP uptake rose by 0.18 percentage points (95%CI: 0.07 to 0.29) among transmasculine people and 0.43 percentage points (95%CI: 0.15 to 0.70) among transfeminine people and increased steadily thereafter. Averaged over the 24 months following initiation, the probability of monthly PrEP uptake increased by 0.34 percentage points (95%CI: 0.20 to 0.48) among transmasculine people and 0.58 percentage points (95%CI: 0.31 to 0.86) among transfeminine people.

Interpretation: In this nationwide cohort study, GAHT initiation was associated with increased PrEP uptake among both transmasculine and transfeminine people. These findings highlight the role that access to gender-affirming care can play in HIV prevention for trans communities.

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Research in Context

Evidence before this study: We searched PubMed and Scopus from database inception to July 21, 2026, using a structured search strategy restricted to terms appearing in the title or abstract fields. The search terms were: ("gender identity" OR trans OR transgender OR "non-binary" OR nonbinary OR "gender-diverse" OR genderqueer OR "gender queer") AND ("hormone therapy" OR "hormone treatment" OR "gender-affirming hormone therapy" OR "gender-affirming care" OR "gender-affirming treatment" OR "GAHT" OR Testosterone OR oestrogen) AND (PrEP OR "pre-exposure prophylaxis" OR "preexposure prophylaxis" OR "tenofovir/emtricitabine" OR "antiretroviral chemoprophylaxis" OR "chemoprevention") AND (HIV OR "Human Immunodeficiency Virus") AND (uptake OR initiation OR use OR usage OR utilisation OR utilization OR prescription). This search returned 86 studies from PubMed and 70 studies from Scopus (combined: 100 studies). After screening, we identified four studies directly exploring the relationship between gender affirming hormone therapy (GAHT) and PrEP uptake. Studies reported an association between use of estradiol-based GAHT and PrEP uptake in transfeminine people. All were cross-sectional analyses of self-reported outcomes in non-representative samples, largely based in the United States and with modest sample sizes. The temporal association between GAHT initiation and PrEP uptake could not be evaluated due to the cross-sectional designs. Our search did not identify any study evaluating PrEP uptake in transmasculine people on testosterone-based GAHT. There is a need for longitudinal research and larger sample sizes to address these limitations.

Added value of this study: Our study provides the first longitudinal evidence on the relationship between GAHT initiation and PrEP uptake, drawing from a sample which captures the near-universe of trans people receiving government-subsidised GAHT in Australia. Using administrative health records from 5,796 transmasculine people who initiated testosterone-based GAHT and 8,079 transfeminine people who initiated estradiol-based GAHT, we applied a stacked event-study design to estimate average within-person changes in the likelihood of PrEP dispensing, using later GAHT initiators as controls. Effects were estimated separately by regimen and relative to a reference period 13–18 months before initiation. Over the 24 months following initiation, the average probability of monthly PrEP dispensing increased by 0.34 percentage points (95%CI: 0.20 to 0.48) among transmasculine people and 0.58 percentage points (95%CI: 0.31 to 0.86) among transfeminine people.

Implications of all the available evidence: Our results indicate that initiation of GAHT is associated with increased PrEP uptake among both transmasculine and transfeminine people. Embedding HIV prevention within gender-affirming care may be a practical way to mitigate HIV inequities experienced by trans people.

1. Introduction

Globally, transgender and nonbinary (hereafter, 'trans') people who have gender identities that differ from their sex assigned at birth are at increased risk of Human Immunodeficiency Virus (HIV) and experience poorer HIV clinical outcomes than the general population.[1] A global meta-analysis found that odds of HIV infection were 66 times higher for transfeminine people and 7 times higher for transmasculine people compared to the general population.[1] Despite this elevated risk, both transfeminine and transmasculine populations have reduced awareness and uptake of HIV prevention strategies, such as HIV pre-exposure prophylaxis (PrEP).[2-4]

Emerging evidence suggests that medical gender affirmation, including gender affirming hormone therapy (GAHT), may influence uptake of HIV prevention strategies among trans people.[5,6] On the one hand, initiating GAHT might increase regular contact and trust with providers, thereby increasing PrEP uptake by reducing barriers to discussing concerns about sexual health.[4] Indeed, a recent longitudinal study showed that GAHT initiation was associated with increased utilisation of primary healthcare including General Practitioner (GP) visits and prescription medications.[7] However, other qualitative studies suggest trans people may prioritise GAHT over PrEP due to cost related barriers or forgo PrEP due to concerns regarding drug interactions with GAHT.[6,8]

A handful of studies have investigated the association between GAHT and PrEP use. Some have reported positive associations [9-11] while others have reported insignificant associations [12,13] or that positive associations become insignificant when controlling for race/ethnicity.[14] Notably, all these studies are cross-sectional and based on small convenience samples of transfeminine adults.

