BMJ Public Health

Factors associated with decreased anal sphincter tone and the accuracy of forced anal examinations to detect individuals having receptive anal intercourse: an observational study

Alan G Nyitray [1,2] B R Simon Rosser [3] Aniruddha Hazra,[4] Jenna Nitkowski,[5] Derek Smith,[6] Bridgett Brzezinski,[7] Timothy J Ridolfi,[8] John A Schneider,[4] Elizabeth Y Chiao,[9] Sandrine Sanos,[10] Ever Mkonyi,[11] Lucy Mgopa,[12] Michael W Ross [13]

Correspondence to
Dr Alan G Nyitray;
anyitray@mcw.edu

ABSTRACT

Introduction Forced anal examinations are used to prosecute sexual and gender minorities (SGM) in multiple countries under the presumption that decreased sphincter tone, assessed by a finger inserted into the anal canal, can detect persons practising receptive anal intercourse. Using baseline data from a longitudinal study, we aimed to determine factors associated with sphincter tone and the accuracy of sphincter tonality to detect persons engaging in receptive anal intercourse.

Methods Clinicians in Chicago, Houston and Milwaukee, USA conducted digital anal rectal examinations (DARE) to score sphincter resting tone (RT) and squeeze tone (ST). On a separate survey, individuals reported their preferred position for anal intercourse, that is, either always/mostly insertive anal intercourse, always/mostly receptive anal intercourse or both receptive and insertive anal intercourse. Multivariable regression assessed factors associated with decreased sphincter tone while the area under the receiver operating characteristic curves (AUC) estimated the accuracy of sphincter tonality to detect receptive anal intercourse.

Results Of 838 participants, 94.0% of whom were cisgendered males, 11.3% had decreased RT (95/838) and 6.3% had decreased ST (53/838). The accuracy of DARE to detect any receptive anal intercourse was little better than random guessing (AUC 0.53, 95% CI 0.51 to 0.55 and AUC 0.51, 95% CI 0.49 to 0.53, respectively). RT and ST decreased with age regardless of sexual behaviour (p_{trend}<0.01 for both). Compared with individuals having always/mostly insertive anal intercourse, individuals having always/mostly receptive anal intercourse were associated with decreased RT, but not ST, while those equally preferring both insertive and receptive anal intercourse were not associated with decreased RT or ST.

Conclusion Decreased sphincter tone is uncommon among SGM who prefer receptive anal intercourse. Given virtually no accuracy, a finger inserted into the anus has no utility to detect individuals practising receptive anal intercourse and thus should not be used as such.

Trial registration number NCT04090060.

WHAT IS ALREADY KNOWN ON THIS TOPIC

⇒ To gather evidence for prosecution of sexual and gender minorities, forced anal exams are used in multiple countries. The examination includes inserting the index finger into the anal canal to detect decreased sphincter tone which is considered evidence of receptive anal intercourse. We found only two small studies (n=58 and n=24) estimating decreased sphincter tone among gay and bisexual men, and none assessing the accuracy of sphincter tone to detect sexual and gender minorities having receptive anal intercourse.

WHAT THIS STUDY ADDS

⇒ This study suggests that decreased sphincter tonality is uncommon in this population and that a finger inserted into the anal canal has virtually no accuracy in detecting a history of receptive anal intercourse.

HOW THIS STUDY MIGHT AFFECT RESEARCH, PRACTICE OR POLICY

⇒ The anal sexual behaviour of individuals cannot be known using the practice of forced anal examinations.

INTRODUCTION

Forced anal examinations are used in at least seven countries to support prosecuting individuals suspected of being sexual minorities, gender minorities or both.[1][2] The exam involves viewing the anus and then inserting a finger into the anal canal to assess sphincter tone. It is not related to clinical care.[3] Reduced sphincter tone has been used in these countries as evidence that the individual engages in receptive anal intercourse (RAI) and thus is a sexual and/or gender minority. The forced anal exam result is used to support conviction

of individuals for same-sex conduct, which can result in imprisonment and, in some cases, execution.[2]

Healthcare providers often perform the forced anal exam under the direction of police[2] and point to a 19th century text by French forensic pathologist Ambroise Tardieu, 'Étude Médico-légale sur les attentats aux moeurs'[4] to justify use of the procedure.[2] Tardieu's influential studies were part of a larger medical literature interested in categorising sexual types, especially male homosexuality or 'pederasty', which he associated with prostitution and crime,[5 6] shaping judicial response and policing of those deemed 'sexual deviants' or 'inverts'.[6–8] He argued that medical expertise could 'locate (anatomical) evidence of pederasty' and, thus, identify those who must be prosecuted.[6] He distinguished two types of evidence and claimed that, 'loose anuses', as judged by an index finger inserted into the anal canal, indicated the individual was a 'passive pederast', with a history of RAI.[6 9] Tardieu also claimed that anuses of homosexual men became funnel shaped because of RAI.[4] To our knowledge, there are no data to support Tardieu's claims, especially the proposition that insertion of a finger into the anal canal is an accurate test of an individual engaging in RAI.

Sphincter resting tone (RT) is controlled by the internal sphincter muscle, an involuntary smooth muscle, while sphincter squeeze tone (ST) is controlled by the external sphincter muscle, a voluntary striated muscle.[10 11] Data on factors associated with RT and ST among sexual and gender minorities (SGM) come from 2 studies with sample sizes ≤58 individuals.[12 13] Sphincter tone among a large sample of SGM has not been reported to our knowledge. As part of two anal cancer screening studies among SGM that included digital anal rectal examinations (DARE) conducted by trained healthcare providers, we collected data on RT, ST and sexual behaviour. A DARE is a clinical procedure that includes inserting a finger into the anus to detect abnormalities and is recommended for anal cancer screening.[14] As part of DARE, healthcare providers also note sphincter tone.[15] Thus, the mechanics of the DARE clinical procedure correspond with the mechanics of the non-clinical forced anal examination. Our objective was to assess clinical and behavioural factors associated with decreased RT and ST among SGM and to estimate the accuracy of a DARE measurement of sphincter tone to detect persons who have RAI.

