UNIVERSITY OF CALIFORNIA, SAN DIEGO

SAN DIEGO STATE UNIVERSITY

Heterogeneity of Body Image Concerns and Associations With Disordered Eating, Muscle-building, and Body Dysmorphic Disorder Symptoms in Sexual Minority Individuals

A dissertation submitted in partial satisfaction of the requirements for the degree Doctor of

Philosophy

in

Clinical Psychology

by

Patrycja Klimek

Committee in charge:

University of California, San Diego

Professor Ariel Lang
Professor Christina Wierenga

San Diego State University

Professor Aaron J. Blashill, Chair
Professor Nader Amir
Professor Vanessa Malcarne
Professor Scott C. Roesch

2022

The Dissertation of Patrycja Klimek is approved, and it is acceptable in quality and form for publication on microfilm and electronically:

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Chair

University of California, San Diego

San Diego State University

2022

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ACKNOWLEDGEMENTS

Chapter 1: I, Patrycja Klimek (primary author of this material), would like to thank all coauthors — Drs. Blashill and Roesch, Ms. Alexandra D. Convertino and Mr. Manuel Gonzales IV — for their contributions to this work. I also would like to thank *Psychology of Sexual Orientation and Gender Diversity* for accepting this work for publication and the American Psychological Association for publishing this work.

Chapter 2: I, Patrycja Klimek (primary author of this material), would like to thank all coauthors — Drs. Blashill, Pennesi, Roesch, Nagata, Ms. Alexandra D. Convertino and Mr. Manuel Gonzales IV — for their contributions to this work. I also would like to thank the *International Journal of Eating Disorders* for accepting this work for publication and John Wiley & Sons publications for publishing this work.

Chapter 3: I, Patrycja Klimek, (primary author of this material), would like to thank all coauthors — Drs. Blashill, Roesch, and Calzo— for their contributions to this work.

VITA

EDUCATION AND TRAINING

SDSU/UC San Diego Joint Doctoral Program in Clinical Psychology, San Diego, CA
August 2016 - 2022
Ph.D. • Clinical Psychology • Major Areas of Emphasis: Behavioral Medicine
Dissertation: Heterogeneity of Body Image Concerns and Associations With Disordered Eating, Muscle-building, and Body Dysmorphic Disorder Symptoms in Sexual Minority Individuals (Defended June 18, 2021)

Central Texas Veterans Health Care System, Temple & Austin, TX
August 2021 – July 2022
Psychology Intern • APA-Accredited Internship

San Diego State University, San Diego, CA
August 2019
M.S. Degree • Major: Clinical Psychology • GPA: 3.97
Thesis Project: Cognitive Behavioral Therapy for Body Image and Self-Care Among Sexual Minority Men Living With HIV: Skills-Based Treatment Mediators

Hunter College, CUNY, New York, NY
September 2009 - 2013
B.A. Degree • Major: Psychology • Psychology GPA: 4.0

Queen Mary University of London, London, UK
September 2012 - December 2012
Study Abroad Program

PUBLICATIONS

*denotes a mentored author

Peer-Reviewed Journal Articles

1. **Klimek-Johnson, P.** (2022). Better understanding change processes and mechanisms: A commentary on "Treatment of compulsive exercise in eating disorders and muscle dysmorphia: A systematic review and meta-analysis." Advance online publication. *Clinical Psychology: Science and Practice.* https://doi.org/10.1037/cps0000069

2. **Klimek, P.,** Convertino, A. D., Pennesi, J.-L., Gonzales IV, M., Roesch, S. C., Nagata, J., & Blashill, A. J. (2021). Confirmatory factor and measurement invariance analyses of the Eating Disorder Examination Questionnaire in sexual minority men and women. *International Journal of Eating Disorders, 54*(5), 745–754. https://doi.org/10.1002/eat.23488

3. **Klimek, P.,** Convertino, A. D., Gonzales IV, M., Roesch, S. C., & Blashill, A. J. (2021). Confirmatory factor and measurement invariance analyses of the Drive for Muscularity Scale in sexual minority men and women. *Psychology of Sexual Orientation and Gender Diversity.* Advance online publication. https://doi.org/10.1037/sgd0000472

4. **Klimek, P**., *Wei, B., & Blashill, A. J. (2020). The effect of mirror exposure on body image outcomes: A systematic review and meta-analysis. *Eating Disorders: The Journal of Treatment and Prevention.* https://doi.org/10.1080/10640266.2020.1791665

5. **Klimek, P.,** Wilhelm, S., Safren, S. A., & Blashill, A. J. (2020). Cognitive behavioral therapy for body image and self-care (CBT-BISC) among sexual minority men living with HIV: Skills-based treatment mediators. *Cognitive Therapy and Research, 44*, 208–215. https://doi.org/10.1007/s10608-019-10035-w

6. *Oshana, A., **Klimek, P.,** & Blashill, A. J. (2020). Minority stress and body dysmorphic disorder symptoms among sexual minority males. *Body Image: An International Journal of Research, 34*, 167–174. https://doi.org/10.1016/j.bodyim.2020.06.001

7. *Wei, B., **Klimek, P.,** Pennesi, J.-L., & Blashill, A. J. (2020). Perceptual and attitudinal body image, disordered eating, and muscle-building behavior in college men. *Psychology of Men and Masculinities, 22(*1), 156–165. https://doi.org/10.1037/men0000290

8. Rozzell, K., Moon, D. Y., **Klimek, P.,** Brown, T., & Blashill, A. J. (2019). Prevalence of eating disorders among 9-10 year old children: Results from a U.S. representative sample. *JAMA Pediatrics, 173*(1), 100–101. https://doi.org/10.1001/jamapediatrics.2018.3678

9. **Klimek, P.,** & Hildebrandt, T. (2018). Psychosocial correlates of gap time to anabolic-androgenic steroid use. *International Journal of Eating Disorders, 51*(6), 535–541. https://doi.org/10.1002/eat.22859

10. **Klimek, P.,** Lamb, K. M., Nogg, K. A., Rooney, B. M., & Blashill, A. J. (2018). Current and ideal skin tone: Associations with tanning behavior among sexual minority men. *Body Image: An International Journal of Research, 25*, 31–34. https://doi.org/10.1016/j.bodyim.2018.01.007

11. **Klimek, P.,** Murray, S., Brown, T., Gonzales IV, M., & Blashill, A. J. (2018). Thinness and muscularity internalization: Associations with disordered eating and muscle dysmorphia in men. *International Journal of Eating Disorders, 51*(4), 352–357. https://doi.org/10.1002/eat.22844

12. Sysko, R., Glasofer, D. R., Hildebrandt, T., **Klimek, P.,** Mitchell, J. E., Berg, K. C., Peterson, C. B., Wonderlich, S. A., & Walsh, B. T. (2015). The eating disorder assessment for DSM-5 (EDA-5): Development and validation of a structured interview for feeding and eating disorders. *International Journal of Eating Disorders, 48*(5), 452–463. https://doi.org/10.1002/eat.2238

Book Chapters

13. Blashill, A. J., Brown, T., & **Klimek, P.** (2019). Body image and eating pathology in sexual minority men: Evidence-based practice. In J. Pachankis, & S. Safren, *The Handbook of evidence-based mental health practice with LGBT clients*. Oxford University Press.

14. **Klimek, P.**, Grotzinger, A., & Hildebrandt, T. (2016). Using acceptance to improve body image among individuals with eating disorders. In A. F. Haynos, E. M. Forman, M. L. Butryn, & J. Lillis, *Mindfulness and acceptance for treating eating disorders and weight concerns* (pp. 121–142. New Harbinger Press.

Under Review or in Preparation

15. **Klimek-Johnson, P.,** Calzo, J., Roesch, S., & Blashill, A. J. (revise and resubmit). Associations between patterns of body image concerns and body image disorder symptoms among sexual minority men and women: A mixture-modeling approach. *Body Image.*.

16. **Klimek-Johnson, P.,** *Moon, D. Y., Rozzell, K., & Blashill, A. J. (in preparation). Executive function in children with parent-reported binge eating: Results from the adolescent brain cognitive development study.

17. Nahid, R., Saunders, J., **Klimek-Johnson, P.**, Convertino, A. D., Fitzsimmons-Craft, E., Nagata, J., & Lavender, J. (under review). Validation of a Farsi version of the Eating Disorder Examination Questionnaire (F-EDE-Q) in adolescents and college students from Iran. *Appetite.*

18. Rutledge, T., Greco, R., & **Klimek-Johnson, P.** (under review). Psychiatric, functional, and patient-centered goals among veterans receiving bariatric surgery: Validation of a pre- and post-bariatric assessment model. *Journal of Behavioral Medicine.*

POSTERS AND SYMPOSIA PRESENTATIONS

***** denotes a mentored author
^denotes Student Research Award, awarded to mentee

1. Brown, T. A., **Klimek-Johnson, P**., Convertino, A. D., Douglas, V. J., Pachankis, J., & Blashill, A. J. (November, 2022). A Pilot Intervention of a Novel Eating Disorder Treatment for Sexual Minority Men and Women. In T. Myers (Chair), "*Eating Pathology in Sexual and Gender Minority Individuals: Prevalence, Related Sociocultural Factors, and Treatment*". Symposium to be conducted at the Annual Convention of the Association for Behavioral and Cognitive Therapies, New York, NY.

2. **Klimek-Johnson, P.,**.Calzo, J. P., Roesch, S. C., Gonzales IV, M., & Blashill, A. J. (2021, November). *Associations between body image patterns and body image disorder symptoms in sexual minority individuals: A mixture modeling approach*. Poster presented at the Association for Behavioral and Cognitive Therapies virtual conference.

3. **Klimek, P.,** Pennesi, J. L., Murray, S., Rozzell, K., & Brown, T., & Blashill, A. J. (2019, March). *Body dissatisfaction and negative affect as predictors of muscularity-oriented eating pathology among men*. Poster presented at the International Conference on Eating Disorders, New York, NY.

4. **Klimek, P.**, Wilhelm, S., Safren, S. A., Blashill, A. J. (2018, November). *Cognitive behavioral therapy for body image and self-care (CBT-BISC) among sexual minority men living with HIV: Skills-based treatment mediators*. Poster presented at the Association for Behavioral and Cognitive Therapies annual conference, Washington, DC.

5. *Moon, D., **Klimek, P.,** & Blashill, A. J. (2018, November). *Neurocognition in children with eating disorders: Results from a nationally representative sample*. Poster presented at the Association for Behavioral and Cognitive Therapies annual conference, Washington, DC.

6. Rozzell, K. N., Moon, D., **Klimek, P.,** Brown, T. A., & Blashill, A. J. (2018, November). *Prevalence of eating disorders among 9-10 year old children: Results from a U.S.*

representative sample. Poster presented at the Association for Behavioral and Cognitive Therapies 52nd Annual Meeting & Scientific Session, Washington D.C.

7. *Wei, B., **Klimek, P.,** & Blashill, A. J. (2018, November). *Perceptual and attitudinal body image measures, disordered eating, and muscle-building behavior in men*. Poster session presented at the Association for Behavioral and Cognitive Therapies annual conference, Washington, DC.

8. **Klimek, P.,** Lamb, K. M., Nogg, K. A., Rooney, B. M., & Blashill, A. J. (2017, March). *Current and ideal skin tone: Associations with tanning behavior among sexual minority men*. Poster presented at the Society of Behavioral Medicine's Annual Meeting, San Diego, CA.

9. ^*Oshana, A., **Klimek, P.**, & Blashill, A. J. (2017, November). *Minority stress and body dysmorphic disorder symptoms among sexual minority males.* Poster presented at the Association for Behavioral and Cognitive Therapies annual conference, San Diego, CA.

10. Hildebrandt, T., **Klimek, P.,** Greif, R., Varangis, E., Loeb, K.,Wai, K., Goldstein, K. E., & Hazlett, E. (2015, April). *Frontostriatal dysfunction during processing of emotional pictures in adult women with bulimia nervosa.* Poster presented at the International Conference on Eating Disorders, Boston, NY.

11. Hildebrandt, T., Planeta-Wilson, B., Carson, R., Huang, Y., Corsi-Travali, S., **Klimek, P.**, Pietrzak, R., Piomelli, D., & Neumeister, A. (2015, April). *Endocannabinoid receptor 1 in weight restored women with anorexia nervosa.* Poster presented at the International Conference on Eating Disorders, Boston, MA.

12. Sysko, R., Glasofer, D. R., Hildebrandt, T., **Klimek, P.,** Mitchell, J. E., Berg, K. C., Peterson, C. B., Wonderlich, S. A., & Walsh, B. T. (2015, April). *The Eating Disorder Assessment for DSM-5 (EDA-5): Development and validation of a structured interview for feeding and eating disorders*. Poster presented at the International Conference on Eating Disorders, Boston, MA.

13. Hail, L., Greif, R., Shope, S., **Klimek, P**. & Hildebrandt, T. (2014, March). *The development and validation of integrity rating scales for cognitive behavioral interventions for eating disorders*. Poster presented at the International Conference on Eating Disorders, New York, NY.

14. **Klimek, P.**, Shope, S., Hildebrandt, T. (2014, March). *The dissemination of behavioral weight loss interventions using smartphone technology*. Poster presented at the Hunter College Annual Psychology Convention, New York, NY.

15. **Klimek, P.**, Hildebrandt, T., Langenbucher, J. (2014, November). *Nutritional supplements as gateway substances to illicit steroid use: Psychological risk factors.* Poster presented at the Association for Behavioral and Cognitive Therapies annual conference, Philadelphia, PA.

16. **Klimek, P.**, Shope, S., Grotzinger, A. D., Hildebrandt, T., Nesmith, K., Mackinnon, D., & Petakov, A. (2014, November). *Effects of group support on weight loss: Evaluating a smartphone intervention for the reduction of obesity*. Poster presented at the Association for Behavioral and Cognitive Therapies annual conference, Philadelphia, PA.

17. **Klimek, P.,** Stafford, S., Diego, Q., Begum, J., & Flores, R. L. (2013, April). *A look at sexual abuse in early childhood: Using research to inform policy.* Paper presented at the meeting of the Hunter Psychology Convention, Hunter College, New York, NY.

18. **Klimek, P.,** Dentico-Olin, D., & Weierich, M. R. (2012, May). *State anxiety and affective ratings of visual social information.* Poster presented at the Pace University Psychology Conference, Pace University, New York, NY.

19. Zaoutis, A., **Klimek, P.,** DaSilva, N., Marganska, A., & Weierich, M. R. (2011, April). *State anxiety and affective responding to visual scenes*. Poster presented at the NorthEast Undergraduate Research Organization for Neuroscience (N.E.U.R.O.N), Hunter College, New York, NY.

TEACHING EXPERIENCE

Instructor: Statistical Methods in Psychology (PSY 280)
January 2020 - May 2021
San Diego State University • San Diego, CA

- Taught 1 hour 15 minute introductory statistics lecture 2 days per week, to over 100 undergraduate students. Experience teaching in-person and online via Zoom
- Independently developed all course lecture slides and exams. Experience developing exams for in-person and Blackboard/Canvas administration.
- Collaborated with other course instructors on syllabus, grading, COVID-19-related course modifications
- Managed Blackboard (Spring 2020) & Canvas (Spring 2021) sites for all course sections, and used Qwickly to post announcements and content.
- Filed cheating/plagiarism incident reports
- Spring 2020 Evaluation rating (on a scale from 1 [poor] to 5 [excellent]): mean = 4.39, median = 5.
- Spring 2021 Evaluation rating: mean = 4.55, median = 5.

Statistics Teacher's Assistant
February 2013 - May 2013
Introduction to Statistics Course • Hunter College, New York, NY

- Assisted students in completing statistical analyses on SPSS software
- Tutored undergraduate students in statistical methods and graded assignments
- Provided lecture presentation on a statistics technique

RESEARCH EXPERIENCE

Graduate Researcher
Body Image, Sexuality, and Health Lab • San Diego State University, San Diego, CA
August 2016 - Present
PI: Aaron J. Blashill, Ph.D.