Altogether, there are no empirical or longitudinal studies investigating the extent to which initiation of GAHT influences PrEP uptake among both transfeminine and transmasculine

people. Addressing this gap, this study estimates the within-person change in PrEP uptake following GAHT initiation leveraging longitudinal, whole-of-population administrative data in Australia.

2. Methods

Data

The data for this analysis was sourced from the Person-Level Integrated Data Asset (PLIDA), an individual-level linked dataset that combines information from population Census and various administrative data sources including healthcare records under Australia's universal health insurance scheme Medicare, social security records, income, and death records.[15] For this analysis, we used prescription medicine records data from the Pharmaceutical Benefits Scheme (PBS) and death records spanning June 2006 to December 2025 (the most recently available and complete at the time of writing). The PBS records capture detailed information on all publicly subsidised medicines dispensed, including the exact date of supply, alongside patient demographics such as gender marker ('male' or 'female' only) and month and year of birth. Because this study used de-identified administrative data accessed through the Australian Bureau of Statistics' DataLab, individual informed consent was not required under the National Statement on Ethical Conduct in Human Research.

Outcome measure

The key outcome for this study was supply of any PrEP medication via the PBS. PrEP was first subsidised under the PBS in April 2018. PrEP prescriptions were identified using PBS item codes for tenofovir disoproxil with emtricitabine dispensed under a PrEP indication (11276L, 11296M, 11306C, 12542D, 14636H). For each individual, we then constructed a binary indicator equal to one in months with at least one PrEP dispensing and zero otherwise. This outcome thus measures PBS-subsidised PrEP dispensing, not PrEP prescribing, possession, or

adherence, and does not capture PrEP obtained through private prescription, personal importation, or other non-PBS sources.

Classification of trans population initiating GAHT

Following the previous literature,[16,17] we identified trans people initiating GAHT using gender markers and hormone prescription records. Specifically, transmasculine people accessing testosterone-based GAHT were classified as those who ever used testosterone and had a current or previous female gender marker and transfeminine people accessing estradiol-based GAHT were classified as those who ever used estradiol and had a current or previous male gender marker. In line with previous research, we excluded all individuals that initiated GAHT before age 15 as well as individuals who ever received both estradiol and testosterone (to avoid ambiguity in GAHT assignment).[18]

Statistical analyses

To estimate the effects of GAHT initiation on the likelihood of PrEP dispensing, we used a stacked cohort event-study design that exploits the variation in the timing of GAHT initiation among trans people who will eventually initiate GAHT. Analyses were conducted separately for transfeminine and transmasculine people at the person-month level, with an event window of 36 months before initiation through 24 months after initiation (including initiation month). To ease interpretation of results, event time was defined relative to GAHT initiation as six-month periods indexed from −6 to +3 (e.g., months −36 to −31 corresponded to event time −6, and months 0 to 5 to event time 0). The third pre-initiation interval (i.e., event time = -3, months –18 to –13 pre-GAHT) was used as the reference period, and used event times $= -6, -5$, and -4 to assess differential pre-initiation trends. Event time = -3 was selected as the reference period to allow for twelve months (two six-month periods) of potential 'anticipation' effects. This allows us to ascertain whether the likelihood of PrEP dispensation changes in response to

the processes involved with initiating GAHT such as through clinical assessment (discussing treatment goals), appointment scheduling, or other preparations for GAHT.

We then constructed sub-experiments, or 'cohorts,' defined by the treated group's calendar month of GAHT initiation and age band. Within each cohort, the treated group comprised people in the relevant age band who initiated the corresponding GAHT regimen in the index month, and the comparison group comprised people in the same age band who initiated that regimen at least 36 months later. The age bands, measured in the treated group's initiation month, were 15–24 years, 25–34 years, and 35–44 years.