METHODS
Data sources
Data for the current analyses come from two longitudinal studies assessing anal cancer screening protocols, the Prevent Anal Cancer (PAC) Self-Swab Study (R01CA215403, AGN) conducted in Milwaukee, USA[16] and the PAC Palpation Study (R01CA232892, AGN) conducted in Chicago and Houston, USA.[17] The studies were conducted 2020–2023. Given a common goal of anal cancer prevention and a common study population,

protocols for the PAC studies were synchronised regarding recruitment, consenting procedures, clinical protocols and forms, clinician training, survey procedures, and, as appropriate, survey items.

Patient and public involvement
Before study activities began, the PAC parent studies convened Community Advisory Boards to support participant recruitment, study activities and data interpretation. Results from the current study have been presented to these boards.

Participants
Individuals were eligible to join either study if they were aged ≥25 years and acknowledged sex with men in the past 5 years or identified with a minority sexual orientation or as a transgender person who has sex with men. Persons in Milwaukee were excluded if they used anti-coagulants other than non-steroidal anti-inflammatory drugs (NSAIDS) or had a prior diagnosis of anal cancer. Individuals in Chicago and Houston were excluded if they had a DARE in the prior 3 months or were being treated for condyloma, haemorrhoids or anal cancer.

Study activity and data collection
Interested persons took an online eligibility survey before being consented online. Once written consent was provided, participants took the baseline survey which had questions about sexual behaviour including their preferred position during anal intercourse: 'In your lifetime, have you mostly engaged in insertive anal sex, receptive anal sex or both?' Response options were 'Always or mostly engaged in insertive anal sex (your penis in his [or their] anus),' 'Always or mostly engaged in receptive anal sex (his [or their] penis in your anus),' 'More or less equally engaged in insertive and receptive anal sex (I have been versatile),' or 'I've never engaged in anal sex'. Additional items asked about sexual behaviour including frequency of anal intercourse and when the last anal intercourse occurred. Other items asked participants about their clinical history, including diagnoses of obesity or diabetes.

After completing the baseline survey, all individuals were asked to attend a clinic visit that included a DARE conducted by a clinician including physicians, advanced practice nurses (APN) and registered nurses. In Chicago, the clinic appointment primarily occurred at a drop-in centre serving SGM. In Houston and Milwaukee, appointments occurred at clinics serving SGM or HIV clinics. Each clinician was trained to conduct the DARE according to International Anal Neoplasia Society Guidelines and to record all perianal and anal canal abnormalities.[15] DARE includes viewing and palpating the perianus and anal os and then palpating the anal canal for abnormalities. As part of palpating the anal canal, sphincter tone was noted using the Digital Rectal Examination Scoring System's (DRESS) 6-point scale for RT, 0='no discernible tone at rest,' 1='very low tone', 2='mildly decreased tone',

3=‘normal’, 4 =‘elevated tone, snug’ and 5=‘very high tone, a tight anal canal, difficult to insert finger’ and the 6-point scale for ST, 0=‘no discernible increase in tone with squeezing effort’, 1=‘slight increase’, 2=‘fair increase but below normal’, 3=‘normal’, 4=‘strong squeeze’ and 5=‘very strong squeeze, to the point of being painful to the examiner’.[18] Clinicians did not know participants’ preferred position for anal intercourse before recording sphincter tone.

Statistical analysis

RT was dichotomised: scores of 0–2 were defined as decreased RT while scores of 3–5 were labelled as normal or increased RT. ST was similarly dichotomised with 0–2 defined as decreased ST and scores of 3–5 defined as normal or increased ST. For the variable preferred position for anal intercourse, the value of ‘never engaged in anal sex’ was combined with ‘always or mostly engaged in insertive anal sex.

To assess the accuracy of DARE to detect any RAI, we estimated the area under the receiver operating characteristics curve (AUC). Individuals who always/mostly preferred RAI were combined with those who practised RAI and IAI about equally, that is, versatile, to construct a variable with two categories: (1) IAI and (2) those who practised any RAI. The accuracy of decreased sphincter tone to detect preferred position for anal intercourse was assessed with 95% CI and stratified by clinician type.

Bivariate analyses for RT and ST were stratified by tonality (either decreased tone or normal/increased tone) and included assessment of their association with age, sex at birth, gender identity, race and ethnicity, sexual orientation, years of school, sexual behaviour, HIV status, self-reported comorbidities (ie, arthritis, carpal tunnel syndrome, cerebral palsy, diabetes, fibromyalgia, chronic lower back pain, motor neuron diseases, movement disorders, multiple sclerosis, obesity, spina bifida, spinal cord injury or stroke), current anxiety and depression, clinician type, and clinical findings from DARE, body mass index (BMI) and waist size.

We constructed a multivariable model to regress RT and ST on preferred position for anal intercourse and other factors after adjustment by confounders. We used purposeful modelling strategies in addition to Directed Acyclic Graphs to support identification of confounders for inclusion and intermediate variables for exclusion.[19 20] Firth bias correction was used in all regression models to reduce bias associated with cells with no data.[21] Age, race and ethnicity, HIV status and assigned sex at birth were considered potential confounders while last RAI was an intermediate variable between preferred position for anal intercourse and sphincter tone and thus was excluded from multivariable modelling. Exposures with a likelihood ratio test p value of less than 0.15 in bivariate analysis were included in logistic regression models and then were manually removed one at a time using backwards elimination if their p value was >0.05. Associations in the multivariable model were considered significant when a p value was ≤0.05. Adjusted ORs (aORs) and unadjusted ORs were reported with 95% CIs. Study size was determined by power analyses for the primary questions in the longitudinal anal cancer studies. The current analysis did not have a separate power assessment.