- Co-investigator on ongoing research study: Brain Stimulation and Visual Processing (PIs: Aaron J. Blashill, Ph.D. & Emily Kappenman, Ph.D.)
    - Managed research assistant support in data collection and documentation
    - Administered transcranial direct current stimulation (tDCS)

    - Trained by Dr. Kappenman in developing electrode montage, electrode placement, and tDCS administration
    - Trained a coordinator in tDCS administration and study management procedures to continue data collection in 2021-2022
    - Responsible for leading future data analyses
- Participated in lab's existing projects through IRB support, data analysis, discussion, and training
- Conducted literature reviews and help generate new research questions and proposals
- Mentored research assistants on independent projects
- Co-Facilitator and Assessor for a Brief, Peer Co-Led, Group-Based Eating Disorder Prevention Program for Sexual Minority Young Adult Men (1R01HD091406-01)
- Primary interventionist on research studies: Development of Two Novel Eating Disorder Interventions for Sexual Minority Individuals (UGP-242615)
- Principal Investigator and Primary interventionist on research study: Investigations of Mirror Exposure Therapy and Transcranial Direct Current Stimulation (Faculty Advisor/Co-PI: Aaron J. Blashill, Ph.D.)

Clinical Research Lab Manager
June 2015 - June 2016
Eating and Weight Disorders Program • Mount Sinai School of Medicine, New York, NY
PI: Thomas Hildebrandt, Psy.D.; Nadia Micali, M.D., Ph.D.; Robyn Sysko, Ph.D.

- Trained and provide support/guidance for new research coordinators/staff in conducting research assessments, execution of lab protocol, grant and IRB submission process, and clinical phone screening
- Trained new administrative staff in all clinical billing/administrative procedures as research coordinators were transitioning out of this dual role
- Oversaw all research study activity assigned to other research coordinators, interns
- Coordinated clinic and lab meetings
- Organized a unified team approach to submission of grants and an electronic file sharing system for all research and clinic-related activities
- Led hiring procedures for new research assistants and interns
- Created tutorials and manuals for intern duties and lab grant and IRB submissions

Clinical Research Coordinator
August 2013 - June 2016
Eating and Weight Disorders Program • Mount Sinai School of Medicine, New York, NY
PI: Thomas Hildebrandt, Psy.D.

- Coordinated research studies by recruiting participants, screening prospective participants, setting up initial and follow-up assessments, and writing and submitting IRB documents
- Contributed to writing papers and analyzing data for publications to scientific journals
- Learned to conduct structured diagnostic/psychological interviews (SCID, EDE, K-SADS, Y-BOCS-ED)
- Trained to conduct neuropsychological tests (WASI, BVMT, HVLT, DKEFS)
- Administered fMRI task that includes peripheral facial electromyography measures

- Billed and scheduled patients using IDX Flowcast until August 2015
- Contributed to and coordinated the submission of NIH and private grants by drafting components of the application (e.g., human subjects, budget)
- Observed clinical trainings in family-based treatment for adolescents, cognitive behavioral therapy for eating disorders, mirror exposure treatment for body image concerns, and cognitive remediation
- Learned/observed procedures of creating and managing an intensive outpatient program

Research Volunteer
August 2012 - June 2013
Eating Disorders Research Unit • NYS Psychiatric Institute, New York, NY
Supervisor: Barbara Smolek, M.P.A.

- Aided research assistants with research study recruitment and data organization
- Observed research meetings and training sessions for relevant research and clinical skills

Research Assistant
February 2011 - May 2012
Cognition, Affect, and Psychopathology Lab • Hunter College, New York, NY
PI: Mariann Weierich, Ph.D.

- Conceptualized and carried out independent conference presentation projects
- Consented and collected data from participants
- Entered, analyzed data using SPSS and edited photo stimuli for research use
- Peer-reviewed lab members' written products and assisted in training new lab members

CLINICAL EXPERIENCE

Mental Health Clinic Rotation
March 2022 - Present
Central Texas VA Health Care System
Temple, Texas
Supervisor: Nathan Winner, PhD

- Conduct biopsychosocial assessments for Veterans requesting mental health services
- Provide individual therapy to Veterans with heterogeneous presenting concerns (e.g., depression, anxiety, panic disorder, PTSD) using evidence-based practice

PTSD Clinic Team (PCT) Rotation
February 2022 - Present
Central Texas VA Health Care System
Temple, Texas
Supervisors: Jennifer Bennett, PhD

- Conduct PTSD clinic intakes using the PSSI-5 semi-structured interview
- Receive training in and provide prolonged exposure and written exposure therapy

Primary Care Mental Health Integration/Health Psychology Rotation
December 2021 – March 2022
Central Texas VA Health Care System
Temple, Texas

Supervisors: Carla Hitchcock-Robinson, Ph.D & Kristen Golba, Ph.D.

- Conduct PCMHI assessments and brief interventions
- Receive training in and provide cognitive behavioral therapy for insomnia
- Co-facilitate Smoking Cessation group

Eating Disorder Treatment Team at the Mental Health Clinic
August 2021 – January 2022
Central Texas VA Health Care System
Austin, Texas
Supervisor: Holly LaPota, Ph.D.

- Conduct diagnostic assessments, deliver evidence-based interventions, engage in treatment team meetings.

Psychosocial Resource and Recovery Center
August 2021 - December 2021
Central Texas VA Health Care System
Temple, Texas
Supervisor: Jennifer Rigsby, Ph.D.

- Co-facilitate groups, provide brief individual therapy, case management, and treatment planning.

VA Weight Control Clinic/Diabetes/Chronic Pain
July 2020 - June 2021
La Jolla VA San Diego Health Care System
San Diego, California
Supervisors: Thomas Rutledge, Ph.D., ABPP

- Provided pre-bariatric and implantable device psychosocial evaluations and complete integrated reports
- Provided individual therapy for weight control, chronic pain, and diabetes
- Attended Opioid Safety Initiative rounds, multidisciplinary team meetings, and didactics
- Engaged in research data collection and manuscript preparation evaluating bariatric weight loss and quality of life outcomes

Mission Valley VA Medical Center- General Mental Health (BHIP)
July 2018 - March 2020
San Diego, California
Supervisors: Julie Kangas, Ph.D.

- Provided evidence-based individual therapy to adult veterans of all ages (e.g., Cognitive Processing Therapy [CPT], Cognitive Behavioral Therapy for Insomnia and Chronic Pain)
- Administered clinical intake assessments and developed treatment plans
- Performed chart-reviews for intake reports
- Completed all requirements for the VA national rollout Cognitive Processing Therapy (CPT) consultation program

Body Image, Sexuality, and Health Lab
February 2018 - June 2021
San Diego, California
Supervisors: Aaron J. Blashill, Ph.D. and Tiffany Brown, Ph.D.

- NIH-funded R01 project (1R01MD012698-01): A Brief, Peer Co-led, Group-based Eating Disorder Prevention Program for Sexual Minority Young Adult Men
    - Co-facilitator for Media Advocacy and the Pride Body Project prevention programs
    - Clinical Semi-Structured Interview Assessor
- Faculty University Grants Program-funded project (UGP-242615): Development of Two Novel Eating Disorder Interventions for Sexual Minority Individuals
    - Primary interventionist providing culturally adapted cognitive behavioral therapy for eating disorders in sexual minority men and women, for an internally funded eating disorder treatment research study
    - Drafted study treatment manuals for both individual and couples-based therapy, building on existing evidence-based manuals

UC San Diego Eating Disorders Center
July 2018 - June 2019
San Diego, California
Supervisors: Julie Trim, Ph.D.

- Provided meal support for eating disorder patients in the partial hospitalization and intensive outpatient programs
- Co-led group therapy in a milieu setting
- Provided individual and family therapy for a young adult patient with Anorexia Nervosa
- Trained in Dialectical Behavior Therapy (DBT) and other evidence-based treatments for eating disorders
- Participated in multidisciplinary treatment team meetings and DBT consultation
- Attended seminars and didactics on eating disorder-related topics

San Diego State University Psychology Clinic
July 2017 - June 2018
San Diego, California
Supervisors: Michael Taylor, Ph.D., Aaron J. Blashill, Ph.D., and Nader Amir, Ph.D.

- Provided evidence-based treatments, such as Dialectical Behavior Therapy and Cognitive Behavioral Therapy to treat a wide-range of psychological disorders
- Administered clinical intake assessments and developed treatment plans
- Administered neuropsychological assessments and wrote integrative reports

RELEVANT VOLUNTEER/WORK EXPERIENCE

Associate Editor
August 2015 - March 2019
Top Tier Editing • New York, NY
Joseph Giardino, Ph.D. and Natasha Black, Ph.D.

- Utilized APA guidelines to edit scientific papers, dissertations/theses, undergraduate submissions

- Provided in depth content analysis to clients
- Received consistent training on extensive, detailed APA guidelines

Helpline Volunteer
February 2012 - February 2014
National Eating Disorders Association • New York, NY
- Responded to calls and emails regarding eating disorder-related inquiries
- Trained and supervised other volunteers in motivational interviewing

Volunteer Guest Speaker
February 2012- April 2012
Holy Cross R.C. Church Saturday Program • Maspeth, NY
- Led weekly group sessions with 5th, 6th, and 7th grade boys or girls regarding positive body image and healthy eating

Volunteer
August 2011 - December 2011
JBFCS Coney Island Real PROS • Brooklyn, NY
- Provided social support for adults with Axis I disorders
- Organized recreational activities and assisted with leading group counseling sessions

PEER-REVIEWING EXPERIENCE

2020-present: Editorial board member, *Eating Disorders: The Journal of Treatment and Prevention*
2021-present: Ad-hoc Reviewer, *Clinical and Behavioral Practice*
2021-present: Ad-hoc Reviewer, *Clinical Psychology: Science and Practice*
2021-present: Ad-hoc Reviewer, *PLOS ONE*
2020-present: Ad-hoc Reviewer, *Psychopharmacology*
2020-present: Ad-hoc Reviewer, *Body Image: An International Journal of Research*
2018-2020: Ad-hoc Reviewer, *Eating Disorders: The Journal of Treatment and Prevention*
2018: Ad-hoc Reviewer, *Psychiatry Research*
2016: Ad-hoc Reviewer, *American Journal of Public Health*
2015-2019: Associate Editor, *Top Tier Editing*
2014-2016: Ad-hoc Reviewer, *Body Image: An International Journal of Research*
2013 RISE Research Award Competition Reviewer, *Association for Psychological Science*

SERVICE

November 2020 - June 2021: SDSU/UC San Diego Curriculum Committee
December 2020-February 2021: SDSU/UC San Diego Student Selection Committee
December 2018-February 2019: SDSU/UC San Diego Student Selection Committee
November 2017: ABCT 2017 Conference Volunteer
April 2015: ICED 2015 Conference Volunteer
March 2014: ICED 2014 Conference Volunteer
October 2010 - May 2013: Hunter College Psych News Writer
September 2011 - June 2012: Psych News Vice-President and Editor
April 2011: N.E.U.R.O.N. Convention Volunteer

PROFESSIONAL AFFILIATIONS

American Psychological Association
Association for Behavioral and Cognitive Therapies (ABCT)
Obesity and Eating Disorders Special Interest Group, ABCT

COGNITIVE, DIAGNOSTIC, ACADEMIC, PERSONALITY, AND NEUROPSYCHOLOGICAL ASSESSMENTS

Addiction Severity Index-Lite Version (ASI-Lite)
Appearance and Performance Enhancing Drug Use Scheduled (APEDUS)
Brief Visuospatial Memory Test-Revised (BVMT-R)
California Verbal Learning Test-Second Edition (CVLT-II)
Cognitive Capacity Screening Examination (CCSE)
Conners' Continuous Performance Test-Third Edition (CPT-3)
Conners' Adult ADHD Rating Scales Self/Observer Report: Long Version (CAARS-S:L; CAARS-O:L)
Eating Disorder Examination Interview (EDE)
Grooved Pegboard Test
Millon Behavioral Medicine Diagnostic (MBMD)
Mini International Neuropsychiatric Interview (MINI)
Minnesota MultiPhasic Personality Inventory 2 (MMPI-2)
Montreal Cognitive Assessment (MoCA)
Multidimensional Health Locus of Control Scales (MHLC-Form A)
Navon Task
Personality Assessment Inventory (PAI)
PTSD Symptom Scale- Interview for DSM-5 (PSS-I-5)
Rey-Osterrieth Complex Figure Test (ROCFT)
Structured Clinical Interview for DSM-IV (SCID)
Wechsler Abbreviated Scale of Intelligence (WASI)
Wechsler Adult Intelligence Scale (WAIS-IV)
Wisconsin Card Sorting Test (WCST)
Woodcock-Johnson Tests of Achievement, 3rd Edition (WJ III ACH)
Yale-Brown Obsessive Compulsive Scale for Eating Disorders (YBOCS-ED)
Yale-Brown Obsessive Compulsive Scale (YBOCS)

HONORS AND AWARDS

Outstanding Doctoral Teaching Award (June 2021)
Joint Doctoral Program Incentive Award (November 2018)
Graduate Student Association Travel Grant (October 2018)
Joint Doctoral Program Publication Award (October 2018, August 2019, July 2020, Dec. 2020)
Hunter College Dean's list (2009-2013)
Peter Vallone Scholarship (2009-2012)
Scholarship & Welfare Fund Undergraduate Award (2013)
Psi Chi Honor Society in Psychology (Member ID: 1030709)
Golden Key International Honour Society (Member ID: 9887647)
Phi Beta Kappa Honor Society
Departmental Honors (for completion of undergraduate honor's thesis) (2013)

ABSTRACT OF THE DISSERTATION

Heterogeneity of Body Image Concerns and Associations With Disordered Eating, Muscle-building, and Body Dysmorphic Disorder Symptoms in Sexual Minority Individuals

by

Patrycja Klimek

Doctor of Philosophy in Clinical Psychology

University of California San Diego

San Diego State University, 2022

Professor Aaron J. Blashill, Chair

Objective: Body image concerns are associated with health outcomes such as eating disorders and body dysmorphic disorder. Sexual minority populations have demonstrated a disproportionate risk for body image concerns. Additionally, both thinness and muscularity-oriented body image concerns are salient in men and women and are independently associated with body image disorders. Therefore, varying body image concern patterns may demonstrate independent pathways towards the development of body image disorders. A better understanding

of heterogeneity in body image concerns and their association with body image disorders and associated health risk behaviors in sexual minority men and women is, therefore, needed. **Methods**: *Study 1* and *Study 2* examined the factor structure and measurement invariance, by gender, of self-report measures of disordered eating (Eating Disorder Examination-Questionnaire; EDE-Q) and drive for muscularity (Drive for Muscularity Scale; DMS), respectively. *Study 3* explored the heterogeneity in body image concerns and associations with body image disorder symptoms, using latent profile analysis. All studies utilized the same samples of young adult sexual minority men (n = 479) and women (n = 483). **Results:** *Studies 1 and 2* indicated factorial validity and measurement invariance by gender of the DMS and EDE-Q models. *Study 3* revealed a 5-profile solution in men and a 4-profile solution in women, characterized by varying levels of both thinness and muscularity concerns. In both men and women, disordered eating and dysmorphic concern were highest when thinness concerns were high, regardless of muscularity concern. Moreover, in both men and women, high muscularity concern profiles demonstrated the highest levels of muscle-building behavior, and profiles with both high or moderate thinness and muscularity concerns demonstrated the highest probabilities of past year illicit appearance and performance enhancing drug misuse. **Conclusion:** *Studies 1, 2, and 3* used psychometric and mixture modeling techniques to better characterize both body image concerns and body image disorders. Results from *Study 3* further demonstrated that particular body image concern profiles, varying in levels of both thinness and muscularity concerns, may be at higher risk for greater disordered eating, muscle-building, and body dysmorphic concerns. Study findings have implications for prevention and treatment for body image disorders.