We excluded individuals with missing outcome data in any month of the event window (for example, individuals censored after death), yielding a balanced panel, and retained only cohorts with at least one treated person and at least 20 eligible future-initiator comparisons. Because PrEP was PBS-listed only from April 2018 and the data runs to December 2025, requiring a complete pre- and post-initiation window restricted the treated analytic sample to individuals who initiated GAHT between May 2021 and December 2022. Similarly, as the comparison group initiated at least 36 months later (i.e., outside the event time and 'anticipation' window), the future-initiator comparator sample was restricted to those who initiated between May 2024 and December 2025.

We then estimated weighted linear probability models with cohort-by-individual and cohort-by-calendar-month fixed effects. Cohort-by-individual fixed effects accounted for all observed and unobserved time-invariant confounders, such as country of birth and other stable factors like underlying health predispositions or personality traits, while cohort-by-calendar-month fixed effects captured secular changes that may have impacted service access and prescribing over time (e.g., national policy changes or broader socioeconomic conditions).

We applied the corrective weights so that the resulting coefficients estimate average treatment effects among treated people, aggregated across sub-experiments in proportion to each sub-experiment's share of treated people [19]. This approach accommodates staggered initiation and treatment-effect heterogeneity without using already-treated people as comparisons.

A causal interpretation requires that, without GAHT initiation, PrEP dispensing in each treated group would have changed in parallel with dispensing in its comparison group. It also requires that GAHT initiation did not affect PrEP dispensing before the prespecified 12-month anticipation period. We assessed the plausibility of these assumptions by examining balance in baseline covariates, plotting the event-study estimates, and jointly testing whether the coefficients for k=-6, -5, and -4 equalled zero. Failure to reject this joint null is consistent with, but does not establish, parallel pre-initiation trends.

We report the descriptive statistics for the full analytical sample as well as for the earlier and later GAHT initiators (treatment and control groups, respectively). We then reported changes in the probability of monthly PrEP supply in percentage points for each six-month interval (point estimates and 95% CIs based on standard errors clustered at the individual level). We summarise the post-initiation effect as the simple average of the four coefficients covering the two years after initiation (months 0–23 after initiation). Additional details on the empirical model, estimating equation and exact weighting formula is provided in the Supplementary Material SM1.

All analyses were conducted using STATA version 18. No primary data collection was undertaken. Data from PLIDA was analysed as per the data-sharing agreement with the Australian Bureau of Statistics. By construction, there were no missing data for exposures, covariates, or outcomes. Individuals were followed continuously in linked national datasets and were censored only at death.

This study is reported according to STROBE guidelines.

Ethics Approval

This study was approved by the University of Melbourne Human Research Ethics Committee.

Role of the funding source

Funding bodies had no role in study design, data collection, data analysis, data interpretation, or writing of the report.

3. Results

Descriptive statistics

The descriptive statistics for the full study sample in the reference period (event time = -3, months –18 to –13 pre-GAHT) are presented in Table 1. The sample comprised 5,796 transmasculine people who initiated GAHT and 8,079 transfeminine people who initiated eGAHT. On average, transmasculine people were slightly younger than transfeminine people at GAHT initiation (24.4 vs 25.8 years) but lived in areas with similar levels of socioeconomic disadvantage (1,009 vs 1,010) and remoteness (1.36 vs 1.33). PrEP dispensing in the reference period was <1% across both regimens (counts not reported for confidentiality). Within each regimen, observed area-level characteristics were similar across treatment and control groups. Consistent with the empirical design, whereby comparison individuals were people of the same age band who initiated GAHT at least 36 months later, control individuals were older at initiation.

Event study results

The main event study results are presented in Figure 1. These show the average within-person change in the probability of monthly PrEP dispensing relative to GAHT initiation, averaged

across six-month periods, with all effects relative to the reference period (13-18 months before initiation). In the periods leading up to GAHT initiation, PrEP dispensing was not changing significantly relative to the reference period for either group. In the 12 months before initiation, however, there was some evidence that dispensing had begun to increase among transfeminine people but not among transmasculine people. In the six-month period of GAHT initiation the probability of dispensing rose by 0.18 percentage points (95%CI: 0.07 to 0.29) among transmasculine people and 0.43 percentage points (95%CI: 0.15 to 0.70) among transfeminine people. Uptake continued to rise thereafter, reaching 0.53 percentage points (95%CI: 0.28 to 0.78) among transmasculine and 0.71 percentage points (95%CI: 0.36 to 1.05) among transfeminine people by around two years after initiation. Averaged over the two years following initiation, the probability of monthly PrEP dispensing increased by 0.34 percentage points (95%CI: 0.20 to 0.48) among transmasculine and 0.58 percentage points (95%CI: 0.31 to 0.86) among transfeminine people.