Since accuracy of DARE may be related to medical training and the number of DAREs performed,[15] supplementary analyses were conducted after restricting the dataset to physicians and APNs who performed >50 DAREs in the study. Due to a limited number of outcomes, multivariable analysis for factors associated with sphincter ST could not be completed in this restricted dataset. We also analysed a second restricted dataset that removed individuals assigned female sex at birth (n=12) since sphincter pressure may be influenced by sex.[22 23] Initial analyses were conducted by using SAS V.9.4 TS Level 1M6 (SAS Institute) and duplicate analyses were conducted using Stata/BE V.18.0 (StataCorp) and SPSS V.28.0.

RESULTS

A total of 1207 individuals in Chicago, Houston and Milwaukee were eligible and gave consent to participate. Of these, 1088 completed the baseline survey including questions about their clinical history and preferred position for anal intercourse. A total of 841 individuals then attended one of nine clinics to receive a DARE and assessment of sphincter tone from a trained clinician. Three DAREs were judged as inadequate by the clinician leaving 838 individuals in the primary analysis. For supplementary analysis, that is, restricting inclusion to individuals whose clinicians conducted >50 DAREs in the study, 609 individuals were included in analyses.

Median age was 41 years (range, 25–80 years) and approximately one-half (52.5%) identified as non-Hispanic (NH) white, 20.9% as NH Black and 21.1% as Hispanic. A total of 85.3% identified as gay, and 43.5% had >16 years of school (table 1). A total of 33.9% and 14.6% of participants self-reported a prior diagnosis of HIV and obesity, respectively. Individuals who reported IAI comprised 23.6% of the sample (n=198), 41.7% (n=349) reported preferring both receptive and insertive anal intercourse about equally, and 34.7% (n=291) reported RAI. Medical doctors, APNs and registered nurses performed DARE on 39.5%, 52.7% and 7.8% of participants, respectively. Clinicians noted no abnormally shaped anuses.

Sphincter RT

Clinicians identified 95 (11.3%) individuals with decreased RT and 743 (90.3%) with normal or increased RT (table 1). On the 0–5 DRESS scale, the mean RT was 2.97 (SD, 0.49). The mean RT among IAI, versatile and RAI individuals was 3.10 (SD, 0.54), 2.95 (SD, 0.47) and 2.91 (0.47), respectively (p<0.001; data are not shown).

The median age of persons with decreased RT was 56 years while the age of persons with normal or increased RT was 39 years (p<0.001) (table 1). Regardless of

Table 1 Characteristics of participants stratified by sphincter resting and squeeze tone, Chicago, Houston and Milwaukee, USA 2020–2022, The Prevent Anal Cancer Studies

Characteristic	Total n=838	Resting tone			Squeeze tone		
		Decreased n=95	Normal/Increased n=743	P value	Decreased n=53	Normal/Increased n=785	P value
Sphincter tone, mean (SD)		2.97 (0.49)			3.04 (0.48)		
Age, years* median (IQR)	41 (32–54)	56 (49–62)	39 (32–52)	<0.001	55 (47–60)	40 (32–53)	<0.001
Body mass index* median (IQR)	28 (25–32)	29 (25–35)	28 (25–31)	0.04	29 (24–33)	28 (25–32)	0.33
Waist size, centimetres				<0.001			0.003
≤102	534 (64.3)	42 (44.2)	492 (66.9)		24 (45.3)	510 (65.6)	
>102	297 (35.7)	53 (55.8)	244 (33.2)		29 (54.7)	268 (34.5)	
Assigned sex at birth†				0.007			0.04
Male	826 (98.6)	90 (94.7)	736 (99.1)		50 (94.3)	776 (98.9)	
Female	12 (1.4)	5 (5.3)	7 (0.9)		3 (5.7)	9 (1.2)	
Gender identity†				0.002			0.17
Man	787 (94.0)	86 (90.5)	701 (94.5)		48 (90.6)	739 (94.3)	
Transgender woman, transgender man, woman and other	29 (3.5)	9 (9.5)	20 (2.7)		4 (7.6)	25 (3.2)	
Non-binary	21 (2.5)	0	21 (2.8)		1 (1.9)	20 (2.6)	
Race and ethnicity				0.20			0.05
White, non-Hispanic	437 (52.5)	56 (59.0)	381 (51.6)		36 (67.9)	401 (51.4)	
Black, non-Hispanic	174 (20.9)	18 (19.0)	156 (21.1)		10 (18.9)	164 (21.0)	
Hispanic	176 (21.1)	18 (19.0)	158 (21.4)		5 (9.4)	171 (21.9)	
Asian, non-Hispanic	30 (3.6)	0	30 (4.1)		0	30 (3.9)	
Other, non-Hispanic‡	16 (1.9)	3 (3.2)	13 (1.8)		2 (3.8)	14 (1.8)	
Sexual orientation†				0.24			0.64
Gay	713 (85.3)	86 (90.5)	627 (84.6)		46 (86.8)	667 (85.2)	
Bisexual	73 (8.7)	4 (4.2)	69 (9.3)		3 (5.7)	70 (8.9)	
Queer	39 (4.7)	3 (3.2)	36 (4.9)		3 (5.7)	36 (4.6)	
Heterosexual, lesbian, other or don't know§	11 (1.3)	2 (2.1)	9 (1.2)		1 (1.9)	10 (1.3)	
Years of school¶				0.03			0.23
≤12	96 (11.5)	14 (14.7)	82 (11.1)		8 (15.1)	88 (11.3)	
13–15	186 (22.4)	30 (31.6)	156 (21.2)		14 (26.4)	172 (22.1)	
16	188 (22.6)	17 (17.9)	171 (23.2)		11 (20.8)	177 (22.7)	
>16	362 (43.5)	34 (35.8)	328 (44.5)		20 (37.7)	342 (43.9)	
Marital status				0.05			0.14
Single no steady partner	365 (44.1)	38 (40.9)	327 (44.6)		23 (43.4)	342 (44.2)	
Married	155 (18.7)	14 (15.1)	141 (19.2)		5 (9.4)	150 (19.4)	
Single with steady partner(s)	146 (17.7)	15 (16.1)	131 (17.9)		12 (22.6)	134 (17.3)	
Cohabitating	105 (12.7)	13 (14.0)	92 (12.5)		6 (11.3)	99 (12.8)	
Widowed, divorced or separated	56 (6.8)	13 (14.0)	43 (5.9)		7 (13.2)	49 (6.3)	
Anal condyloma detected at visit†				0.17			0.04
No	825 (98.5)	92 (96.8)	733 (98.7)		50 (94.3)	775 (98.7)	
Yes	13 (1.5)	3 (3.2)	10 (1.3)		3 (5.7)	10 (1.3)	