INTRODUCTION

Body image concerns are significantly associated with elevated symptoms of eating disorders, body dysmorphic disorder (BDD), and other mental health concerns. Body image concerns can be characterized as thinness- or muscularity-oriented, such that men typically endorse the mesomorphic (low body fat, high muscularity) body ideal (Pope et al., 1999) and women typically endorse the thin ideal (Owen & Laurel-Seller, 2000). However, increasing evidence supports the relevance of both thinness and muscularity concerns across men and women. For example, the tripartite model, which posits that sociocultural influence plays a role in the development of body dissatisfaction and subsequent disordered eating (van den Berg et al., 2002), has been adapted to consider both thinness- and muscularity-oriented body image concerns. Investigations of the tripartite model have demonstrated that both muscularity and body fat concerns were associated with eating disorder and muscle-building behaviors in men (Tylka, 2011) and, more recently, women (Girard et al., 2018; Hoffman & Warschburger, 2019). Moreover, athletic and general appearance ideal internalization as well as overall body dissatisfaction have also been positively associated with BDD symptoms in adult men and women (e.g., Ahmadpanah et al., 2019; Didie et al., 2010; Hrabosky et al., 2009). Additionally, individuals with BDD have also demonstrated greater muscle tone and thinness-oriented body dissatisfaction compared with nonclinical controls (Hrabosky et al., 2009; Lambrou et al., 2012). Support of the tripartite influence model, therefore, demonstrates associations between body image disorders and thinness and muscularity internalization and dissatisfaction across men and women.

Individuals may also endorse varying combinations of thinness and muscularity concerns (Bozsik et al., 2018; Yellan & Tiggemann, 2003). A latent class analysis identified binge

eating/purging, muscularity concerns, and high shape/weight concerns (presence of both leanness- and muscularity-oriented concerns) patterns, in a sample of adolescent and young adult men (Calzo et al., 2015; 2016). Moreover, a recent latent profile analysis, in a sample of male and female adolescents and young adults, demonstrated comparable relevance of both muscularity and thinness-oriented concerns in the development of eating disorder and muscle-building behaviors (Hoffmann & Warschburger, 2018). In addition, Hoffmann and Warschburger (2018) reasoned that thinness and muscularity concerns may co-occur in both men and women. Other researchers have corroborated that both men and women can possess a high drive for thinness simultaneously with a high drive for muscularity (Kelley et al., 2010). However, muscularity and thinness-oriented concerns may not be orthogonal in their pathways to eating disorder and muscle-building behaviors; for example, prior literature has demonstrated that men who internalized the muscular ideal demonstrated higher levels of muscle dysmorphia symptoms when they did not highly internalize the thin ideal (Klimek et al., 2018). Therefore, further examination of the heterogeneity in body image concerns, in both men and women, is needed.

Sexual minority populations (i.e., non-heterosexual identity and/or attraction to the same gender) have demonstrated a disproportionate risk for the development and increased severity of body image concerns, eating disorders, and BDD (Boroughs et al., 2010; Calzo et al., 2013; Gonzales & Blashill, 2021; Kamody et al., 2020). An investigation of the tripartite influence model, in a sample of gay men, demonstrated a dual pathway to maladaptive body change behaviors, such that muscularity dissatisfaction was linked to muscle-building behaviors (e.g., excessive weight-lifting), and body fat dissatisfaction was linked to disordered eating behaviors (e.g., dietary restraint; Tylka & Andorka, 2012). In addition, muscularity and body fat

dissatisfaction linked mesomorphic ideal internalization—characterized by low body fat and muscularity—to muscle-building and disordered eating behaviors, respectively. The tripartite model has also been supported in samples of sexual minority women, such that thinness internalization has been linked to dietary restraint (Hazzard et al., 2019; Huxley et al., 2015). However, bisexual and lesbian women did not demonstrate significant associations between muscularity internalization and dietary restraint (Hazzard et al., 2019). Existing and mixed findings suggest that thinness and muscularity internalization and dissatisfaction may vary in their associations with body image disorder symptoms in sexual minority men and women.

Heterogeneity in body image concerns and weight/shape control behaviors has been minimally investigated in sexual minority individuals, despite research supporting that sexual minority men and women may endorse both drive for thinness and muscularity (Bozsik et al., 2018; Yellan & Tiggemann, 2003). For example, latent class analyses, in a sample of heterosexual and sexual minority men indicated varying patterns of concerns — those who are primarily muscle-concerned (i.e., high levels of muscularity-oriented body image attitudes and behaviors), primarily lean-concerned (i.e., high levels of body fat/thinness-oriented body image attitudes and moderate levels of muscularity concern and dieting behaviors) or those who have low levels of overall body image concerns and weight/shape control behaviors (Calzo et al., 2015). Sexual minority young adult men were more likely to be lean-concerned than heterosexual men, and both heterosexual and sexual minority men had similar likelihoods of being in the muscle-concerned group classification. These analyses indicated that leanness- and muscularity-oriented concerns may be associated with varying health risk behaviors in men. However, little is known about the variability in body image concerns among sexual minority women and subsequent associations with health risk behaviors. Moreover, the existing

examination of this topic in sexual minority men (Calzo et al., 2015) involved the use of dichotomous indicators, non-validated measurements, and also combined body image concerns, disordered eating, and muscle-building behaviors as class indicators. Therefore, **Study 3** addresses the gaps in the literature by investigating the heterogeneity in body image concerns among sexual minority men and women, and further evaluates associations between varying body image concern patterns—using continuous measures—and disordered eating, muscle-building behavior, as well as BDD symptoms—which have yet to be investigated in relation to varying body image concern profiles.

Study 3 involved the use of latent profile analyses, and included thinness and muscularity internalization and thinness- and muscularity-oriented attitudes, as indicators for body image concern patterns. Subsequently, associations between identified patterns and behavioral outcomes, such as eating disorder, muscle-building, and BDD symptoms, were assessed. In order to ensure a rigorous study design, self-report measures of these constructs were validated in samples of sexual minority men and women. For example, the Drive for Muscularity Scale (DMS; McCreary & Sasse, 2000) is a 15-item measure that was designed to assess muscularity-oriented body image attitudes and behaviors. This measure has been validated in samples of sexual minority men, with support for the two-factor solution (DeBlaere & Brewster, 2017; Nerini et al., 2016) and the one-factor solution (Nerini et al., 2016); however, the factor structure of the DMS has yet to be examined in sexual minority women. Therefore, **Study 1** aimed to examine the factor structure and measurement invariance of the DMS in sexual minority men and women.

Additionally, the Eating Disorder Examination-Questionnaire (EDE-Q; Fairburn & Beglin, 1994) is a measure of eating and shape/weight concerns, for which the original four-

factor structure (Weight Concern, Shape Concern, Eating Concern, and Dietary Restraint) has been consistently unsupported in a variety of samples (see Rand-Giovannetti et al., 2020 for review). Moreover, factor structure investigations are limited in samples of sexual minority individuals. Most recently, Scharmer et al. (2020) examined measurement invariance of the EDE-Q between sexual minority and heterosexual men and found a brief three-factor model to be invariant by sexual orientation (Grilo et al., 2015). However, to my knowledge, the factor structure of the EDE-Q has not been examined in sexual minority women. Additionally, although Friborg's four-factor structure of the EDE-Q (Friborg et al., 2013) has demonstrated invariance by gender, in samples of unknown sexual orientation (Jenkins & Davey, 2020; Rand-Giovannetti et al., 2020), it is unclear if this measure is invariant by gender, in sexual minority individuals. Moreover, varying factor structures have been supported in samples of sexual minority men and individuals with unknown sexual orientation (Rand-Giovannetti et al., 2020; Scharmer et al., 2020). Therefore, Specific Aim 2 aimed to examine the factor structure of the EDE-Q, comparing fit of Friborg's four-factor model (Friborg et al., 2013), the brief three-factor model (Grilo et al., 2015), and the original four-factor model (Fairburn & Beglin, 1994). In addition, the aim was to investigate measurement invariance by gender, of the best-fitting model among sexual minority men and women.

Studies 1 and 2, therefore, utilized confirmatory factor and measurement invariance analyses of the aforementioned measures. These seminal studies aimed to strengthen the validity of findings from latent profile analyses in sexual minority individuals. The final study, **Study 3**, aimed to better characterize body image concerns in sexual minority individuals, using latent profile analyses, which may inform treatment and prevention efforts for eating disorders and BDD.

CHAPTER 1: Study 1

The content within this section, titled "Chapter 1: Study 1" reflects material from a paper that has been published in the *Psychology of Sexual Orientation and Gender Diversity* APA journal. The formal citation is as follows:

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Abstract

The Drive for Muscularity Scale (DMS) is a commonly used measure used to assess the pursuit of muscularity. However, the factor structure of this measure has yet to be confirmed in a sample of sexual minority women. Moreover, the invariance of this measure across gender has also yet to be explored. The aim of the present study was, therefore, to conduct a confirmatory factor analysis (CFA) of the DMS in samples of both cisgender sexual minority men and women, and subsequently evaluate the measurement invariance by gender. The sample consisted of 962 cisgender sexual minority young adult men (N = 479) and women (N = 483). A series of CFAs were conducted, assessing both the one-factor and two-factor solutions of the DMS, with and without the inclusion of item 10 ("I think about taking anabolic steroids"). Across cisgender sexual minority young adult men and women, the 14-item two-factor solution demonstrated most appropriate fit, although the 15-item two-factor solution was also adequate among only women. Measurement invariance analyses indicated that the 14-item two-factor DMS can be used in samples of both cisgender sexual minority men and women. The present study was novel in exploring the factor structure of the DMS in sexual minority women and measurement invariance by gender; however, future research is needed to further corroborate these findings and assess measurement invariance by sexual orientation and race.

Keywords: drive for muscularity, sexual minority, confirmatory factor analysis, measurement invariance

Public Health Significance Statement: The present study supports the use of the Drive for Muscularity Scale to assess the pursuit of muscularity, in sexual minority men and women. The study also demonstrates that this self-report measure performs similarly across both men and women in a sexual minority sample.

Confirmatory Factor and Measurement Invariance Analyses of the Drive for Muscularity Scale in Sexual Minority Men and Women

Drive for Muscularity in Men and Women

Body image concerns have been linked to negative health outcomes, including depression and eating disorders (e.g., Bucchianeri & Neumark-Sztainer, 2014). Body image concerns are typically conceptualized as gendered, such that men endorse the mesomorphic ideal—a body type characterized by low body fat and high muscularity (Pope et al., 1999), and women endorse the thin-ideal, which is characterized by a slender physique, low body fat, and low weight (e.g., Owen & Laurel-Seller, 2000; Swami & Tovée, 2005). Drive for muscularity, or the attitudinal and behavioral preoccupation with increased muscularity (McCreary & Sasse, 2000), is often used as a marker of muscularity-based concerns. Men typically endorse greater drive for muscularity than women (McCreary & Saucier, 2009), and drive for muscularity has been linked to exercise dependence (Hale et al., 2010), symptoms of muscle dysmorphia (Grieve & Helmick, 2008), poorer self-esteem, and symptoms of depression (McCreary & Sasse, 2000), in men and adolescent boys. Prior research has, therefore, focused on the distinctions between men and women in body image ideals and concerns.

However, there is new, emerging evidence that women also endorse an ideal that includes some form of muscularity or lean muscle enhancement (Bozsik et al., 2018; Karazsia et al., 2017). For example, women experienced decreased body satisfaction when exposed to images that were both lean and muscular, but not images that were overly muscular (Benton & Karazsia, 2015) or 'normal' weight (Homan et al., 2012), suggesting that the combination of thinness and muscle tone may be the new emerging body ideal for women. Drive for muscularity may, therefore, be a concern for both men and women.

Drive for Muscularity in Sexual Minority Individuals

Prior research has also indicated there is a greater drive for muscularity in sexual minority men and women compared with their heterosexual counterparts (Yean et al., 2013), indicating its salience for examination among this population. In sexual minority men, drive for muscularity has been associated with mental health concerns, such as increased depressive symptoms (Parent & Bradstreet, 2017), disordered eating (Brennan et al., 2012), and intent to misuse anabolic steroids (Brewster et al., 2017). Although drive for muscularity, to our knowledge, has not been examined in its association with mental health concerns among sexual minority women, a recent study in women of unknown sexual orientation found that drive for muscularity was associated with greater eating disorder, depressive, and stress symptoms (Cunningham et al., 2019), indicating that, similar to the thin-ideal pursuit, the pursuit of muscularity is also associated with negative psychological outcomes among women. Therefore, drive for muscularity appears to be associated with mental health concerns for both sexual minority men and women and should be further examined in this community.

Factor Structure of the Drive for Muscularity Scale

The Drive for Muscularity Scale (DMS; McCreary & Sasse, 2000) is a 15-item measure that was designed to assess the pursuit of muscularity. An initial exploratory factor analysis in a separate mixed gender sample of Canadian youths and adults with unknown sexual orientation status (McCreary et al., 2004) found a two-factor solution with the following subscales: (1) Muscle-Oriented Body Image (MBI), which captured muscularity dissatisfaction; and (2) Muscle-Oriented Behavior (MB), which captured muscle-building behavior, omitting Item 10 (“I think about taking anabolic steroids”). An additional exploratory factor analysis among Scottish, primarily heterosexual men further corroborated the two-factor solution, although they found

support for inclusion of item 10. The men in this sample were participants in a sporting event and were, on average, older than McCreary et al.'s (2004) sample—characteristics that may increase the relevance of appearance and performance-enhancing drug use (Hildebrandt et al., 2007; Irving et al., 2002). Of note, the authors also found support for a global factor, which represented the omnibus drive for muscularity construct. Although the two-factor and one-factor solutions were supported among men, the authors suggested that only the one-factor solution (i.e., global factor) should be used among women. The DMS has, therefore, demonstrated varying factor structures dependent on gender.

Subsequent examinations of the DMS have corroborated this identified factor structure. Among men, the DMS has been examined cross-nationally in various samples (e.g., Compte et al., 2015; Swami et al., 2018), none of which reported sexual orientation. Of particular note, two studies have examined the DMS in sexual minority samples: one in the United States (DeBlaere & Brewster, 2017) and one in Italy (Nerini et al., 2016). These studies found support for the two-factor solution, with one study reporting a large interfactor correlation (r = .54; Nerini et al., 2016); there was also some support for the inclusion of Item 10 (DeBlaere & Brewster, 2017) and a one-factor solution (Nerini et al., 2016). Therefore, the factor structure among sexual minority men may mirror the original sample, demonstrating appropriate fit for a two-factor solution and a global factor. Moreover, support for Item 10 in a sexual minority sample of men and lack of support in prior factor analyses may reflect evidence suggesting increased risk of anabolic-androgenic steroid use in sexual minority adolescent boys compared with their heterosexual counterparts (Blashill et al., 2017). However, the factor structure of the DMS has yet to be examined in sexual minority women. Investigations of the factor structure of the DMS in women of unknown sexual orientation demonstrated support for a one-factor solution,

excluding item 10, and a lack of appropriate fit for a two-factor solution (de Carvalho et al., 2019; McCreary et al., 2004). It is unclear if the same factor structures of the DMS apply to samples of sexual minority women.

Present Study

The primary purpose of the present study was to examine the factor structure and measurement invariance of the DMS in sexual minority men and women. The study aims were to initially compare one-factor and two-factor models of the 14-item (excluding item 10) and 15-item DMS, separately in sexual minority men and women. The best fitting model, across men and women, would then be used to investigate measurement invariance by gender. Finally, concurrent validity and internal consistency of the DMS were also investigated for both sexual minority men and women.