4. Discussion

In this longitudinal, quasi-experimental study of 13,875 trans Australians, we report significant and sustained increases in PrEP uptake in both transmasculine and transfeminine people for up to 24 months following GAHT initiation.

Our results are consistent with cross-sectional analyses reporting positive associations with PrEP use among transfeminine people using GAHT [9-11] and gender affirmation more broadly.[5,20] Our results do contrast however to qualitative studies which have suggested that transfeminine people may be more likely to prioritise gender-affirming medical care over PrEP [20,21] due to concerns around cost or potential drug-drug interactions.[6,8] However, substantial differences in the populations studied and empirical design, including unobserved confounding

and a lack of information on dynamic patterns relative to GAHT initiation, complicate such comparisons.

Several mechanisms may explain why we see that GAHT initiation is followed by increased PrEP uptake. First, evidence from randomized, prospective cohort, and quasi-experimental studies has consistently shown that GAHT improves mental health among both transfeminine and transmasculine people.[22-24] Reduced psychological distress may in turn support engagement in health-promoting behaviours, including safer sex practices and medication adherence.[4,25] Second, review with an affirming practitioner to initiate GAHT typically provides the opportunity to develop an ongoing and trusting relationship with a provider who is competent to manage GAHT and other aspects of healthcare. Given trans people experience heightened rates of healthcare discrimination and subsequent healthcare avoidance, it follows that building trust with an affirming care provider may help trans people connect with other type of care, including reducing barriers to discussing concerns about sexual health.[25] Several studies have theorised that GAHT initiation leads to increased awareness of previously undiagnosed long-term health conditions and that this in part accounts for the increased use of primary and preventative healthcare, including care unrelated to gender-affirmation, observed among trans people following GAHT initiation.[26-28] Disentangling the relative contributions of these different mechanisms will be an important direction for future work.

Of note, we report an increase in PrEP uptake in the 12 months prior to initiation of GAHT in transfeminine people. The reasons for this are likely multifactorial; firstly, there are baseline differences in HIV risk in which transfeminine people have historically had higher rates of HIV than transmasculine people[1] and national clinical guidelines recommend assessment of HIV risk on an individualised basis.[29] Second, transfeminine people have been shown to have lower healthcare engagement at baseline, and this could represent identification of unmet need following engagement with a healthcare provider.[7,28]

Our results should be considered with the context of several limitations. First, it is important to note that in our data, we cannot observe trans people who accessed GAHT privately, nor individuals who desired to, but could not access, GAHT. While this does not impact the internal validity of our empirical approach, the present findings may not be generalisable to the broader trans population. Of note, pre-initiation PrEP uptake in our sample (<1%) was somewhat lower compared to the only national community survey of PrEP uptake in trans Australians (half of whom were on GAHT at the time of the survey), which reported that 1.9% of transmasculine people and 2.7% transfeminine were using PrEP in 2018.[30] The lower rates in our sample, likely reflects that our sample comprises all people initiating GAHT nationally, whereas community-survey respondents are disproportionately sexually active and urban. Nevertheless, future research is needed to understand patterns of PrEP use across the broader trans population, including those who do not access GAHT. Of note, Australia recently included questions on gender identity in its population Census. This will provide a unique opportunity to better understand facilitators and barriers to PrEP uptake and is recommended for future research.

Similarly, we cannot observe PrEP obtained outside of the PBS. This is an important consideration as, in some cases, PrEP can be obtained privately at a lower cost than through the PBS.[31] However, our within-person design accounts for individual-level confounding that may predict non-PBS PrEP use, such as socioeconomic background, and if individuals increasingly turned to non-PBS PrEP after GAHT initiation, our estimates would likely understate the true rise in uptake.