Continued

Table 1 Continued

Characteristic	Total n=838	Resting tone		P value	Squeeze tone		P value
		Decreased n=95	Normal/Increased n=743		Decreased n=53	Normal/Increased n=785	
HIV diagnosis history				<0.001			0.99
No	548 (66.1)	42 (44.2)	506 (68.9)		35 (66.0)	513 (66.1)	
Yes	281 (33.9)	53 (55.8)	228 (31.1)		18 (34.0)	263 (33.9)	
Obesity diagnosis history				0.002			0.61
No	716 (85.4)	71 (74.7)	645 (86.8)		44 (83.0)	672 (85.6)	
Yes	122 (14.6)	24 (25.3)	98 (13.2)		9 (17.0)	113 (14.4)	
Preferred position for anal intercourse				0.06			0.69
Always/mostly insertive	198 (23.6)	14 (14.7)	184 (24.8)		10 (18.9)	188 (24.0)	
Versatile	349 (41.7)	40 (42.1)	309 (41.6)		23 (43.4)	326 (41.5)	
Always/mostly receptive	291 (34.7)	41 (43.2)	250 (33.7)		20 (37.7)	271 (34.5)	
Last receptive anal intercourse†				0.04			0.02
Within last month	364 (43.8)	39 (41.1)	325 (44.1)		15 (28.3)	349 (44.8)	
>1 month	394 (47.4)	45 (47.4)	349 (47.4)		34 (64.2)	360 (46.2)	
Never	33 (4.0)	1 (1.1)	32 (4.3)		0	33 (4.2)	
Don't know	41 (4.9)	10 (10.5)	31 (4.2)		4 (7.6)	37 (4.8)	
Clinician type				<0.001			<0.001
Medical doctor	331 (39.5)	12 (12.6)	319 (42.9)		8 (15.1)	323 (41.2)	
Advanced practice nurse	442 (52.7)	69 (72.6)	373 (50.2)		25 (47.2)	417 (53.1)	
Registered nurse	65 (7.8)	14 (14.7)	51 (6.9)		20 (37.7)	45 (5.7)	

Data are n (%). Missing: waist size n=7; gender identity n=1; race and ethnicity n=5; sexual orientation n=2; marital n=11; HIV diagnosis history n=9; last receptive anal intercourse n=6.
All hypothesis tests are Pearson χ^2 unless otherwise noted.
*Student's t-test.
†Fisher's exact test.
‡Other includes Native Hawaiian or Pacific Islander, American Indian or Alaskan Native and other.
§Individuals' self-reported sexual orientation included 'heterosexual' (n=1) and 'lesbian' (n=2) although self-reported sexual behaviour satisfied inclusion criteria.
¶Cochran-Armitage test for trend.
IQR, interquartile range; SD, standard deviation.

preferred position for anal intercourse, increased age was associated with decreased RT ($p_{trend} \leq 0.01$) (figure 1).

Individuals with decreased RT also reported obesity almost twice as often as those with normal or increased tone (p=0.002) (table 1). A higher proportion of people with HIV had decreased RT compared with HIV-negative persons (18.9% and 7.7%, respectively, p<0.001, table 1) and individuals reporting a diagnosis of diabetes or arthritis also had decreased RT compared with those not reporting these diagnoses (p<0.001, online supplemental table 1).

In univariate analysis (online supplemental table 2), increasing age, BMI and waist size were associated with decreased RT. Assigned sex at birth, gender identity, marital status, HIV status, diabetes, obesity, arthritis, stroke, preferred position for anal intercourse, frequency of any anal intercourse and clinician type were also associated with RT. For example, reporting a prior diagnosis

of obesity was associated with decreased RT (OR 2.25, 95% CI 1.35 to 3.73, compared with those not reporting obesity). Individuals preferring RAI were associated with decreased RT (OR 2.11, 95% CI 1.12 to 2.95 compared with individuals preferring IAI).

In multivariable analysis for decreasing RT, age, gender identity, race/ethnicity, HIV status, obesity and clinician type were significant while preferred position for anal intercourse was also associated with RT after adjusting for confounders (aOR 2.82, 95% CI 1.37 to 5.82 for persons who performed RAI compared with those performing IAI) (table 2). Engaging equally in RAI and IAI was not associated with decreased RT.