Method

Participants and Procedures

The present study involved secondary data analysis from a parent study, which had a primary aim of examining racial and ethnic disparities in body image and eating disorders (Gonzales & Blashill, 2021). Participants were 479 sexual minority men and 483 sexual minority women aged 18–30 years (M = 23.68, SD = 3.73), who were recruited from across the United States through Qualtrics Panels. Qualtrics Panels is a service provided by Qualtrics, an online survey-based platform, in which individuals can create accounts and participate in surveys. A summary of sample demographics is provided in Table 1.1. Inclusion criteria for the current study were: 1) self-identify as cisgender man or woman; 2) self-identify as gay, lesbian, bisexual, or any other nonheterosexual identity; 3) between the ages of 18–30 years; 4) self-identify as either African American, Non-Hispanic White, Asian American/Pacific Islander, or Hispanic

with any other race; and 5) English speaking. Sexual orientation was assessed by asking participants to describe their (a) sexual orientation ("How would you describe your sexual identity?") and (b) sexual attraction ("How would you describe your sexual attraction?"). If individuals met predetermined criteria based on their Qualtrics profile, they were sent a de-identified invitation to participate in a survey. If potential participants accepted the invitation to participate in the survey, they were then consented and subsequently given a prescreener to confirm that they met eligibility criteria. Eligible participants completed a 15–20 minute survey. Participants were given $4 of e-reward currency, which is administered and redeemed by Qualtrics, for example, for airline miles or various gift cards. All procedures were reviewed and approved by the University's Institutional Review Board.

Measures

Drive for Muscularity

The 15-item Drive for Muscularity Scale (DMS; McCreary & Sasse, 2000) was used to assess an individual's motivations, behaviors, and attitudes towards a more muscular body (e.g., "I wish I were more muscular;" "I try to consume as many calories as I can in a day"). Response options were on a 6-point Likert scale, ranging from 1 (*never*) to 6 (*always*). The original factor structure of the DMS consisted of two subscales: Muscle-Oriented Body Image (MBI) and Muscle-Oriented Behavior (MB; McCreary et al., 2004). The two-factor model, with item 10 omitted, has been supported in high school and college samples of men and women (McCreary et al., 2004) as well as a community sample of sexual minority men (DeBlaere & Brewster, 2017). The inclusion of item 10 has also been supported in sexual minority men (DeBlaere & Brewster, 2017). A higher order factor, averaging across the 14 items of the DMS, has also been tested and supported in high school and college sample of men and women (McCreary et al., 2004). The

internal consistency was adequate for both the 14-item DMS (MBI: $\alpha = .93$; MB: $\alpha = .87$; global score: $\alpha = .93$) and the 15-item DMS (MBI: $\alpha = .93$; MB: $\alpha = .87$; global score: $\alpha = .90$) in a sample of sexual minority men (DeBlaere & Brewster, 2017). The internal consistency was also adequate for the 14-item DMS subscales in high school and college samples of men of unknown sexual orientation (MBI: $\alpha = .88$; MB: $\alpha = .81$), as well as for the global score in both men ($\alpha = .87$) and women ($\alpha = .82$; McCreary et al., 2004).

Appearance and Performance Enhancing Drug Use

Appearance and performance enhancing drug (APED) use was assessed using seven items derived from the Growing Up Today Study (see Field et al., 1999)—a national study of adolescent children of women participating in the Nurse's Health Study II (Solomon et al., 1997). These seven items assess frequency of protein powder or shake, weight loss shake/drinks, creatine, amino acids, beta-hydroxy-beta-methylbutyrate (HMB), dehydroepiandrosterone (DHEA), growth hormone (without Doctor's prescription), and anabolic/injectable steroids (without Doctor's prescription) use during the past year. Response options ranged from 0 (*never*) to 4 (*daily*), and the mean frequency of use was calculated for each individual APED.

Statistical Analysis

Univariate normality of item distributions was assessed by examining frequency histograms and multivariate normality was assessed with Mardia's test, using the MVN package in RStudio (Version 1.2.1335). Results indicated a nonnormal distribution of DMS items in both men (skewness = 2173.66, $p < .001$; kurtosis = 25.66, $p < .001$) and women (skewness = 4120.32, $p < .001$; kurtosis = 58.04, $p < .001$). Therefore, confirmatory factor analysis (CFA) was conducted using the robust weighted least squares mean and variance adjusted estimator

(WLSMV) and entering the DMS items as ordinal variables. CFA was conducted using the lavaan package in RStudio.

Prior research has indicated support for a one-factor and two-factor structure of the DMS in both men and women (McCreary et al., 2004). Therefore, in the present study, the fit of a single-factor and two-factor model—consisting of MBI and MB factors—were compared. Although some findings have supported the exclusion of item 10 ("I think about taking anabolic steroids"), others have advocated for its inclusion, including in samples of sexual minority men (DeBlaere & Brewster, 2017). DeBlaere and Brewster (2017), therefore, advised researchers to evaluate validity and factor structure of both the 14- and 15-item DMS. CFA models were conducted separately for men and women prior to assessing measurement invariance. If the CFA models, conducted separately in men and women, demonstrated acceptable fit for a particular factor structure, multiple group analyses were then conducted to evaluate measurement invariance by gender (Vandenberg & Lance, 2000). Once configural invariance was established, metric and scalar invariance were assessed.

In the present study, single-factor and two-factor models of both the 14-item and 15-item DMS were tested, yielding a total of four models. Because there was less than 5% missing data on all DMS items, pairwise deletion processes were also implemented (Parent, 2012). Firstly, model fit was assessed using the comparative fit index (CFI), root mean square error of approximation (RMSEA), and the standardized root mean square residual (SRMR). Given the exploratory nature of the present study's analyses, the following, more liberal, threshold values for descriptive fit indices were used to indicate reasonable acceptable fit: CFI > .90, RMSEA < .08, and SRMR < .08 (Bentler, 1990; Steiger, 1990). Next, the descriptive fit indices of nonnested models, with and without item 10, were compared within both the single-factor and

two-factor models. The chi-square test of exact fit was also reported, though researchers have advised against using the χ^2 statistic as a formal test of goodness-of-fit given its sensitivity to sample size (Schermelleh-Engel et al., 2003). The best fitting single-factor model was compared with the best fitting two-factor model with a Satorra-Bentler scaled χ^2 difference test (SB $\Delta\chi^2$; Satorra & Bentler, 2001) using the "lavTestLRT" command in R. A higher order CFA could not be conducted because there were less than three factors examined. Standardized and unstandardized factor loadings were reported for the best fitting model.

The best fitting model across both men and women was then used for assessment of measurement invariance by gender, using the marker method (Vandenberg & Lance, 2000). Significant differences between configural and metric invariance models were assessed using the recommended values of $\Delta CFI < .010$, in conjunction with either $\Delta RMSEA < .015$ or $\Delta SRMR < .030$, which would indicate invariance (Chen, 2007). Significant differences between metric and scalar invariance models were assessed using the recommended values of $\Delta CFI < .010$, in conjunction with either $\Delta RMSEA < .015$ or $\Delta SRMR < .010$ (Chen, 2007).

Internal consistency of the DMS was evaluated using Cronbach's alpha (α) and omega (ω; Dunn et al., 2014). Finally, concurrent validity was assessed between the DMS factors and the seven APED use variables, using Spearman correlations (ρ). Very small, small, medium, large, and very large correlations were established as .05, .10, .20, .30, and .40 respectively (Funder & Ozer, 2019). Correlation analysis was completed using SPSS (Version 26), and all other analyses were completed using RStudio (Version 1.2.1335).

Results

Confirmatory Factor Analysis

The model fit indices of all baseline models, for men and women separately, are summarized in Table 1.2. Based on descriptive fit indices, across both men and women, the 14-item factor models demonstrated better fit than the 15-item models. Therefore, the one- and two-factor 14-item models were then compared, in both men and women. The SB $\Delta\chi^2$ test indicated that the 14-item one-factor model fit significantly worse than the 14-item two-factor model in men (SB $\Delta\chi^2[1] = 180.79$, $p < .001$) and women (SB $\Delta\chi^2[1] = 126.79$, $p < .001$). Table 1.3 illustrates the standardized and unstandardized factor loadings for the 15-item two-factor model, demonstrating significant factor loadings on both factors. The interfactor correlation was very large and statistically significant for men ($r = .630$, $p < .001$) and women ($r = .786$, $p < .001$).

Measurement Invariance by Gender

The results of measurement invariance analyses are summarized in Table 1.4. The configural invariance model demonstrated reasonably acceptable fit based on one of three descriptive fit indices (CFI = .969, RMSEA = .108, SRMR = .086), although factor loadings appeared similar across men and women. Constraining factor loadings to be equal across groups led to ΔCFI, ΔRMSEA, and ΔSRMR within recommended thresholds, indicating metric invariance (Chen, 2007). Constraining item intercepts to also be equal across groups led to ΔCFI, ΔRMSEA, and ΔSRMR within recommended thresholds, indicating scalar invariance.

Concurrent Validity and Scale Reliability of Best Fitting Model

The total sample mean and standard deviation (*SD*) of the DMS MB subscale was 2.03 (*SD* = 1.10) and 2.61 (*SD* = 1.27) for the DMS MBI subscale, with individual scores ranging from 1 to 6. Internal consistency was adequate for the DMS MB subscale (α = .94, 95% CI [.93,

.94]; ω = .94, 95% CI [.93, .94]) and the MBI subscale (α = .93, 95% CI [.92, .94]; ω = .93, 95% CI [.92, .94]). As indicated in Table 1.5, DMS MB subscale demonstrated significant positive very large correlations and the DMS MBI subscale demonstrated significant positive small-to-large correlations with APED use, including frequency of protein, weight loss shakes, creatine, amino acids, DHEA, growth hormone, and AAS use, in both men and women.

Discussion

The factor structure of the DMS has been evaluated in heterosexual samples of men and women as well as in a sample of sexual minority men. The present study was the first known to confirm the factor structure in a sample of cisgender sexual minority women and explore measurement invariance by gender. Results indicated that a two-factor structure excluding item 10 demonstrated adequate fit for both sexual minority cisgender men and women. However, the two-factor model including item 10 also demonstrated good fit in the sample of sexual minority women. Using the 14-item two-factor model, measurement invariant analyses indicated that the DMS was invariant across men and women. The 14-item two-factor DMS also demonstrated appropriate reliability and validity, such that the MB and MBI subscales were strongly and positively correlated with the use of APEDs, including illicit substances such as AAS. The present study was novel in its assessment of criterion validity of the DMS through associations with frequency of APED use.

The current study is consistent with prior literature in that the two-factor solution was supported in sexual minority men (DeBlaere & Brewster, 2017). Sexual minority men in the current sample also had comparable mean subscale scores to those of prior studies (e.g., DeBlaere & Brewster, 2017; McCreary et al., 2004). The similar mean scores and factor structures among men in the present study and prior studies may strengthen the reliability and

generalizability of the factor structure and measurement invariance findings. However, DeBlaere and Brewster (2017) found support for the inclusion of item 10 ("I think about taking anabolic steroids"), whereas in the present study, the 15-item factor solution demonstrated poorer statistical and descriptive fit in sexual minority men, compared with the 14-item factor structure. Sexual minority men in the present study may have demonstrated better descriptive and statistical fit with the exclusion of item 10 because of the age range of the sample. The current sample ranged in age from 18 to 30 years, whereas DeBlaere and Brewster (2017) included a sample of sexual minority men ranging in age from 18 to 62 (M = 28.80, SD = 14.50)—a wider age range that is more representative of men who misuse AAS and individuals at risk for AAS misuse onset (Hildebrandt et al., 2007). Similarly, an exploratory factor analysis of the DMS among Scottish, primarily heterosexual men also supported the inclusion of item 10 with an older sample (M = 38.9, SD = 9.80; McPherson et al., 2010). Therefore, the inclusion of the item 10 may depend on the age group of men being assessed. Nevertheless, in the present study, the differences in descriptive fit indices between the 14- and 15-item two-factor models are marginal, which also indicates that further research is needed to confirm the most appropriate factor structure of the DMS in sexual minority men.

Although confirmation of the two-factor solution corroborates prior CFAs, the lack of support for a one-factor solution is inconsistent with findings from a CFA of the Italian version of the DMS, among sexual minority men (Nerini et al., 2016), and with findings from studies with samples of unknown sexual orientation (e.g., McCreary et al., 2004). This inconsistency may indicate cultural bias or noninvariance of the DMS across sexual orientation groups. An additional difference between studies was the racial breakdown of the sample; the present study included a more diverse sample such that only 38.6% identified as White. The DMS may,

therefore, perform differently as a function of race. Future research is needed to evaluate measurement invariance by sexual orientation and race.

The present study also deviates from investigations of the factor structure of the DMS in women of unknown sexual orientation, among whom only a 14-item one-factor solution was supported (de Carvalho et al., 2019; McCreary et al., 2004). In contrast, the current study found support for the two-factor structure with or without item 10. This difference may be explained by the characteristic differences between the current sample and previous investigations of the DMS factor structure in women. For example, in the present study, 25.5% of women indicated illicit APED use during the past year, and the sample was more racially diverse than the majority White samples of prior studies (de Carvalho et al., 2019; McCreary et al., 2004). Additionally, the MB and MBI subscale mean scores endorsed by the sexual minority women in this sample are comparable to women with medium to high levels of body image concerns (Hoffmann & Warschburger, 2018). Although prior literature has indicated that risk for disordered eating and thinness-oriented behaviors may be similar among sexual minority and heterosexual women (Matthews-Ewald et al., 2014), sexual minority women have demonstrated higher drive for muscularity than heterosexual women (Yean et al., 2013). Therefore, the DMS may have a different factor structure in sexual minority versus heterosexual women, although future research is needed to test differences by sexual orientation. Alternatively, the current study's sample of sexual minority women may not be reflective of the average drive for muscularity in the sexual minority female population. Further research is needed to better understand muscularity attitudes and behaviors in sexual minority women. Future investigations of the DMS factor structure should also consider APED use among their samples, in order to better understand the performance of item 10 in different populations.

Although the present study was novel in its analysis of the factor structure in sexual minority women and measurement invariance by gender, there were several limitations. Heterosexual men and women were not recruited for the current study, which would have allowed for an evaluation of measurement invariance by sexual orientation in addition to gender. Another limitation is the lack of consensus in guidelines for model fit comparisons as well as for evaluating measurement invariance, when using the WLSMV estimator. For example, recent literature cautioned against the use of descriptive fit indices to assess measurement invariance using this estimator (Sass et al., 2014). In addition, although model comparison tests have been developed to compare the fit of nested models, no such tests have been developed for nonnested model comparison using the WLSMV estimator. Therefore, the present study compared nonnested models (14-item DMS vs. 15-item DMS) by exploring descriptive fit indices. Moreover, cutoff values for descriptive fit indices and change in descriptive fit indices should be used and interpreted with caution, despite their common use in the field (Barrett, 2007; Marsh et al., 2004). Additionally, although the present study provided support for criterion validity of the DMS in sexual minority men and women, convergent and discriminant validity could not be investigated. Finally, the present study did not include individuals who identify as transgender. Prior literature has indicated that transgender sexual minority compared with cisgender heterosexual individuals may be at elevated risk for disordered eating behaviors (Diemer et al., 2015). This group is, therefore, important to investigate in the context of drive for muscularity, and the DMS may perform differently in this population. Given limitations, the findings from the present study should be interpreted with caution and treated as exploratory.

Conclusion

The present study confirms the factor structure of the DMS in cisgender sexual minority men and women and establishes that the 14-item two-factor DMS performs similarly in both men and women. The two-factor DMS with the inclusion of item 10 may also be supported in sexual minority women and needs further examination in men. Thus, researchers interested in exploring gender differences in the DMS among sexual minority population are encouraged to use the 14-item two-factor solution of the DMS. The present study is unique not only in its inclusion of sexual minority women but also in its racial diversity. Future research is needed to explore the factor structure of the DMS in transgender individuals and the measurement invariance by sexual orientation and race.