Finally, we cannot directly observe HIV status. As PrEP is indicated only for people without HIV, our sample will include some individuals who are ineligible, or become ineligible (i.e., seroconvert), throughout the study period. However, with an estimate HIV prevalence among trans Australians of approximately 1.2%,[30] and our within-person design suggests that

prevalent HIV infection would be unlikely to materially affect our estimates. The timing of new HIV diagnoses relative to GAHT initiation is less easily accounted for, and future research linking HIV notifications to administrative data could clarify how seroconversion patterns interact with GAHT initiation.

Despite these limitations, our study has several strengths and unique contributions. It is, to our knowledge, the largest population-based study investigating PrEP uptake relative to GAHT initiation and the first to report within-person dynamics longitudinally — tracking the same individuals before and after initiation rather than comparing GAHT users to non-users at a point in time. In providing the first population-level evidence on PrEP uptake among transmasculine people, our study addresses a gap the HIV prevention literature which has been repeatedly identified [6,32]. The use of administrative records with exact dispensation dates also addresses bias from recall and self-reporting pertaining to both GAHT and PrEP use. The empirical approach further accommodates treatment-effect heterogeneity across age and calendar time, addressing potential biases from individual level confounding and compositional changes (such as noted demographic changes among GAHT initiators[17]). Finally, because comparison individuals are themselves future GAHT initiators, our estimates are not confounded by the selection into treatment that has to date, biased comparisons between GAHT users and non-users.

These findings have important policy implications. First, these results provide clear evidence that access to GAHT improved uptake of PrEP – a vital tool to eliminating HIV. With trans people consistently identified as a priority population HIV Strategies internationally and across every level of government in Australia [33-35], the most direct implication is that expanding access to GAHT is an important lever to meet HIV prevention goals. These findings are especially salient amid mounting political and legal restrictions on gender-affirming care in Australia and internationally [36]. Beyond formal restrictions, there is a shortage of trans-competent providers

and trans people continue to face discrimination in healthcare. Measures that address these structural barriers and promote equitable access to GAHT — such as expanding provider training in trans health — could reduce inequities while also strengthening HIV prevention nationally.

The results also suggest that HIV prevention and gender-affirming care should be integrated rather than siloed: interventions to increase PrEP uptake among trans people should embed it within gender-affirming and sexual healthcare, and, conversely, efforts to expand gender-affirming care should retain HIV prevention as a core component. Community-based clinics specialising in trans health are also well placed to meet these needs, offering gender-affirming care alongside culturally competent HIV prevention, testing, and treatment in a single, setting. LGBTIQ Community Controlled Health Organisations in Australia are well placed to deliver such care and have been recently earmarked funding as a part of Australia's National Action Plan for the Health and Wellbeing of LGBTIQA+ People 2025–2035,[37]. As data on these services improve, an important next step will be to evaluate how such co-located models shape PrEP uptake and HIV outcomes relative to mainstream primary care.

Further, this research points to the need for improved visibility and sustained data collection efforts for trans populations, including those who do and do not access GAHT. While HIV surveillance in Australia acknowledges trans populations, the reporting of HIV diagnoses in this group is typically grouped together as a single population due to low numbers and limitations in data capturing systems.[38] There is a need for consistent collection and reporting of data concerning the health of trans populations while also ensuring confidentiality and privacy is maintained to leverage data to improve health outcomes without identifying individuals who do not want to be identifiable in the data.

Altogether, our findings show that initiating GAHT is followed by sustained increases in PrEP uptake among both transmasculine and transfeminine people and reinforces that access to gender-affirming care can play a central role in HIV prevention for trans communities.

Contributors

KS, CCh, AS, BJN, and CCo conceptualised the study and methodology. KS and BJN acquired funding. TC, CCh, BJN, and KS developed empirical approach. KS conducted formal analysis and project administration. CCh accessed and verified the data. KS, BJN, AS, CCh, and TC wrote the first draft of the manuscript. All authors reviewed the analyses and drafts of this manuscript and approved its final version.

Data sharing statement

Data is available upon request to the Australian Bureau of Statistics.

Declaration of interests

KS is a cofounder, and serves on the committee, of LGBTQ+ Economists and Allies in the Asia-Pacific (LEAP).