In supplementary analysis with clinicians completing DAREs with >50 individuals in the study, a total of 609 individuals were analysed (online supplemental table 3) with the prevalence of decreased RT being 8.4%. In multivariable analysis in this restricted dataset, factors
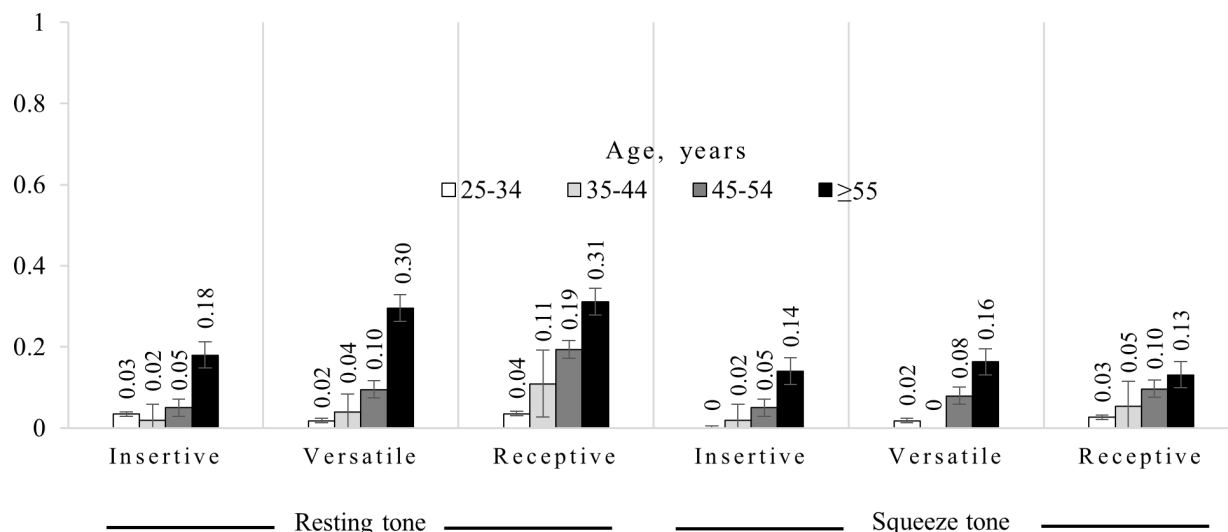
Figure 1 The proportion of individuals with decreased sphincter resting and squeeze tone by age and preferred position for anal intercourse in the Prevent Anal Cancer Studies, Chicago, Houston and Milwaukee, USA, 2020–2022. The Cochrane-Armitage test for trend, p<0.01 for each histogram.

associated with decreased RT were similar to the full dataset: increasing age, obesity, preferring always/mostly RAI (compared with IAI) and an APN clinician type (compared with physician); however, gender identity, race/ethnicity and HIV status were no longer associated with decreased RT (online supplemental table 4).

Sphincter ST

Clinicians detected 6.3% (n=53) of individuals with decreased ST (table 1). On the 0–5 DRESS scale, the mean ST was 3.04 (SD, 0.48). By preferred position for anal intercourse, the mean DRESS scale score was 3.10 (SD, 0.55), 3.02 (SD, 0.45) and 3.01 (SD, 0.44) among individuals preferring IAI, being versatile and preferring RAI, respectively (p=0.12) (data are not shown).

As with RT, the median age of persons with decreased ST was higher than those with normal/increased tone, 55 and 40 years, respectively (p<0.001, table 1). Increasing age was associated with decreased ST regardless of preferred position for anal intercourse (p_{trend}<0.01, figure 1). Unlike with RT, there was no difference in ST by HIV status (p<0.001 and p=0.99, respectively). Also unlike RT, there was little difference in ST among people with and without a self-reported diagnosis of obesity (p=0.002 and p=0.61).

In univariate logistic regression analysis for ST (online supplemental table 2), factors significantly associated with ST were generally similar to factors associated with RT, for example, age, waist size, assigned sex at birth, diabetes, arthritis, frequency of anal intercourse and clinician type. Unlike with RT, BMI, gender identity, marital status, HIV status, obesity, stroke and preferred position for anal sex were not associated with ST while race and ethnicity and condyloma detected at the clinic visit were associated with ST.

In multivariable analysis (table 2), decreased ST was associated with increasing age, being assigned female sex at birth (compared with being assigned male), marital status, a condyloma diagnosis at the clinic visit and clinician type of registered nurse (compared with physician) after adjusting for other variables, including confounders, in the model. Being married, compared with single with no steady partner(s), was protective of decreased ST. Individuals preferring RAI or being versatile were not significantly associated with decreased ST.

Accuracy

The AUC of a DARE assessment of RT to detect individuals having any RAI was 0.53 (95% CI 0.51 to 0.55) (table 3). The accuracy of a DARE assessment of ST to detect individuals having any RAI was 0.51 (95% CI 0.49 to 0.53).

In supplementary analyses with only physicians and APNs, the accuracy of a DARE assessment of RT and ST to detect individuals having any RAI remained close to 0.50 (online supplemental table 5). Also in supplementary analysis, removing 12 individuals assigned female sex at birth from the dataset modified point estimates little and did not change the overall conclusions.