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Tables

Table 1.1. *Demographic characteristics of the sample.*

Variable	SM Men *N* (%)	SM Women *N* (%)	Total Sample *N* (%)
Race[a]			
White	184 (38.6%)	187(38.7%)	371 (38.6%)
Black/African American	146 (30.5%)	148 (30.6%)	294 (30.6%)
Asian/Pacific Islander	134 (28.1%)	138 (28.6%)	272 (28.3%)
Native American/American Indian	13 (2.7%)	10 (2.1%)	23 (2.4%)
Ethnicity			
Hispanic/Latino/a	120 (25.1%)	114 (23.6%)	234 (24.3%)
Sexual Identity			
Lesbian/Gay	239 (49.9%)	97 (20.1%)	336 (34.9%)
Bisexual	206 (43.0%)	358 (74.1%)	564 (58.6%)
Asexual	10 (2.1%)	10 (2.1%)	20 (2.1%)
Other[b]	24 (5%)	18 (3.7%)	42 (4.4%)
Sexual Attraction			
Only attracted to same sex	203 (42.4%)	92 (19.0%)	295(30.7%)
Mostly attracted to same sex	89 (18.6%)	53 (11.0%)	142 (14.8%)
Equally attracted to same sex	187 (39.0%)	338 (70.0%)	525 (54.5%)
	Mean (*SD*)	Mean (*SD*)	Mean (*SD*)
Age	24.03 (3.76)	23.33 (3.68)	23.68 (3.73)

Note. SM = sexual minority
[a] Missing race data for two men
[b] Other sexual identities included but were not limited to Pansexual, Demisexual, Queer

Table 1.2. *Model fit indices by gender for the 14-item and 15-item DMS factor structures.*

Model	χ^2	*df*	*p*	CFI	RMSEA	SRMR
14-item, one-factor						
Men	1194.087	77	< .001	.925	.174	.156
Women	842.838	77	< .001	.940	.144	.107
14-item, two-factor						
Men	480.980	76	< .001	.973	.106	.084
Women	524.293	76	< .001	.965	.111	.077
15-item, one-factor						
Men	1303.338	90	< .001	.921	.168	.164
Women	916.272	90	< .001	.943	.138	.114
15-item, two-factor						
Men	540.603	89	< .001	.971	.103	.091
Women	575.665	89	< .001	.967	.107	.08

Note. CFI = comparative fit index; RMSEA = root mean square error of approximation; SRMR = standardized root mean square residual

Table 1.3. *Standardized and unstandardized factor loadings from the 14-item two-Factor CFA in men and women.*

DMS Item	Men		Women	
	MB	MBI	MB	MBI
1. *I wish I were more muscular*		.695 (0.856)		.776 (0.90)
2. *I lift weights to build more muscle*	.804 (0.96)		.800 (1.01)	
3. *I use protein or energy supplements*	.838 (1.04)		.792 (0.99)	
4. *I drink weight gain or protein shakes*	.858 (1.07)		.852 (1.06)	
5. *I try to consume as many calories as I can in a day*	.691 (0.86)		.706 (0.88)	
6. *I feel guilty if I miss a weight-training session*	.806 (1.00)		.839 (1.05)	
7. *I think I would feel more confident if I had more muscle mass*		.813 (1.17)		.860 (1.11)
8. *Other people think I work out with weight too often*	.764 (0.95)		.855 (1.07)	
9. *I think I would look better if I gained 10 points of bulk*		.780 (1.12)		.820 (1.06)
11. *I think I would feel stronger if I gained a little more muscle mass*		.798 (1.15)		.821 (1.06)
12. *I think that my weight-training schedule interferes with other aspects of my life*	.730 (0.91)		.862 (1.08)	
13. *I think that my arms are not muscular enough*		.884 (1.27)		.846 (1.09)
14. *I think that my chest is not muscular enough*		.903 (1.30)		.800 (1.03)
15. *I think that my legs are not muscular enough*		.810 (1.17)		.791 (1.02)

Note. Unstandardized factor loadings are presented in parentheses; DMS = Drive for Muscularity Scale; MB = Muscularity-Oriented Behavior; MBI = Muscularity-Oriented Body Image

Table 1.4. *Measurement invariance by gender: Model fit indices.*

Model	χ^2	*df*	*p*	CFI	RMSEA	SRMR	Δ χ^2	Δ CFI	Δ RMSEA	Δ SRMR
Configural Model	1001.172	152	< .001	.969	.108	.086	--	--	--	--
Metric Invariance: Factor Loadings Equal Across Groups	952.606	166	<.001	.971	.099	.089	-48.566	.002	-.009	.003
Scalar Invariance: Factor Loadings & Intercepts Equal Across Groups	1242.086	220	< .001	.963	.098	.086	240.914	-.008	-.001	- .003

Note. CFI = comparative fit index; RMSEA = root mean square error of approximation; SRMR = standardized root mean square residual

Table 1.5. *Bivariate Spearman correlations between DMS subscales and APED use*

Variable	1	2	3	4	5	6	7	8	9
1. DMS MB subscale	—	.653**	.636**	.497**	.502**	.509**	.473**	.506**	.481**
2. DMS MBI subscale	.519**	—	.397**	.284**	.359**	.354**	.338**	.361**	.368**
3. Protein Use	.664**	.334**	—	.552**	.424**	.415**	.386**	.398**	.380**
4. Weight Loss Shake Use	.533**	.210**	.508**	—	.532**	.509**	.514**	.542**	.498**
5. Creatine Use	.572**	.256**	.473**	.615**	—	.685**	.725**	.677**	.505**
6. Amino Acids Use	.585**	.279**	.494**	.525**	.683**	—	.705**	.593**	.566**
7. DHEA Use	.537**	.205**	.425**	.632**	.691**	.730**	—	.721**	.681**
8. Human Growth Hormone Use	.499**	.164**	.352**	.575**	.592**	.576**	.758**	—	.780**
9. Anabolic-Androgenic Steroid Use	.500**	.132**	.323**	.576**	.624**	.583**	.739**	.775**	—
Mean (*SD*)									
Men	2.55(1.20)	3.45(1.35)	1.26(1.35)	0.97(1.28)	0.76(1.17)	0.80(1.22)	0.63(1.13)	0.60(1.12)	0.53(1.03)
Women	2.03(1.10)	2.60(1.27)	1.01(1.24)	0.99(1.32)	0.46(1.00)	0.56(1.09)	0.39(0.94)	0.37(0.93)	0.37(0.94)

Note. Correlations are above the diagonal for women and below the diagonal for men. DMS MB = Drive for Muscularity, Muscularity-Oriented Behavior; DMS MBI = Drive for Muscularity, Muscularity-Oriented Body Image; DHEA = Dehydroepiandrosterone

** $p < .01$

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CHAPTER 2: Study 2

The content within this section, titled "Chapter 2: Study 2," reflects material from a paper that has been published in the *International Journal of Eating Disorders*. The formal citation is as follows:

Klimek, P., Convertino, A. D., Pennesi, J. -L., Gonzales IV, M., Roesch, S. C., Nagata, J. M., & Blashill, A. J. (2021). Confirmatory factor and measurement invariance analyses of the Eating Disorder Examination Questionnaire in sexual minority men and women. *International Journal of Eating Disorders, 54*(5), 745–754. https://doi.org/10.1002/eat.23488

Abstract

Objective: The present study aimed to investigate the factor structure of the Eating Disorder Examination Questionnaire (EDE-Q) in a large sample of cisgender sexual minority men and women, and subsequently, to evaluate measurement invariance by gender. **Method:** The sample consisted of 962 sexual minority adult men (n = 479) and women (n = 483) who completed online self-report surveys. Confirmatory factor analysis was conducted using two previously supported factor structures (Friborg et al.'s four-factor model and Grilo et al.'s brief three-factor model) as well as the original four-factor structure of the EDE-Q. **Results:** Results indicated that the best fitting models were Friborg et al.'s four-factor model (CFI = .974, RMSEA = .098, SRMR = .070) and Grilo et al.'s brief three-factor model (CFI = .999, RMSEA = .049, SRMR = .017). The model fit of both factor structures were nearly identical when examined separately for men and women. The original four-factor structure could not be supported in this sample. Measurement invariance analyses further indicated that the best fitting models were invariant by gender in sexual minority individuals. Internal consistency was adequate for all subscales of Friborg et al.'s and Grilo et al.'s models. **Discussion:** The present study provides support for the use of the EDE-Q in sexual minority men and women. Additionally, findings demonstrate that the EDE-Q performs similarly in sexual minority men and women. Future research is needed to further evaluate measurement invariance of the EDE-Q by sexual orientation, gender identity, and race.

Keywords: eating disorders, sexual minorities, bisexual, lesbian, gay, factor analysis, psychometrics, symptom assessment, Eating Disorder Examination-Questionnaire

Confirmatory Factor and Measurement Invariance Analyses of the Eating Disorder Examination Questionnaire in Sexual Minority Men and Women

Sexual minority individuals (i.e., individuals who identify as gay, lesbian, bisexual, or any identity other than heterosexual, and/or that are attracted to and/or engage in sexual behavior with others of the same or multiple genders; Institute of Medicine, 2011) are at greater risk for developing eating disorders and disordered eating behavior as compared to their heterosexual peers (e.g., Calzo et al., 2017). Although studies examining the prevalence of diagnosable eating disorders in sexual minority populations are rare, a recent, nationally representative study of United States adults found elevated rates of eating disorder diagnoses in sexual minority individuals as compared to heterosexual men and women (Kamody et al., 2020); however, this study did not examine differences in eating disorder diagnoses among sexual minority individuals by gender. Previous studies that have examined disparities by gender have found higher rates of eating disorders in sexual minority men as compared to heterosexual men, but no differences in women by sexual orientation (Diemer et al., 2015; Feldman & Meyer, 2007; Matthews-Ewald et al., 2014). Additionally, most studies conclude that sexual minority individuals have higher rates of unhealthy weight control behaviors, including dieting, fasting, purging, laxative use, and diet pill use to lose weight as compared to heterosexual individuals (Austin et al., 2013; Laska et al., 2015; Matthews-Ewald et al., 2014; Watson et al., 2017). Overall, sexual minority individuals have demonstrated higher risk for eating disorder diagnoses and behaviors as compared to heterosexual individuals. Therefore, appropriate measurement and assessment of eating disorder symptoms in this population is of paramount importance so that clinicians and researchers can reliably detect eating disorders within sexual minority individuals and link them with care.

One of the most widely used measures of eating pathology is the Eating Disorder Examination-Questionnaire (EDE-Q; Fairburn & Beglin, 1994). Originally developed and validated in women of unknown sexual orientation, the EDE-Q contains 28 items, 22 of which are used to create four theoretical subscales: Weight Concern, Shape Concern, Eating Concern, and Dietary Restraint (Fairburn & Beglin, 2008). However, this factor structure has rarely been replicated in psychometric analyses, and differing factor structures have often been found (see Rand-Giovannetti et al., 2020 for review). Therefore, the most appropriate factor structure of the EDE-Q remains unknown.

Psychometric examinations of the EDE-Q within sexual minority individuals are rare. Previous researchers have presented norms for the EDE-Q using the original four theoretical subscales for cisgender sexual minority men and women (Nagata, Capriotti, et al., 2020; Nagata, Compte, et al., 2020; Nagata, Murray, et al., 2020). Only one known study has examined measurement invariance of the EDE-Q between sexual minority and heterosexual men (Scharmer et al., 2020), which found support for a brief three-factor structure that utilized seven items of the EDE-Q and three subscales: Dietary Restraint, Weight/Shape Overvaluation, and Body Dissatisfaction (Grilo et al., 2015). To our knowledge, no previous research has examined the factor structure of the EDE-Q scores among sexual minority women.

Moreover, examinations of measurement invariance by gender are also relatively rare. Rand-Giovannetti et al. (2020) found support for metric invariance in men and women of unknown sexual orientation, and scalar invariance for all but two EDE-Q items of a modified four-factor structure that used all 22 items of the EDE-Q and four subscales: Dietary Restraint, Preoccupation and Restriction, Weight and Shape Concern, and Eating Shame (Friborg et al., 2013). In addition, Jenkins and Davey (2020) also found support for the measurement invariance

of the aforementioned brief three-factor structure with seven items among men and women. Therefore, at least among individuals of unknown sexual orientation, it appears that the EDE-Q scores are invariant by gender utilizing both Friborg et al.'s (2013) four-factor structure and Grilo et al.'s (2015) brief three-factor structure. Evaluation of measurement invariance of the EDE-Q is useful in supporting examinations of group (e.g., gender) differences in eating disorder symptoms.

The current study aimed to test the factor structure of the EDE-Q in cisgender sexual minority men and women as well as measurement invariance by gender. No known studies to date have examined the factor structure of the EDE-Q scores among sexual minority women, and there has been limited research among sexual minority men. Based on prior research, it was hypothesized that Fairburn and Beglin's (1994) original four-factor model would not be supported. It was also hypothesized that Grilo et al.'s (2015) model would fit well as it did in prior samples of both college men and women (Rand-Giovannetti et al., 2020) as well as sexual minority men (Scharmer et al., 2020). No directional hypothesis was made about the fit of Friborg et al.'s (2013) model due to mixed findings in the literature (e.g., Rand-Giovannetti et al., 2020; Scharmer et al., 2020). Additionally, both of these models have also demonstrated measurement invariance by gender in samples of unknown sexual orientation, therefore, measurement invariance of the EDE-Q was hypothesized in the present sample of sexual minority men and women. Despite no a priori reason to predict lack of invariance by gender, confirming invariance in the current study will bolster future researchers' confidence in examining group differences on the EDE-Q between sexual minority men and women.

Method

Participants and Procedures

Participants were recruited from across the United States via Qualtrics Panels, which is an online survey-based platform (https://www.qualtrics.com). Qualtrics Panels recruits individuals through, for example, online advertisements, and individuals who are interested create accounts and participate in surveys that match their Qualtrics demographic profile (e.g., age, gender, sexual orientation, state of residence). The current study was a secondary data analysis from a parent study (Gonzales & Blashill, 2021), which examined racial and ethnic differences in body image disorders, body image concerns, and appearance and performance enhancement drug misuse. Potential participants were sent a deidentified invitation to participate in the parent study if they met the following inclusion criteria based on their Qualtrics profile: 1) cisgender man or woman; 2) gay, lesbian, bisexual, or any other non-heterosexual identity; 3) between the ages of 18–30 years; 4) African American, Non-Hispanic White, Asian American/Pacific Islander, or Hispanic with any other race; and 5) English speaking. Following the confirmation of eligibility via a prescreener, participants in the parent study took a 15–20 minute survey. Each participant received $4 of e-rewards currency for participating in the study, which are administered by Qualtrics. All procedures were reviewed and approved by the San Diego State University Institutional Review Board. The data that support the findings of this study are available on request from the corresponding author. The data are not publicly available due to privacy/ ethical restrictions.

Measures

Demographic Characteristics

Participants were asked to provide information such as age, race, ethnicity, sexual identity, and sexual attraction. Sexual identity was assessed by the following question: "How would you describe your sexual identity?" Participants were asked to select *Lesbian/Gay, Bisexual, Heterosexual, Asexual, Other,* or *Prefer Not to Answer*. Sexual attraction was assessed by the following question: "How would you describe your sexual attraction?" Participants were asked to select *Male who is only attracted to males, Female who is only attracted to females, Male who is mostly attracted to males, Female who is mostly attracted to females, Male who is equally attracted to males and females, Female who is equally attracted to males and females, Male who is only attracted to females,* or *Female who is only attracted to males.* For statistical analysis purposes, the response options for the sexual attraction variable were recoded to *Only attracted to same gender, Mostly attracted to same gender,* and *Equally attracted to men and women.* No participants indicated attraction only to the opposite gender; therefore, this response option was not included in descriptive and group difference analyses.