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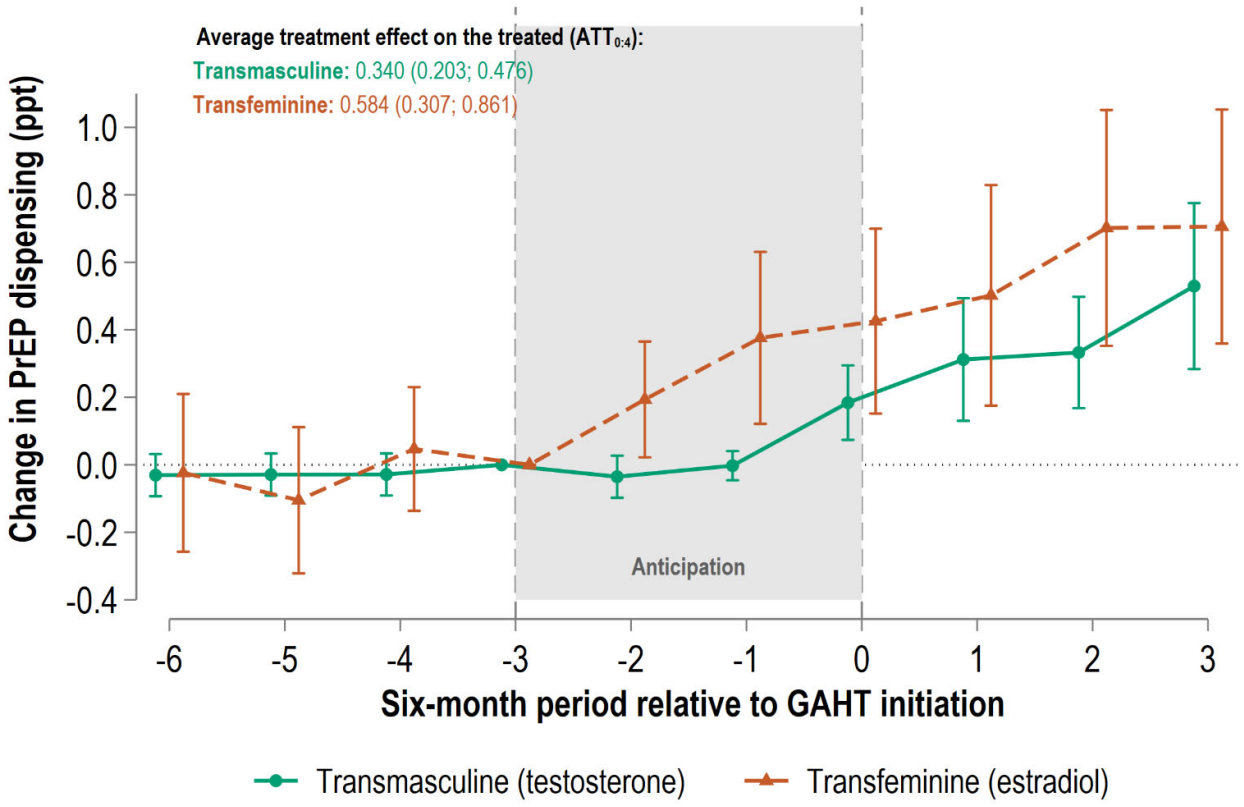
Tables and Figures

Table 1 – Descriptive statistics for analytical sample

	Testosterone-based GAHT			Estradiol-based GAHT		
	Full sample (n=5,796) Mean (SD) / % (n)	**Treated group (n=2,649) Mean (SD) / % (n)**	**Control group (n=3,147) Mean (SD)**	**Full sample (n=8,079) Mean (SD) / % (n)**	**Treated group (n=3,526) Mean (SD) / % (n)**	**Control group (n=4,553) Mean (SD)**
Age start GAHT (years)	24.44 (6.72)	23.17 (6.20)	25.51 (6.96)	25.78 (6.81)	24.46 (6.30)	26.80 (7.02)
Year start GAHT						
2021	17.13% (993)	37.49% (993)	—	15.37% (1,242)	35.22% (1,242)	—
2022	28.57% (1,656)	62.51% (1,656)	—	28.27% (2,284)	64.78% (2,284)	—
2024	5.30% (307)	—	9.75% (307)	5.03% (406)	—	8.91% (406)
2025	49.00% (2,840)	—	90.25% (2,840)	51.33% (4,147)	—	91.09% (4,147)
Area-level characteristics[A]						
Socioeconomic disadvantage	1008.74 (70.19)	1009.92 (71.51)	1007.68 (68.97)	1009.92 (69.75)	1011.72 (69.71)	1008.38 (69.76)
Remoteness score	1.36 (0.67)	1.37 (0.66)	1.36 (0.68)	1.33 (0.62)	1.32 (0.61)	1.34 (0.63)
Outcomes						
Filled PrEP script[B]	<1%	<1%	<1%	<1%	<1%	<1%