DISCUSSION

We report data that reject the utility of the forced anal examination to detect persons having RAI. In this sample of 838 individuals who were sexual minorities, gender minorities, or both, decreased anal sphincter RT was uncommon (11.3%) with 88.7% of individuals having normal or increased RT based on a DARE DRESS score. For ST, 93.7% of SGM had normal or increased ST. The accuracy of a DARE assessment of RT and ST to detect individuals having any RAI was only 0.53 and 0.51,

Table 2 Multivariable analysis of factors associated with decreased sphincter resting and squeeze tone, Chicago, Houston and Milwaukee, USA 2020–2022

	Resting tone	Squeeze tone
	aOR* (95% CI)	aOR† (95% CI)
Age, years	**1.09 (1.06 to 1.11)**	**1.07 (1.04 to 1.09)**
Assigned sex at birth		
Male	-	1.0
Female	-	**13.84 (3.19 to 60.05)**
Gender identity		
Man	1.0	-
Transgender woman, transgender man, woman and other	**3.55 (1.11 to 11.38)**	-
Non-binary	0.45 (0.02 to 9.04)	-
Race and ethnicity		
White, non-Hispanic	1.0	-
Black, non-Hispanic	1.62 (0.82 to 3.22)	-
Hispanic	1.37 (0.71 to 2.63)	-
Asian, non-Hispanic	0.16 (0.01 to 3.67)	-
Other, non-Hispanic‡	**6.06 (1.37 to 26.83)**	-
Marital status		
Single no steady partner		1.0
Married	-	**0.35 (0.13 to 0.94)**
Single with steady partner(s)	-	1.28 (0.57 to 2.87)
Cohabitating	-	0.75 (0.28 to 2.01)
Widowed, divorced or separated	-	1.01 (0.38 to 2.66)
Anal condyloma detected at visit		
No	-	1.0
Yes	-	**6.59 (1.42 to 30.59)**
HIV diagnosis history		
No	1.0	-
Yes	**1.72 (1.01 to 2.92)**	-
Obesity diagnosis history		
No	1.0	-
Yes	**2.10 (1.17 to 3.79)**	-
Preferred position for anal intercourse		
Always/mostly insertive	1.0	-
Versatile	1.80 (0.89 to 3.66)	-
Always/mostly receptive	**2.82 (1.37 to 5.82)**	-
Clinician type		
Medical doctor	1.0	1.0
Advanced practice nurse	**3.51 (1.77 to 6.94)**	1.93 (0.87 to 4.32)
Registered nurse	**5.91 (2.38 to 14.69)**	**11.79 (4.71 to 29.52)**

Before rounding to two decimals, bolded point estimates and 95% CI did not include unity.
*Adjusted by variables retained in model and potential confounder assigned sex at birth.
†Adjusted by variables retained in model and potential confounder race and ethnicity.
‡Other includes Native Hawaiian or Pacific Islander, American Indian or Alaskan Native and other.
aOR, adjusted OR.

Table 3 Accuracy of digital anal rectal examinations to detect persons engaging in any receptive anal intercourse,* Chicago, Houston and Milwaukee, USA 2020–2022

	Resting tone accuracy† (95% CI)	Squeeze tone accuracy† (95% CI)
Overall	0.53 (0.51 to 0.55)	0.51 (0.49 to 0.53)
Clinician type		
Medical doctor	0.52 (0.51 to 0.54)	0.52 (0.51 to 0.53)
Advanced practice nurse	0.53 (0.50 to 0.57)	0.51 (0.49 to 0.53)
Registered nurse	0.53 (0.43 to 0.64)	0.52 (0.39 to 0.65)

*Any receptive anal intercourse is defined as a preferred position for anal intercourse that is either versatile or always/mostly receptive anal sex.
†Accuracy is assessed by the area under the receiver operating characteristics curve.

respectively. Since an AUC value of 0.50 means a test is no better than flipping a coin, the accuracy of sphincter tonality to detect RAI is virtually nil. A limitation of this finding is that sphincter tone may differ for individuals experiencing forced versus voluntary examinations. If forced exams result in tensing or sphincter contraction, regardless of preferred position for anal sex, we would expect accuracy of the exam to decrease.

Decreased anal sphincter RT and ST were strongly associated with age in all categories of preferred position for anal intercourse. With each year of age, there was a 9% increased risk of having decreased RT. Age-associated decreased sphincter tone has ample support in the literature.[22–25] Age-related fibrotic processes likely affect both smooth[26] and striated[11] muscles, reducing muscle content and enhancing atrophy[10 27]; thus, in this sample, age-related exposures, that is, diabetes, arthritis and stroke, were associated with decreased tonality in univariate analysis but not after adjusting for age.

Studies assessing the natural variation in sphincter tone in asymptomatic individuals generally find high variability even within age groups and genders.[22 23] No studies have assessed sphincter tone among SGM with varying sexual practices. Two small studies[12 13] have used manometry to assess the association between sphincter tone and RAI. Miles et al[12] compared 40 gay males having RAI (23 of whom had HIV) with 18 age-matched heterosexual males who did not acknowledge RAI. Chun et al[13] enrolled 14 HIV-negative gay males having RAI and ten age-matched male controls not acknowledging RAI. Both studies observed lower RT among the gay males acknowledging RAI than the controls while ST did not differ between the two groups. These results are consistent with our observations. Chun et al suggested that lower RT pressures during manometry may occur if the internal sphincter muscle of those preferring RAI is better able to relax during anal canal manometry compared with those acknowledging only IAI.

While these data indicate that SGM seldom have decreased sphincter tone (only 14.1% of those preferring RAI had decreased RT), they also suggest an association with decreased RT for those always/mostly having RAI but no significant association with those having any RAI, that is, those preferring RAI and those equally preferring both RAI and IAI. The strongest influence on tone was age, regardless of preferred position for anal intercourse. Note that for those preferring RAI, age-related decreased sphincter tone may result in decreased anodyspareunia.[28 29]

In general, factors associated with decreased RT and ST were similar with notable exceptions including those always/mostly preferring RAI having decreased RT but not ST. Similar to the reasoning from Chun et al,[13] perhaps individuals preferring RAI were better able to relax the voluntary external sphincter muscle during the DARE than individuals preferring IAI. Individuals with HIV were also associated with decreased RT but not ST which may be related to HIV-induced accelerated ageing and damage to smooth muscle cells caused by HIV and antiretroviral treatment.[30] To our knowledge, the association between obesity and sphincter RT in males has not been assessed. Obesity is associated with chronic inflammation[31] which may induce fibrotic processes, in turn, promoting internal sphincter atrophy.[32]

Those with decreased RT and ST had increased odds of receiving a DARE from an APN or registered nurse compared with a physician. These results were consistent with the restricted data set which used observations from clinicians conducting >50 DAREs in the study. In Houston, where APNs completed all DAREs, participants were substantially older and more likely to have HIV compared with Chicago participants where most DAREs were conducted by a physician; thus, residual age-related or HIV-related confounding may explain differences in sphincter tone by clinician type. Alternatively, differences in tone assessment might occur if physicians receive more digital rectal examination training or practice in school than APNs or registered nurses.