Eating Disorder Symptoms

The Eating Disorder Examination-Questionnaire 6.0 (EDE-Q; Fairburn & Beglin, 1994) was used to assess the frequency and/or severity of eating and shape/weight concerns over the past 28 days. The EDE-Q has 22 items which are scored on frequency and Likert scales ranging from 0 (*no days* or *not at all)* to 6 *(every day* or *markedly*). The original factor structure of the EDE-Q includes four subscales: Dietary Restraint, Eating Concern, Weight Concern, and Shape Concern, and a global score (Fairburn & Beglin, 1994). Rand-Giovannetti et al. (2020) found strongest support for Friborg et al.'s (2013) four-factor model in a sample of 981 undergraduate

students (69.9% women) using CFA with a WLSMV estimator. This model has previously demonstrated adequate internal consistency in terms of Cronbach's alpha (Dietary Restraint = .86, Preoccupation and Restriction = .82, Weight and Shape Concern = .93, and Eating Shame = .78) in a community sample of 538 Norwegian women (Friborg et al., 2013). Grilo et al.'s seven-item three-factor model, which demonstrated acceptable fit in a sample of heterosexual and sexual minority adult men (Scharmer et al., 2020), also had adequate internal consistency in terms of Cronbach's alpha (Dietary Restraint = .89, Shape/Weight Overvaluation = .92, Body Dissatisfaction = .92) in a sample of 801 university students (n = 573 women, n = 228 men; Grilo et al., 2015).

Statistical Analysis

Descriptive statistics were conducted for demographic characteristics. Means (M) and standard deviations (SD) were calculated for continuous variables and frequencies and percentages of total sample for categorical variables. Additionally, differences between men and women on demographic variables were assessed using independent sample t-tests, for the continuous age variable, or Pearson's chi-squared (χ^2) tests for categorical variables.

Confirmatory factor analyses (CFA) of the EDE-Q was conducted using three existing models: Fairburn and Beglin's (1994) original four-factor model, Friborg et al.'s (2013) four-factor model, and Grilo et al.'s (2015) brief three-factor model. The best-fitting model among sexual minority men and women was then used to investigate measurement invariance by gender. Fairburn and Beglin's (1994) model was included because it is the most commonly utilized factor structure despite well-documented lack of support for this model (e.g., Rand-Giovannetti et al., 2020). Additionally, Friborg et al.'s (2013) model demonstrated best fit, compared with 12 different 22-item EDE-Q models, in a sample of undergraduate psychology

students ranging in age from 16 to 48 years with a mean age of 20.34 (*SD* = 3.74; Rand-Giovannetti et al., 2020). Moreover, Grilo et al.'s (2015) brief three-factor model was supported in samples of sexual minority and heterosexual men, compared with six other factor structures including Friborg's four-factor model (Scharmer et al., 2020). Grilo et al.'s (2015) brief three-factor model was also supported in undergraduate students (Rand-Giovannetti et al., 2020) and both a clinical and undergraduate nonclinical samples of women from recent investigations of brief EDE-Q models using the Portuguese version of the EDE-Q (Machado et al., 2020). The multitude of other existing EDE-Q models, which have been reviewed by Rand-Giovannetti and colleagues (2020), were not chosen because of, for example, either the restrictive sample demographics in which they were evaluated (e.g., only women, bariatric samples, or athletes; Darcy et al., 2013; Parker et al., 2016; Peterson et al., 2007) or, in the case of other brief models, inclusion of only shape or weight concern items (e.g., Wade et al.'s brief one-factor model; Chan & Leung, 2015; Wade et al., 2008). The choice of Friborg et al.'s, Grilo et al.'s, and the original Fairburn et al.'s models in the current study was, therefore, based on evidence-based fit with the current study's sample and was the most parsimonious route.

CFA models were conducted for the full sample and then, separately, for men and women, prior to assessing measurement invariance, using a WLSMV estimator. Pairwise deletion processes were implemented for CFA models due to at most 1% missing data on all EDE-Q items (Parent, 2012). Pairwise deletion when using the WLSMV estimator has been shown to generate unbiased estimates as long as the amount of missing data is not substantial (Asparouhov & Muthén, 2010). Prior research has indicated support for Friborg et al.'s (2013) four-factor model in a sample of men and women of unknown sexual orientation (Rand-Giovannetti et al., 2020), and recent research has supported Grilo et al.'s (2015) brief three-factor

model among heterosexual and sexual minority men (Sharmer et al., 2020). Therefore, in the present study, the fit of these models, as well as the ubiquitous, original factor structure (Fairburn & Beglin, 1994) were compared.

Model fit was assessed using the comparative fit index (CFI), root mean square error of approximation (RMSEA), and the standardized root mean square residual (SRMR). Findings from simulation studies conducted by Hu and Bentler (1999) have indicated the following thresholds suggestive of good model fit: CFI ≥ .95, RMSEA < .06, and SRMR ≤ .08. The chi-squared test of exact fit was also reported, although the χ^2 statistic should be interpreted with caution, given its sensitivity to sample size (Schermelleh-Engel et al., 2003). The best fitting single-factor model was compared with the best fitting two-factor model with a Satorra-Bentler scaled χ^2 difference test (SB $\Delta\chi^2$; Satorra & Bentler, 2001). Standardized and unstandardized factor loadings were reported for the best fitting model.

The best fitting model across both men and women was then used for assessment of measurement invariance by gender, using the marker method (Vandenberg & Lance, 2000). Configural invariance indicates that factor loading patterns are similar between groups. Metric invariance indicates equal factor loadings, and scalar invariance indicates equal loadings and thresholds (i.e., intercepts). Significant differences between configural and metric invariance models were assessed, such that ΔCFI $<$ .010, in conjunction with either ΔRMSEA $<$ .015 or ΔSRMR $<$ .030, would indicate invariance (Chen, 2007). Significant differences between metric and scalar invariance models were assessed using the same thresholds, except that ΔSRMR $<$ .010 would indicate invariance (Chen, 2007). Internal consistency of the EDE-Q was evaluated using Cronbach's alpha (α) and omega (ω; Dunn et al., 2014) for the full sample, and separately for men and women. However, the recommended reliability coefficient for any two-item

subscales is the Spearman-Brown coefficient (ρ), as it is considered less biased than Cronbach's alpha and other reliability coefficients (Eisinga et al., 2013). Additionally, 95% confidence intervals were reported for reliability coefficients of subscales including more than two items. CFA and internal consistency analyses were conducted using the lavaan (Rosseel, 2012) and userfriendlyscience (Peters, 2014) packages in RStudio.

Results

Participants

Participants were 962 cisgender sexual minority men (n = 479) and women (n = 483) ranging in age from 18–30 years (M_{age} = 23.68, SD = 3.73). Men in the sample demonstrated a mean age of 24.03 years (SD = 3.76) and women demonstrated a mean age of 23.33 years (SD = 3.68). There was a small but statistically significant difference in age between men and women, $t(960) = 2.95$, $p = .003$, $d = .19$. Additionally, there were no statistically significant gender differences in race or ethnicity frequency distributions. However, a statistically significant gender difference was present for sexual identity and sexual attraction frequency distributions. Table 1 summarizes the demographic characteristics of the present sample, including race, ethnicity, and sexual orientation.

Confirmatory Factor Analysis

Results from Mardia's multivariate normality test and frequency histograms, using the MVN package (Korkmaz et al., 2014) in RStudio (Version 1.2.1335), indicated a nonnormal distribution of EDE-Q items for the full sample (skewness = 2173.66, $p < .001$; kurtosis = 25.66, $p < .001$) as well as, individually, for men (skewness = 6088.67 $p < .001$; kurtosis = 47.71, $p < .001$) and women (skewness = 5313.26, $p < .001$; kurtosis = 38.08, $p < .001$). Therefore, CFA

was conducted using the robust weighted least squares mean and variance adjusted estimator (WLSMV) and entering the EDE-Q items as ordinal variables.

The model fit indices of all models that converged, for the full sample and, separately, for men and women, are summarized in Table 2. Table 2 does not include Fairburn and Beglin's (1994) original four-factor structure because a review of factor correlations, factor loadings, and variances indicated that this was a problematic model, with correlations between the Shape Concern and Weight Concern factors exceeding 1, even with the removal of the redundant item 8 ("Has thinking about shape or weight made it very difficult to concentrate on things you are interested in [for example, working, following a conversation, or reading?]"), and negative factor loadings and variances. Based on descriptive fit indices in the full sample, both Friborg et al.'s (2013) four-factor model and Grilo et al.'s (2015) brief three-factor model demonstrated appropriate model fit. When we examined the factor structure separately for men and women, the results were nearly identical to the full sample. Because full-item models cannot be directly compared with reduced-item models due to differing numbers of variables (Rand-Giovannetti et al., 2020), both models were considered the best fitting models.

A second-order CFA was also conducted using Friborg et al.'s (2013) model, in which the four factors loaded onto a single higher order factor. The SB $\Delta\chi^2$ test indicated that the higher order model fit significantly worse than the first-order model in the full sample (SB $\Delta\chi^2[2] = 23.57$, $p < .001$), as well as, separately, in men (SB $\Delta\chi^2[2] = 8.90$, $p = .01$) and women (SB $\Delta\chi^2[2] = 13.86$, $p < .001$). Tables 3 and 4 illustrate the standardized and unstandardized factor loadings, with 95% confidence intervals, for Friborg et al.'s (2013) four-factor model and Grilo et al.'s brief three-factor model, respectively, demonstrating significant factor loadings on all factors, among men and women. The interfactor correlations in Friborg et al.'s (2013) model

were statistically significant ($p < .001$) and very large among the full sample (rs range: .691–.839), and separately, in men (rs range: .728–.842) and women (rs range: .653–.841). The interfactor correlations in Grilo et al.'s (2015) model were also statistically significant ($p < .001$) and very large among the full sample (rs range: .574–.891), and separately, in men (rs range: .633–.872) and women (rs range: .511–.906).

Measurement Invariance by Gender of the Best Fitting Models

Measurement invariance analyses were conducted using both Friborg et al.'s (2013) four-factor model and Grilo et al.'s (2015) brief three-factor model. The results of measurement invariance analyses are summarized in Table 5. The configural invariance model demonstrated good fit based on two of three descriptive fit indices for Friborg et al.'s four-factor model (CFI = .974, RMSEA = .093, SRMR = .073) and based on all three descriptive fit indices for Grilo et al.'s brief three-factor model. Constraining factor loadings to be equal across groups led to ΔCFI, ΔRMSEA, and ΔSRMR within recommended thresholds, indicating metric invariance (Chen, 2007). Constraining item intercepts to also be equal across groups led to ΔCFI, ΔRMSEA, and ΔSRMR within recommended thresholds, indicating scalar invariance.

Scale Reliability of the Best Fitting Models

Internal consistency was adequate for Friborg et al.'s (2013) four-factor model, including the Dietary Restraint (α = .88, 95% CI [.87, .89]; ω = .88, 95% CI [.87, .89]), Preoccupation and Restriction (α = .91, 95% CI [.90, .92]; ω = .91, 95% CI [.90, .92]), Weight and Shape Concern (α = .95, 95% CI [.95, .96]; ω = .96, 95% CI [.95, .96]), and Eating Shame (α = .85, 95% CI [.83, .86]; ω = .85, 95% CI [.83, .87]) subscales. Additionally, internal consistency was adequate for Grilo et al's model factors, including Dietary Restraint (α = .88, 95% CI [.87, .89]; ω = .88, 95% CI [.87, .89]), Weight/Shape Overvaluation (ρ = .90), and Body Dissatisfaction (ρ = .87).

Discussion

The current study used CFA to test the factor structure of the EDE-Q in a large sample of cisgender sexual minority men and women in the United States. To our knowledge, this study is the first to explore the factor structure of the EDE-Q in sexual minority women, and this research adds to the paucity of research examining the factor structure of EDE-Q among sexual minority men. Analyses compared three models of the EDE-Q factor structure: Fairburn and Beglin's (1994) original four-factor model, Friborg et al.'s (2013) four-factor model, and Grilo et al.'s (2015) brief three-factor model. The best fitting models were then further assessed for evidence of measurement invariance by gender.

Consistent with much of the existing research on the factor structure of the EDE-Q (see Rand-Giovannetti et al., 2020 for review), no support was found for Fairburn and Beglin's (1994) original theoretically derived four-factor model. This finding suggests that Fairburn and Beglin's (1994) original factor structure may have limited use with sexual minority men and women, and future studies should explore whether similar results are found in other samples of sexual minority individuals. However, Fairburn and Beglin's model converged with warnings of negative factor loadings and variances in the current sample, which may not generalize to other samples. Among the models compared in the CFA, both Friborg et al.'s (2013) four-factor model and Grilo et al.'s (2015) three-factor model demonstrated adequate fit. Results were nearly identical when we examined the factor structure in the full sample and separately for men and women. Supplemental analyses, using Friborg et al.'s (2013) four-factor model, examining a higher order model with the four factors loaded onto a single factor, consistent with the EDE-Q global score, fit statistically significantly worse than the first-order model. These findings are consistent with Rand-Giovannetti et al.'s (2020) review of EDE-Q factor structures in

undergraduate men and women of unknown sexual orientation, who indicated that the lack of a higher order factor may suggest that a global EDE-Q score may not capture the multidimensional nature of eating pathology. However, Rand-Giovannetti et al. (2020) also cautioned that the chi-squared difference test for nested model comparison may be sensitive to small differences in model fit, which indicates that the higher order model may be statistically but not practically significantly different from the four-factor model. The present findings indicate support for the calculation of EDE-Q subscale scores, using Friborg et al.'s four-factor structure and Grilo et al.'s brief three-factor structure in samples of sexual minority men and women. Furthermore, although the higher order model demonstrated significantly worse statistical fit than Friborg et al.'s four-factor structure, it did demonstrate adequate descriptive fit. Thus, future research is needed to further test the model fit and utility of a higher order factor structure of the EDE-Q.

Measurement invariance analyses of the EDE-Q by gender using both Friborg et al.'s (2013) and Grilo et al.'s (2015) models found evidence for configural, metric, and scalar invariance in this sample. These results are consistent with findings from previous studies of gender-related measurement invariance of the EDE-Q in samples of unreported sexual orientation (Grilo et al., 2015; Jenkins & Davey, 2020; Penelo et al., 2013), suggesting that the EDE-Q has the same factor analytic properties for men and women. Inconsistent with Rand-Giovannetti et al.'s (2020) findings, which indicated a lack of measurement invariance on two Weight and Shape Concern factor items, in the present study, Friborg et al.'s (2013) four-factor model demonstrated scalar invariance across all factors, suggesting that Weight and Shape Concern subscale scores may represent similar levels of eating pathology in sexual minority men and women. Given mixed findings across studies, future research should seek to further elucidate

whether differences in the Weight and Shape Concern factor exist between heterosexual and sexual minority men and women.

The findings of this study should be interpreted in the context of several limitations. First, data were collected using online Qualtrics panels which may reveal different psychometric properties to data collected via conventional in-person sampling methods. However, findings from a large meta-analytic review indicate that the psychometric properties of data collected from online panel sources are not meaningfully different to data based on conventional samples and are, therefore, comparable (Walter et al., 2019). Further, our findings are based on data provided by young cisgender sexual minority men and women in the United States who volunteered to participate in research. Findings from this sample may not generalize to other sexual minority samples, eating disorder patients or other clinical samples, heterosexual or gender minority individuals, different age groups, or individuals outside of the United States. Future research should attempt to replicate this factor structure of the EDE-Q among these other groups. Additionally, this study could not test measurement invariance by sexual orientation because there was no heterosexual comparison group and, within the sexual minority sample, low sample sizes across sexual minority subgroups (i.e., gay, lesbian, and bisexual individuals). It would also be important for researchers to investigate structural invariance of the EDE-Q across different racial and ethnic groups in the sexual minority population, to determine whether use of the EDE-Q across racial groups among sexual minority individuals is appropriate. Future studies should be conducted to address this, specifically by assessing for structural invariance between heterosexual and sexual minority groups, sexual minority subgroups, and different racial and ethnic groups to ensure that mean EDE-Q scores can appropriately be compared.