Notes: Control group comprises future GAHT initiators; year of initiation differs by design, so no normalised difference is shown for those rows. Feasible treated-initiation window: May 2021 – December 2022. Controls initiate ≥36 months after their cohort's index month (2024m5 – 2025m12). A) There were 829 and 1,350 people with missing information about geographic characteristics within the testosterone-based GAHT and estradiol-based GAHT sample, respectively. Area-level socioeconomic disadvantage is based on the Index of Relative Socio-economic Disadvantage from the Australian Bureau of Statistics' Socio-Economic Indexes for Areas, assigned to each individual according to their area of residence at the Statistical Area Level 3 geography; the index is standardised to a national average of 1000, with lower scores indicating greater disadvantage. Remoteness score is based on the Australian Statistical Geography Standard Remoteness Area classification, coded from 1 (Major Cities of Australia) to 5 (Very Remote Australia), such that higher values indicate greater remoteness; the reported figure is the mean of these categories.

Figure 1 – Event study for PrEP uptake



Notes: PrEP uptake is defined as monthly supply of any PrEP prescription. Event time is measured in six-month periods relative to gender-affirming hormone therapy (GAHT) initiation. Each period spans six months: period 0 covers months 0–5 (the six months from, and including, initiation), period 1 months 6–11, and so on; negative periods precede initiation (period −1 covers months −6 to −1). Period −3 (months −18 to −13) is the reference period. The shaded region marks the pre-specified anticipation window (periods −2 and −1, i.e., the 12 months before initiation). Points are average within-person changes in the probability of monthly PrEP dispensing relative to the reference period (percentage points), with 95% confidence intervals.

Supplementary Material

SM.1. Empirical strategy

All notation and equations apply separately to the analyses of testosterone-based gender-affirming hormone therapy (tGAHT) and estradiol-based gender-affirming hormone therapy (eGAHT).

Target estimands and identifying assumptions

Following Baker et al. (2026), we use potential-outcomes notation to define the causal parameters targeted by the stacked event-study design and the assumptions required for their identification.

Let $s \in S$ index the retained sub-experiments, G_s denote the calendar month in which the treated group in sub-experiment *s* initiates GAHT, and *t* index calendar months. Define six-month event time as

$$K_{st} = \left\lfloor \frac{t - G_s}{6} \right\rfloor$$

Initiation occurs at $K_{st} = 0$. The event window spans $k = -6, \ldots, 3$, corresponding to months –36 through 23 relative to initiation. The reference period is $k = -3$, corresponding to months –18 through –13. The intervals $k = -2$ and –1 cover the 12 months immediately preceding initiation and constitute the prespecified anticipation period.

Let $\mathcal{T}_s$ and $\mathcal{C}_s$ denote the sets of treated and future-initiator comparison individuals in sub-experiment *s*, and let N_s^T and N_s^C denote their respective counts. Define

$$\boldsymbol{w_S} = \frac{\boldsymbol{N_s^T}}{\sum_{r \in S} \boldsymbol{N_r^T}}$$

as sub-experiment s's share of treated individuals across the retained sub-experiments.

For individual *i* in sub-experiment *s*, let $Y_{ist}(G_s)$ denote the potential outcome if the individual initiates GAHT in the treated group's initiation month, and let $Y_{ist}(\infty)$ denote the potential outcome if the individual initiates GAHT at least one year after the end of sub-experiment *s*'s event window. Here, ∞ is shorthand for remaining untreated and outside the anticipation period throughout the event window.