The combined gender identity category of transgender, woman and other had decreased resting sphincter tone although data were sparse (n=29). Of these, eight individuals reported an assignment of female sex at birth (27.6%) which helps explain the association between this gender identity category and decreased RT. Lower RT in females than males may be due to a shorter anal canal, parity or decreased muscle mass.[24 25 32 33]

Limitations

To our knowledge, the 838-person sample size in this study is larger than any other assessment of sphincter tone among community-recruited and healthy individuals. Practical limitations in this large study required using the DRESS scale as a proxy for manometry. While the DRESS scale is strongly correlated with manometry pressures (Spearman rank correlation, 0.82 for RT and 0.81 for ST),[18] it may introduce more error in sphincter

tone outcome scores. Nonetheless, DARE has been found to be of sufficient value for measuring sphincter tone in clinical settings[34] including when compared against three-dimensional high-resolution anal manometry, balloon expulsion test, transperineal ultrasound and surface electromyography.[35] In addition, our observation of decreased RT with age and decreased ST with sex at birth are consistent with other studies using manometry.[25 32] Two clinicians, a physician and APN, conducted 65% of DAREs which may increase reliability in resting and squeeze sphincter tone measurement. Self-reported lifetime preferred position for anal intercourse, disease history and frequency of anal intercourse are subject to recall bias. No data were collected about douching, sex toys or other anal manipulations which may limit our understanding of factors associated with sphincter tone. The sample was diverse regarding age, race, ethnicity and gender identity; however, it was also highly educated.

Inclusion criteria were the same in the three cities except for three criteria listed in the methods. We think it is highly unlikely these differing criteria would change study conclusions. We are aware of no data linking anticoagulant use or DARE to changes in internal or external sphincter function. In addition, only one person in Chicago and Houston reported current treatment for condyloma, enlarged haemorrhoids or anal cancer.

CONCLUSION

In this study with 838 SGM, decreased sphincter RT and ST were infrequent. Increased age was strongly associated with decreased sphincter RT and ST.

DARE had almost no accuracy to detect individuals having RAI; thus, the forced anal examination is useless in identifying SGM who prefer RAI while also causing significant harm to individuals subjected to the test.[1–3 8] The proposition that a finger inserted into the anal canal can detect an individual engaging in RAI is false.

Author affiliations
[1]Psychiatry and Behavioral Medicine, Medical College of Wisconsin, Milwaukee, Wisconsin, USA
[2]Center for AIDS Intervention Research, Medical College of Wisconsin, Milwaukee, Wisconsin, USA
[3]School of Public Health, University of Minnesota, Minneapolis, Minnesota, USA
[4]University of Chicago Medicine Infectious Diseases & Global Health, Chicago, Illinois, USA
[5]University of Wisconsin-Madison School of Medicine and Public Health, Madison, Wisconsin, USA
[6]Crofoot Research Center, Houston, Texas, USA
[7]Medical College of Wisconsin, Milwaukee, Wisconsin, USA
[8]Department of Surgery, Medical College of Wisconsin, Milwaukee, Wisconsin, USA
[9]The University of Texas MD Anderson Cancer Center, Houston, Texas, USA
[10]Les Plumes Rouges, San Antonio, Texas, USA
[11]Case Western Reserve University, Cleveland, Ohio, USA
[12]Department of Psychiatry and Mental Health, Muhimbili University of Health and Allied Sciences, Dar es Salaam, Tanzania
[13]Department of Family Medicine and Community Health, University of Minnesota Twin Cities, Minneapolis, Minnesota, USA

ORCID iDs
Alan G Nyitray http://orcid.org/0000-0003-2020-9904

B R Simon Rosser http://orcid.org/0000-0001-8862-531X
Michael W Ross http://orcid.org/0000-0002-5718-9989

REFERENCES

1 Human Rights Committee of the United Nations. In dialogue with Egypt, experts of the human rights committee commend measures combatting discrimination, raise issues concerning treatment of Lesbian, gay, Bisexual, Transgender and Intersex persons and judicial independence. Geneva, Switzerland UN Geneva, United Nations; 2023.

2 Cichowitz C, Rubenstein L, Beyrer C. Forced anal examinations to ascertain sexual orientation and sexual behavior: an abusive and medically unsound practice. *PLoS Med* 2018;15:e1002536.

3 International Forensic Expert Group. Statement on Anal examinations in cases of alleged Homosexuality. *Torture* 2016;26:85–91.

4 Tardieu A. *Étude Médico-Légale Sur Les Attentats Aux Moeurs*. 5th edn. Paris: J.B. Ballière et fils, 1867:197–210.

5 Tamagne F. *Histoire de l'homosexualité: Berlin, Londres, Paris 1919-1939*. Paris: Éditions du Seuil, 2000:232–3.

6 Ross AI. *Public City, Public Sex: Homosexuality, Prostitution, and Urban Culture in Nineteenth-Century Paris*. Philadelphia: Temple University Pressx, 2019:99–114.

7 Houbre G. The bastard offspring of Hermes and Aphrodite: sexual "anomalies" and medical curiosity in France. In: Cryle P, Forth C, eds. *Sexuality at the fin-de-siecle: The Makings of a 'Central Problem'*. Delaware: Newark University of Delaware Press, 2008: 62–3.