Despite these limitations, the study's findings are strengthened by the large sample size and the sample's racial and ethnic diversity.

Although the present study supports the use of both Friborg et al.'s (2013) and Grilo et al.'s (2015) models of the EDE-Q, there are few methodological and theoretical concerns to be considered with the use of Grilo et al.'s brief-three factor model. Grilo et al.'s brief three-factor model includes three items assessing dietary restraint, and four items (across two factors) assessing shape and weight concerns. Unlike Friborg et al.'s (2013) model, Grilo et al.'s (2015) model did not address eating behaviors outside of dietary restraint, such as binge eating or purging, and other eating concerns such as shame around eating—a factor associated with the thoughts and behaviors shown to maintain disordered eating (Goss & Allan, 2009). Although shape and weight concerns are considered core pathology in eating disorders, for researchers and clinicians interested in evaluating eating concerns and behavior other than dietary restraint, this model has limitations because it does not assess eating-related cognitive and interpersonal factors which are core to many theoretical models of disordered eating (e.g., Cooper et al., 2009; Fairburn, 2008). Additionally, Hair and colleagues (2014) have indicated that latent factors should have a minimum of three items per factor to avoid under-identification of a model and to reliably measure a construct and increase its generalizability. Thus, although Grilo et al.'s (2015) model may have benefits as a brief clinical assessment, researchers and clinicians should be cautious of the aforementioned limitations when choosing to utilize it.

Overall, the current research provides a meaningful contribution to the existing literature on the factor structure of the EDE-Q and adds to the scarcity of existing research on the EDE-Q among sexual minority men and women. Most notably, these results add to the growing literature suggesting that researchers and clinicians should take caution in utilizing Fairburn and Beglin's

(1994) original theoretically derived factor structure for the EDE-Q. Future researchers are encouraged to consider multiple factor structures in their analyses to further evaluate the utility of the original factor structure. Instead, this research provides further support for the factor structure posited in Friborg et al.'s (2013) four-factor model and Grilo et al.'s (2015) brief three-factor model. Additionally, these findings provide evidence that the EDE-Q, as conceptualized in Friborg et al.'s (2013) and Grilo et al.'s (2015) models for sexual minority men and women, is invariant across genders, suggesting that comparison of scores by gender is appropriate. However, given the paucity of research examining measurement invariance of the EDE-Q, further research is needed.

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Tables

Table 2.1. *Demographic characteristics of the sexual minority sample.*

Variable	Men *n* (%)	Women *n* (%)	Total Sample *n* (%)	χ^2	*p*
Race[a]					
White	184 (38.6%)	187(38.7%)	371 (38.6%)	$\chi^2[3] = 0.45$	.93
Black/African American	146 (30.5%)	148 (30.6%)	294 (30.6%)		
Asian/Pacific Islander	134 (28.1%)	138 (28.6%)	272 (28.3%)		
Native American/American Indian	13 (2.7%)	10 (2.1%)	23 (2.4%)		
Ethnicity					
Hispanic/Latino/a	120 (25.1%)	114 (23.6%)	234 (24.3%)	$\chi^2[1] = 0.28$	.60
Sexual Identity					
Lesbian/Gay	239 (49.9%)	97 (20.1%)	336 (34.9%)	$\chi^2[3] = 101.82$	<.001
Bisexual	206 (43.0%)	358 (74.1%)	564 (58.6%)		
Asexual	10 (2.1%)	10 (2.1%)	20 (2.1%)		
Other[b]	24 (5%)	18 (3.7%)	42 (4.4%)		
Sexual Attraction					
Only attracted to same gender	203 (42.4%)	92 (19.0%)	295(30.7%)	$\chi^2[2] = 94.31$	<.001
Mostly attracted to same gender	89 (18.6%)	53 (11.0%)	142 (14.8%)		
Equally attracted to same gender	187 (39.0%)	338 (70.0%)	525 (54.5%)		

[a] Missing race data for two men

[b] Other sexual identities included, but were not limited to Pansexual, Demisexual, or Queer

Table 2.2. *Model fit comparisons of factor structures of the Eating Disorder Examination Questionnaire.*

Model	χ^2	*df*	*p*	CFI	RMSEA	SRMR
Friborg et al's (2013) four-factor model						
Men	963.02	203	< .001	.974	.089	.069
Women	1120.73	203	< .001	.975	.097	.077
Full sample	2084.76	203	< .001	.974	.098	.070
Friborg et al.'s (2013) second-order model						
Men	951.47	205	< .001	.975	.087	.070
Women	1116.16	205	< .001	.975	.096	.079
Full sample	2065.42	205	< .001	.974	.097	.071
Grilo et al.'s (2015) brief three-factor model						
Men	19.03	11	.06	.999	.039	.018
Women	21.83	11	.03	.999	.045	.018
Full sample	36.38	11	< .001	.999	.049	.017

Note. CFI = comparative fit index; RMSEA = root mean square error of approximation; SRMR = standardized root mean square residual.

Table 2.3. *Factor loadings of Friborg et al.' s model of the Eating Disorder Examination Questionnaire .*

Item	Factor Loadings					
	Men		Women		Full Sample	
	Unstandardized [95% CI]	Standardized [95% CI]	Unstandardized [95% CI]	Standardized [95% CI]	Unstandardized [95% CI]	Standardized [95% CI]
Factor 1: Dietary Restraint						
1. Restraint over eating	1.04 [0.98,1.10]	0.85 [0.82,0.88]	1.00 [0.94,1.05]	0.87 [0.84,0.90]	1.02 [0.98,1.06]	0.86 [0.84,0.88]
3. Food avoidance	0.96 [0.90,1.02]	0.81 [0.78,0.81]	1.00 [0.95,1.06]	0.87 [0.84,0.90]	0.98 [0.94,1.02]	0.85 [0.82,0.87]
4. Dietary rules	0.99 [0.93,1.06]	0.84 [0.80,0.87]	0.93 [0.87,0.99]	0.81 [0.77,0.85]	0.96 [0.91,1.00]	0.82 [0.80,0.85]
Factor 2:Preoccupation &Restriction						
2. Avoidance of eating	0.94 [0.89,0.99]	0.78 [0.74,0.82]	0.96 [0.90,1.02]	0.78 [0.74,0.82]	0.95 [0.91,0.99]	0.78 [0.76,0.81]
5. Empty stomach	1.07 [1.01,1.12]	0.84 [0.80,0.87]	1.04 [0.98,1.10]	0.82 [0.78,0.85]	1.05 [1.01,1.10]	0.83 [0.80,0.85]
7. Preoccupation with food, eating, calories	1.05 [0.99,1.11]	0.82 [0.79,0.86]	1.09 [1.03,1.15]	0.85 [0.83,0.88]	1.07 [1.02,1.11]	0.84 [0.81,0.86]
8. Preoccupation with shape and weight	1.09 [1.03,1.15]	0.85 [0.83,0.88]	1.12 [1.06,1.18]	0.87 [0.85,0.90]	1.10 [1.05,1.14]	0.86 [0.84,0.88]
9. Fear of losing control over eating	1.12 [1.06,1.19]	0.88 [0.85,0.91]	1.09 [1.02,1.16]	0.85 [0.82,0.88]	1.11 [1.06,1.15]	0.87 [0.85,0.89]
Factor 3: Weight & Shape Concern						
6. Flat stomach	0.87 [0.81,0.92]	0.74 [0.70,0.79]	0.85 [0.79,0.91]	0.73 [0.69,0.78]	0.87 [0.83,0.90]	0.74 [0.71,0.77]
10. Fear of weight gain	1.16 [1.09,1.23]	0.86 [0.83,0.88]	1.18 [1.10,1.25]	0.86 [0.84,0.89]	1.15 [1.10,1.20]	0.86 [0.84,0.87]
11. Feelings of fatness	1.15 [1.09,1.23]	0.86 [0.83,0.88]	1.19 [1.12,1.26]	0.87 [0.85,0.89]	1.18 [1.13,1.23]	0.87 [0.86,0.89]

Table 2.3. *Factor loadings of Friborg et al.' s model of the Eating Disorder Examination Questionnaire,* Continued.

Item	Factor Loadings					
	Men		Women		Full Sample	
	Unstandardized [95% CI]	Standardized [95% CI]	Unstandardized [95% CI]	Standardized [95% CI]	Unstandardized [95% CI]	Standardized [95% CI]
Factor 3: Weight & Shape Concern						
12. Desire to lose weight	1.17 [1.10,1.24]	0.87 [0.84,0.90]	1.24 [1.16,1.31]	0.91 [0.89,0.92]	1.21 [1.16,1.26]	0.90 [0.88,0.91]
22. Importance of weight	1.19 [1.12,1.26]	0.90 [0.86,0.91]	1.19 [1.12,1.26]	0.87 [0.85,0.89]	1.20 [1.15,1.25]	0.89 [0.88,0.90]
23. Importance of shape	1.19 [1.12,1.26]	0.89 [0.87,0.91]	1.19 [1.11,1.26]	0.87 [0.84,0.90]	1.20 [1.15,1.25]	0.89 [0.87,0.90]
24. Reaction to prescribed weighing	0.99 [0.91,1.08]	0.74 [0.68,0.79]	0.92 [0.83,1.01]	0.67 [0.62,0.73]	0.94 [0.88,1.00]	0.70 [0.66,0.73]
25. Dissatisfaction with weight	1.16 [1.09,1.22]	0.86 [0.84,0.88]	1.18 [1.11,1.25]	0.86 [0.84,0.88]	1.16 [1.11,1.21]	0.86 [0.85,0.88]
26. Dissatisfaction with shape	1.15 [1.07,1.22]	0.85 [0.83,0.88]	1.17 [1.10,1.24]	0.86 [0.84,0.88]	1.15 [1.10,1.21]	0.85 [0.84,0.87]
27. Discomfort seeing body	1.12 [1.05,1.19]	0.83 [0.80,0.86]	1.17 [1.10,1.24]	0.86 [0.84,0.88]	1.15 [1.10,1.19]	0.85 [0.83,0.86]
28. Discomfort exposing body	1.11 [1.04,1.18]	0.83 [0.80,0.85]	1.15 [1.07,1.22]	0.84 [0.81,0.87]	1.13 [1.08,1.12]	0.84 [0.82,0.85]
Factor 4: Eating Shame						
19. Eating in secret	0.75 [0.65,0.85]	0.69 [0.60,0.77]	0.75 [0.65,0.86]	0.66 [0.57,0.75]	0.74 [0.67,0.82]	0.67 [0.60,0.73]
20. Guilt after eating	1.33 [1.16,1.51]	0.92 [0.88,0.96]	1.33 [1.14,1.51]	0.88 [0.85,0.90]	1.35 [1.22,1.48]	0.90 [0.87,0.93]
21. Social eating	1.22 [1.07,1.36]	0.84 [0.80,0.88]	1.17 [1.01,1.34]	0.77 [0.72,0.82]	1.21 [1.09,1.32]	0.80 [0.77,0.84]

Note. all p-values are < .001; Standardized and unstandardized factor loadings from a confirmatory factor analysis are presented for a four-factor model, originally supported in "Core pathology of eating disorders as measured by the Eating Disorder Examination Questionnaire (EDE-Q): The predictive role of a nested general (g) and primary factors," by O. Friborg, D. L. Reas, J. H. Rosenvinge, & Ø. Rø, 2013, *International Journal of Methods in Psychiatric Research, 22*(3), pp. 195–203 (https://doi.org/10.1002/mpr.1389).

Table 2.4. *Factor loadings of Grilo et al.' s model of the Eating Disorder Examination Questionnaire.*

Item	Factor Loadings					
	Men		Women		Full Sample	
	Unstandardized (95% CI)	Standardized (95% CI)	Unstandardized (95% CI)	Standardized (95% CI)	Unstandardized (95% CI)	Standardized (95% CI)
Factor 1: Dietary Restraint						
1. Restraint over eating	1.02 (0.96, 1.07)	0.84 (0.81, 0.87)	0.97 (0.92, 1.01)	0.85 (0.83, 0.88)	0.99 (0.95, 1.03)	0.85 (0.83, 0.86)
3. Food avoidance	0.99 (0.93, 1.04)	0.83 (0.80, 0.86)	1.04 (0.98, 1.09)	0.88 (0.86, 0.91)	1.01 (0.97, 1.05)	0.86 (0.84, 0.88)
4. Dietary rules	0.99 (0.94, 1.05)	0.84 (0.80, 0.87)	0.96 (0.91, 1.01)	0.82 (0.79, 0.85)	0.97 (0.94, 1.01)	0.83 (0.80, 0.85)
Factor 2: Shape/Weight Overvaluation						
22. Importance of weight	0.98 (0.94, 1.02)	0.92 (0.90, 0.94)	1.01 (0.98, 1.05)	0.94 (0.92, 0.95)	1.00 (0.97, 1.02)	0.93 (0.92, 0.94)
23. Importance of shape	1.02 (0.98, 1.06)	0.94 (0.92, 0.96)	0.99 (0.95, 1.02)	0.93 (0.90, 0.95)	1.00 (0.76, 1.03)	0.93 (0.92, 0.95)
Factor 3: Body Dissatisfaction						
25. Dissatisfaction with weight	1.02 (0.97, 1.06)	0.92 (0.89, 0.94)	1.01 (0.98, 1.05)	0.91 (0.89, 0.93)	1.01 (0.98, 1.04)	0.91 (0.90, 0.93)
26. Dissatisfaction with shape	0.98 (0.94, 1.03)	0.90 (0.88, 0.93)	0.99 (0.96, 1.02)	0.90 (0.88, 0.92)	0.99 (0.96, 1.02)	0.90 (0.89, 0.92)

Note. all p-values are < .001; Standardized and unstandardized factor loadings from a confirmatory factor analysis are presented for a brief three-factor model of the EDE-Q, originally supported in "Factor structure and construct validity of the Eating Disorder Examination-Questionnaire in college students: Further support for a modified brief version," by C. M. Grilo, D. L. Reas, C. J. Hopwood, & R. D. Crosby, 2015, *International Journal of Eating Disorders, 48*(3), pp. 284–289 (https://doi.org/10.1002/eat.22358).

Table 2.5. *Measurement invariance by gender: Model fit indices.*

Model	χ^2	*df*	*p*	CFI	RMSEA	SRMR	Δ χ^2	Δ CFI	Δ RMSEA	Δ SRMR
Friborg et al.'s (2013) four-factor model:										
Configural Model	2079.406	406	< .001	.974	.093	.073	--	--	--	--
Metric Invariance: Factor Loadings Equal Across Groups	1971.283	424	<.001	.976	.087	.073	-108.123	.002	-.006	0
Scalar Invariance: Factor Loadings & Intercepts Equal Across Groups	2210.552	530	< .001	.974	.081	.073	239.269	-.002	-.006	0
Grilo et al.'s (2015) brief three factor model:										
Configural Model	41.046	22	.008	.999	.042	.018	--	--	--	--
Metric Invariance: Factor Loadings Equal Across Groups	46.675	26	.008	.999	.041	.019	5.629	0	.001	.001
Scalar Invariance: Factor Loadings & Intercepts Equal Across Groups	105.336	58	< .001	.998	.041	.018	58.661	-.001	0	-.001

Note. CFI = comparative fit index; RMSEA = root mean square error of approximation; SRMR = standardized root mean square residual

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CHAPTER 3: Study 3

The content within this section, titled "Chapter 3: Study 3," reflects material which is under review at *Body Image: International Journal of Research*. A formal citation is as follows:

Klimek, P., Calzo, J., Roesch, S. C., & Blashill, A. J. (under review). Associations between body image patterns and body image disorder symptoms in sexual minority individuals: A mixture-modeling approach. *Body Image: International Journal of Research.*

Abstract

Objective: Body image concerns are associated with disordered eating, body dysmorphic disorder (BDD), and muscle-building behaviors including appearance and performance enhancing drug (APED) misuse. Both thinness and muscularity body image concerns have been demonstrated in sexual minority individuals—a vulnerable population for increased severity of body image concerns. Varying patterns of thinness and muscularity-oriented concerns may be differentially associated with body image disorders and related health risk behaviors. **Method:** The present study used latent profile analyses to identify body image patterns in sexual minority men (n = 479) and women (n = 483). Subsequently, auxiliary variables were included to investigate associations between latent profiles and illicit APED misuse, muscle-building behavior, disordered eating, and BDD symptoms. **Results:** A 5-profile solution demonstrated best fit for men and a 4-profile solution for women. In both sexual minority men and women, disordered eating and BDD symptoms were highest when thinness concerns were high, regardless of muscularity concern. Further, high muscularity concern profiles had higher severity of muscle-building behavior in both men and women, even if high levels of thinness concerns were present. Moreover, profiles with both high or moderate levels of both thinness and muscularity concerns demonstrated the highest probabilities of past year illicit APED misuse. **Conclusion:** Particular body image concern profiles, varying in levels of both thinness and muscularity concerns, may be at higher risk for greater disordered eating, muscle-building, and body dysmorphic concerns. The study findings may have implications for treatment and prevention of body image-related disorders in sexual minority individuals.