For post-initiation event time $k = 0, \ldots, 3$, the target average treatment effect among treated people is

$$ATT_k = \sum_{s \in S} w_s E\left[Y_{si,t \in k}(G_s) - Y_{si,t \in k}(\infty) \,\middle|\, i \in T_s\right].$$

Thus, ATT_k is a treated-share-weighted average of the sub-experiment-specific effects on the probability of monthly PrEP dispensing. Only retained sub-experiments contribute to the estimand.

We also estimate treatment effects for $k = -2$ and -1. Because these intervals precede the first observed GAHT dispensing, they capture possible changes associated with preparing to initiate GAHT rather than post-initiation effects.

Identification rests on two assumptions. First, within each retained sub-experiment, treated and comparison-group members would have experienced the same change in PrEP dispensing had they both initiated GAHT after the event window:

$$E\left[Y_{is,t \in k}(\infty) - Y_{is,t \in k=-3}(\infty) \middle|\, i \in T_s\right] = E\left[Y_{is,t \in k}(\infty) - Y_{is,t \in k=-3}(\infty) \middle|\, i \in C_s\right],$$

where $k = 0, \ldots, 3$. This is the sub-experiment-specific parallel-trends assumption.

Second, GAHT initiation has no effect on PrEP dispensing before the prespecified anticipation period:

$$Y_{ist}(G_s) = Y_{ist}(\infty) \quad \text{for all k} \leq -3$$

This assumption permits anticipation during the 12 months immediately preceding initiation. Requiring comparison-group members to initiate at least 36 months after the treated group ensures that they remain untreated and outside their own anticipation period throughout the event window.

Under these assumptions, the post-initiation event-time effect is identified by

$$\boldsymbol{ATT_k = \sum_{s \in S} q_s\left(E[Y_{is,t \in k} - Y_{is,t \in k=-3} | i \in T_s] - E[Y_{is,t \in k} - Y_{is,t \in k=-3} | i \in C_s]\right)},$$

where $k = 0, \ldots, 3$. We summarise the post-initiation effects using the simple average across the four post-initiation intervals:

$$ATT_{\{0:3\}} = \frac{1}{4} \sum_{k=0}^{3} ATT_k$$

Because the four intervals have equal duration, this estimand is also the average monthly effect during the first 24 months after initiation.

Estimation

We estimate the following weighted linear probability model:

$$Y_{sit} = \sum_{\substack{k=-6 \\ k\neq -3}}^{3} \beta_k D_{ksit} + \alpha_{si} + \delta_{st} + \epsilon_{sit} \quad (1)$$

where Y_{sit} denotes PrEP uptake for individual i in sub-experiment s and month t; D_{ksit} are event-time indicators for GAHT initiation (with $k = -3$ omitted as the reference period); α_{si} are sub-experiment-by-individual fixed effects; δ_{st} are sub-experiment-by-month fixed effects; and ϵ_{sit} is an error term. Standard errors are clustered at the individual level.

In an unweighted stacked regression, the coefficients do not generally recover the target treated-share-weighted effects. We therefore apply the corrective weights proposed by Wing et al. (2024). Treated observations receive a weight of one. Comparison observations in sub-experiment s receive weight

$$\boldsymbol{w_s^C} = \frac{\left(\frac{\boldsymbol{N_s^T}}{\sum_{s\in S} \boldsymbol{N_s^T}}\right)}{\left(\frac{\boldsymbol{N_s^C}}{\sum_{s\in S} \boldsymbol{N_s^C}}\right)}$$

The corrective weights align the distribution of comparison observations across sub-experiments with that of treated observations. Under the identifying assumptions,

Under the identifying assumptions, β_k estimates the average treatment effect on the treated at event time $k \geq 0$:

$$\widehat{ATT}_k = \hat{\beta}_k$$

The estimated average post-initiation effect is

$$\widehat{ATT}_{0:4} = \frac{1}{4}\sum_{k=0}^{3} \hat{\beta}_k$$

The coefficients for $k = -2$ and -1 capture possible changes associated with preparing to initiate GAHT. The coefficients for $k = -6, -5$, and -4 assess differential trends before the anticipation period.

To assess the plausibility of the identifying assumptions, we test the joint null hypothesis:

$$H_0: \beta_{-6} = \beta_{-5} = \beta_{-4} = 0.$$

Failure to reject this hypothesis is consistent with an absence of detectable differential trends before the anticipation period, but it does not establish the parallel-trends assumption.

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