8 Robertson WJ, Bunkley EN. Iatrogenic Necropolitics: forced Anal examinations and state-sanctioned Homophobia. *Cult Health Sex* 2024;26:317–31.

9 Long S. When doctors torture: the anus and the state in Egypt and beyond. *Health Hum Rights* 2004;7:114.

10 Singh J, Boopathi E, Addya S, *et al*. Aging-associated changes in microRNA expression profile of internal Anal sphincter smooth muscle: role of microRNA-133A. *Am J Physiol Gastrointest Liver Physiol* 2016;311:G964–73.

11 Rajasekaran MR, Kanoo S, Fu J, *et al*. Age-related external Anal sphincter muscle dysfunction and fibrosis: possible role of WNT/B-Catenin signaling pathways. *Am J Physiol Gastrointest Liver Physiol* 2017;313:G581–8.

12 Miles AJ, Allen-Mersh TG, Wastell C. Effect of Anoreceptive intercourse on Anorectal function. *J R Soc Med* 1993;86:144–7.

13 Chun AB, Rose S, Mitrani C, *et al*. Anal sphincter structure and function in homosexual males engaging in Anoreceptive intercourse. *Am J Gastroenterol* 1997;92:465–8.

14 Stier EA, Clarke MA, Deshmukh AA, *et al*. International Anal Neoplasia society's consensus guidelines for Anal cancer screening. *Int J Cancer* 2024;154:1694–702.

15 Hillman RJ, Berry-Lawhorn JM, Ong JJ, *et al*. International Anal Neoplasia society guidelines for the practice of Digital Anal Rectal examination. *J Low Genit Tract Dis* 2019;23:138–46.

16 Nyitray AG, Nitkowski J, McAuliffe TL, *et al*. Home-based self-sampling vs clinician sampling for Anal Precancer screening:

the prevent Anal cancer self-SWAB study. *Int J Cancer* 2023;153:843–53.

17 Flores RA, Wilkerson JM, Travis A, *et al*. Men who have sex with men experience low anxiety and few barriers to performing Anal self or companion examinations: a qualitative study of the prevent Anal cancer palpation study. *Cult Health Sex* 2024;26:920–35.

18 Orkin BA, Sinykin SB, Lloyd PC. The Digital Rectal examination scoring system (DRESS). *Dis Colon Rectum* 2010;53:1656–60.

19 Hosmer DW, Lemeshow S, Sturdivant RX. Applied logistic regression. In: Sturdivant RX, ed. *Lemeshow S*. New Jersey: Wiley & Sons, Available: https://onlinelibrary.wiley.com/doi/book/10.1002/9781118548387

20 Rothman KJ, Greenland S, Lash TL, eds. *Modern Epidemiology*. 3rd edn. Philadelphia, PA: Lippincott Williams & Wilkins, 2008.

21 Firth D. Bias reduction of maximum likelihood estimates. *Biometrika* 1993;80:27–38.

22 Kim HJ, Kim N, Choi Y, *et al*. Effects of aging and gender on the Anorectal function of healthy subjects assessed with conventional Anorectal manometry. *Korean J Gastroenterol* 2022;80:254–61.

23 Oblizajek NR, Gandhi S, Sharma M, *et al*. Anorectal pressures measured with high-resolution manometry in healthy people-normal values and asymptomatic pelvic floor dysfunction. *Neurogastroenterol Motil* 2019;31:e13597.

24 Jameson JS, Chia YW, Kamm MA, *et al*. Effect of age, sex and parity on Anorectal function. *Br J Surg* 1994;81:1689–92.

25 Gundling F, Seidl H, Scalercio N, *et al*. Influence of gender and age on Anorectal function: normal values from Anorectal manometry in a large Caucasian population. *Digestion* 2010;81:207–13.

26 Mohanty I, Singh J, Rattan S. Downregulation of Thromboxane A2 and angiotensin II type 1 receptors associated with aging-related decrease in internal Anal sphincter tone. *Sci Rep* 2019;9:6759.

27 Mahdy MAA. Skeletal muscle fibrosis: an overview. *Cell Tissue Res* 2019;375:575–88.

28 Grabski B, Kasparek K. Sexual Anal pain in gay and Bisexual men: in search of explanatory factors. *J Sex Med* 2020;17:716–30.

29 Vansintejan J, Vandevoorde J, Devroey D. The gay men sex studies: Anodyspareunia among Belgian gay men. *Sex Med* 2013;1:87–94.

30 Haser GC, Sumpio B. Systemic and cell-specific mechanisms of Vasculopathy induced by human immunodeficiency virus and highly active antiretroviral therapy. *J Vasc Surg* 2017;65:849–59.

31 Després JP. Health consequences of visceral obesity. *Ann Med* 2001;33:534–41.

32 Abe T, Kunimoto M, Hachiro Y, *et al*. Effects of age and sex on the Anorectal sensory threshold to electrical stimulation: a single-center observational study. *J Anus Rectum Colon* 2023;7:74–81.

33 Lee HR, Lim SB, Park JY. Anorectal Manometric parameters are influenced by gender and age in subjects with normal bowel function. *Int J Colorectal Dis* 2014;29:1393–9.

34 Carrington EV, Scott SM, Bharucha A, *et al*. Expert consensus document: advances in the evaluation of Anorectal function. *Nat Rev Gastroenterol Hepatol* 2018;15:309–23.

35 Dekker L, van Reijn-Baggen DA, Han-Geurts IJM, *et al*. To what extent are Anorectal function tests comparable? A study comparing Digital Rectal examination, Anal Electromyography, 3-dimensional high-resolution Anal manometry, and Transperineal ultrasound. *Int J Colorectal Dis* 2023;38:12.