Keywords: body image, thinness, muscularity, eating disorder, muscle-building

Associations Between Body Image Patterns and Body Image Disorder Symptoms in Sexual Minority Individuals: A Mixture-Modeling Approach

Eating disorders (EDs) and body dysmorphic disorder (BDD) are serious psychiatric disorders associated with some of the highest levels of suicidality and premature mortality (Angelakis et al., 2016; Arcelus et al., 2011; Chesney et al., 2014; Snorrason et al., 2019). Moreover, increasing evidence also supports distinct clinical presentations of muscularity-oriented EDs (e.g., overregulation of protein consumption), muscle dysmorphic disorder (a subtype of BDD characterized by muscularity-oriented drive for size, appearance intolerance, and functional impairment; American Psychiatric Association, 2013; Hildebrandt et al., 2004), and associated health risk behaviors such as illicit appearance and performance enhancing drug (APED) misuse, particularly in samples of men (Murray et al., 2016). Men with muscle dysmorphia and muscularity-oriented disordered eating have demonstrated comparable dietary restriction to men with anorexia nervosa, which has the highest rate of mortality across psychiatric disorders, and thus, may be associated with similar medical risks (Harris & Barraclough, 1998; Murray et al., 2012; Murray et al., 2018). Additionally, illicit APEDs (e.g., anabolic-androgenic steroids [AAS], human growth hormone) are used to gain muscle and reduce body fat and are associated with serious adverse mental and physical health effects (e.g., cardiomyopathy, neuroendocrine dysfunction, major mood disorders; for a review, see Goldman et al., 2019; Pope et al. 2014). Therefore, further research is needed to better understand these serious mental health concerns and to inform ED and BDD treatment and prevention efforts.

Sexual minority (i.e., non-heterosexual identity and/or attraction to the same gender) individuals are considered a vulnerable population for the development of body image disorders and other associated health risk behaviors such as illicit APED misuse (Boroughs et al., 2010;

Calzo et al., 2013; Gonzales & Blashill, 2021; Kamody et al., 2020; Simone et al., 2020). Sexual minority men and women have demonstrated 1.93 to 3.69 times higher odds of lifetime EDs than their heterosexual counterparts (Kamody et al., 2020). Additionally, recent studies have suggested higher occurrence rates of probable BDD in sexual minority individuals (approximately 50% of samples; Gonzales & Blashill, 2021; Oshana et al., 2020) compared with the general population (2.4%; Koran et al., 2008). Moreover, sexual minority adolescent boys have demonstrated elevated lifetime AAS misuse occurrence rates compared with their heterosexual counterparts (Blashill et al., 2017). Further, a sample of adult sexual minority men and women demonstrated considerably high occurrence rates (35.7% and 25.5%, respectively) of any past year illicit APED misuse (AAS, human growth hormone, dehydroepiandrosterone; Gonzales & Blashill, 2021) compared to the global lifetime prevalence rate of AAS misuse obtained in a sample of men and women of unknown sexual orientation (3.3%; Sagoe et al., 2014). Sexual orientation disparities in body image disorders and associated health risk behaviors (e.g., APED misuse) highlight the importance of gaining more knowledge on body image disorders in sexual minority individuals.

EDs and BDD also share core psychopathology—body image disturbance (Fairburn, 2008; Hrabosky et al., 2009; Phillips et al. 1995). One of the leading theoretical models of body image concerns is the tripartite influence model, which posits that sociocultural influences may lead to body dissatisfaction and subsequent engagement in body change behaviors (Thompson et al., 1999). Early investigations of the tripartite influence model supported the associations between thinness or general appearance ideal internalization, body dissatisfaction, and ED symptoms (van den Berg et al., 2002) as well as cosmetic surgery attitudes (Menzel et al., 2011). The tripartite influence model was also extended to support dual body image pathways—thinness

concerns and muscularity concerns—to body image disorder symptoms in men (e.g., dietary restraint, muscle-building behaviors; Tylka, 2011). Tylka (2011) found that thinness concerns were associated with greater dietary restraint, and muscularity concerns were associated with greater engagement in muscle-building behaviors (e.g., excessive exercise, muscle-building supplement use). Moreover, in a sample of primarily heterosexual college men, independent positive associations emerged between muscularity and thinness internalization and body image disorders symptoms such as disordered eating and muscle dysmorphia (Klimek et al., 2018; Schaefer et al., 2021). Increasing evidence suggests that women also endorse a muscular body ideal (Bozsik et al., 2018; Girard et al., 2018; Hazzard et al., 2019). For example, women demonstrated positive associations between both muscularity and thinness internalization and dietary restraint (Hazzard et al., 2019). Additionally, in a sample of adolescent girls, internalization of the athletic ideal predicted future muscle-building behavior (Hoffmann & Warschburger, 2019). Athletic and general appearance ideal internalization as well as overall body dissatisfaction have also been positively associated with BDD symptoms in adult men and women (e.g., Ahmadpanah et al., 2019; Didie et al., 2010; Hrabosky et al., 2009). Further, individuals with BDD and individuals with bulimia nervosa have demonstrated comparable dissatisfaction in various shape-related areas such as the lower torso (Hrabosky et al., 2009). Moreover, individuals with BDD have also demonstrated greater muscle tone and thinness-oriented body dissatisfaction compared with nonclinical controls (Hrabosky et al., 2009; Lambrou et al., 2012). Prior research may indicate similarities in associations between thinness concerns and both ED and BDD as well as elevated muscularity concerns in individuals with more severe BDD symptoms. Support of the tripartite influence model, therefore, demonstrates

associations between body image disorders and thinness and muscularity internalization and dissatisfaction across men and women.

The tripartite influence model of body image concerns has also been supported in sexual minority individuals. For example, gay men have demonstrated positive associations between muscularity dissatisfaction and muscle-building behaviors (e.g., excessive weight-lifting), as well as between body fat dissatisfaction and disordered eating behaviors (e.g., dietary restraint; Tylka & Andorka, 2012). In addition, muscularity and body fat dissatisfaction linked mesomorphic ideal internalization—characterized by low body fat and muscularity—to muscle-building and disordered eating behaviors, respectively. Other studies, however, demonstrated a negative association between body fat dissatisfaction and AAS misuse as well as no significant associations between muscularity dissatisfaction and AAS misuse (Griffiths et al., 2017) or disordered eating (Smith et al., 2011) in samples of sexual minority men. The tripartite model has also been supported in samples of sexual minority women, such that thinness internalization was associated with dietary restraint (Hazzard et al., 2019; Huxley et al., 2015). However, bisexual and lesbian women did not demonstrate significant associations between muscularity internalization and dietary restraint (Hazzard et al., 2019). Existing, mixed findings suggest that thinness and muscularity internalization and dissatisfaction may vary in their associations with body image disorder symptoms in sexual minority men and women.

Moreover, individuals may endorse varying combinations of thinness and muscularity concerns (Bozsik et al., 2018; Yellan & Tiggemann, 2003). Latent class analyses in a sample of heterosexual and sexual minority men indicated varying patterns of concerns — those who were primarily muscle-concerned (i.e., high levels of muscularity-oriented body image attitudes and behaviors), primarily lean-concerned (i.e., high levels of body fat/thinness-oriented body image

attitudes and moderate levels of muscularity concern and dieting behaviors) or those who had low levels of overall body image concerns and weight/shape control behaviors (Calzo et al., 2015). Sexual minority young adult men were more likely to be lean-concerned than heterosexual men, and both heterosexual and sexual minority men had similar likelihoods of being in the muscle-concerned group classification. In contrast, in a sample of adolescent and young adult men and women of unknown sexual orientation, latent profile analyses indicated that thinness concerns co-occurred with muscularity concerns but did not yield a muscularity concern-only or thinness concern-only profile (Hoffmann & Warschburger, 2018). Other researchers have corroborated that both men and women can possess a high drive for thinness simultaneously with a high drive for muscularity (Kelley et al., 2010). Given the paucity of literature and mixed findings across existing studies, the heterogeneity of body image concerns is still unclear.

Varying patterns of thinness and muscularity-oriented concerns may also be differentially associated with behavioral health outcomes. For example, primarily heterosexual undergraduate men with high muscularity internalization had higher levels of muscle dysmorphia if they also had low thinness internalization versus high thinness internalization (Klimek et al., 2018). In a sample of weightlifting men, a latent class characterized by desire to decrease body fat and increase muscularity demonstrated the highest levels of eating pathology, muscle dysmorphic concern, illicit APED misuse, and other weight and shape control behaviors (Hildebrandt et al., 2006). Further, mixture modeling investigations of APED users demonstrated that APED risk was highest among individuals endorsing high overall appearance concerns and muscle dysmorphic concerns compared with individuals with other body image patterns characterized by varying levels of drive for size, desire for leanness, and general appearance concerns (e.g.,

Hildebrandt et al., 2010). Moreover, disordered eating behaviors and muscle-building behaviors were highest among adult women and men with high levels of thinness and muscularity concerns, compared with those with low concerns and those with moderate concerns (Hoffman & Warschburger, 2018). Thus, individuals with body image patterns characterized by high levels of both thinness and muscularity concerns have consistently demonstrated more severe body image disorder symptoms than individuals with lower thinness and muscularity concerns.

However, little is known about the variability in body image concerns among sexual minority individuals and associations between varying patterns and body image-related disorders. Advanced mixture modeling approaches (e.g., latent class analyses) with auxiliary variables allow for researchers to model associations between latent classes and theorized outcomes (Asparouhov & Muthén, 2021). Although Calzo et al. (2015) were the first to explore heterogeneity of body image concerns and associated behaviors (e.g., APED use, disordered eating behaviors) in sexual minority men using latent class analyses, this research was part of a larger parent study and, thus, included non-validated, mostly single-item measurements of relevant variables. Moreover, the investigation was limited to sexual minority men. Thus, an investigation of body image patterns in sexual minority men and women, using validated measures, may lead to novel characterization of body image patterns and associated health outcomes in this population. Further, the only existing mixture modeling investigation in sexual minority men used dichotomous indicator variables by using cut-off scores for body image concerns, disordered eating, and muscle-building behaviors (Calzo et al., 2015). The use of continuous profile indicators may reveal greater variability in body image patterns than when these indicators are dichotomized. Finally, Calzo et al. (2015) combined body image concerns with body image disorder symptoms as class indicators. Body image concerns are considered

risk factors preceding the development of body image disorders (e.g., Feusner et al., 2010; Stice, 2001); thus, disentangling body image concerns from disordered eating and muscle-building behaviors may be clinically relevant.

The present study, therefore, addresses several gaps in investigations of the heterogeneity in body image patterns among sexual minority individuals. For example, the present study, to our knowledge, is the first to use latent profile analyses with continuous and psychometrically validated indicator variables to explore body image patterns and subsequent associations with body image disorder symptoms in sexual minority men and women. Although Hoffman and Warschburger (2018) also investigated heterogeneity in body image patterns using latent profile analyses with continuous indicators and subsequently investigated associations between these patterns and body image disorder symptoms (e.g., disordered eating and muscle-building behavior), this investigation was in a sample of individuals with unknown sexual orientation. Moreover, to our knowledge, no existing studies have explored variability in body image concerns in sexual minority women. Additionally, no existing studies have investigated associations between varying body image patterns and BDD symptoms. The present study will, therefore, contribute significantly to the understanding of body image heterogeneity in sexual minority men and women.

The first aim of the present study was to identify varying patterns of body image concerns in sexual minority individuals, including both thinness and muscularity internalization and thinness- and muscularity-oriented attitudes. Subsequently, the present study aimed to investigate associations between identified patterns and body image disorder symptoms, such as ED symptoms, muscle-building, illicit APED misuse, and BDD symptoms. Because of mixed findings across latent class and profile analyses identifying thinness- and muscularity-oriented

body image patterns in men and women (e.g., Calzo et al., 2015; 2016; Hoffmann & Warschburger, 2018), no a priori hypotheses were formed.

Method

Participants & Procedures

Participants were 479 sexual minority men and 483 sexual minority women aged 18–30 years and were recruited as part of a parent study investigating racial and ethnic differences in body image concerns and related behavioral health outcomes (Gonzales & Blashill, 2021). Prospective participants were consented and completed a prescreener through Qualtrics Panels. Participants were deemed eligible if they were aged 18 to 30 years, English-speaking and self-identified as (a) a cisgender man or woman; (b) gay, lesbian, bisexual, or any nonheterosexual identity; and (c) Non-Hispanic Black or African American, White, Asian American/Pacific Islander, or Hispanic with any other race. Eligible participants completed a self-report survey via Qualtrics. All procedures were reviewed and approved by the University's Institutional Review Board.

Measures

Body Image Concern Indicators

Muscularity Dissatisfaction. The Muscularity-Oriented Body Image subscale of the Drive for Muscularity Scale (DMS; McCreary & Sasse, 2000) was used to measure muscularity attitudes. The 14-item, two-factor DMS, which includes Muscle-Oriented Body Image and Muscle-Oriented Behavior subscales, has demonstrated support in the current sample of sexual minority men and women (Klimek, Convertino, Gonzales et al., 2021). Internal consistency was adequate for the DMS Muscle-Oriented Body Image (Men: $\alpha = .93$, $\omega = .92$; Women: $\alpha = .93$, $\omega = .93$).

Thinness Concerns. The Eating Disorder Examination Questionnaire (EDE-Q; Fairburn & Beglin, 1994) is a commonly used assessment of ED symptoms and consists of 22 items, scored on frequency and Likert scales ranging from 0 (*no days or not at all)* to 6 *(every day or markedly*), which represent the frequency and/or severity of eating and shape/weight concerns. Friborg et al.'s (2013) four-factor model of the EDE-Q was supported in the current sample of sexual minority men and women (Klimek, Convertino, Pennesi et al., 2021) and includes the following subscales: (a) Dietary Restraint, (b) Preoccupation and Restriction, (c) Eating Shame, and (d) Shape/Weight Concerns. Thinness-oriented body image concerns were evaluated using the Shape/Weight Concerns subscale of Friborg et al.'s factor structure of the EDE-Q. Internal consistency of the Shape/Weight Concerns subscale was adequate in both men and women, ranging from α and ω = .95 to .96 across both samples.

Thinness and Muscularity Internalization. The Sociocultural Attitudes Towards Appearance Questionnaire-4 Revised (SATAQ-4R; Schaefer et al., 2017) evaluates internalization of appearance ideals and appearance-related pressures. The SATAQ-4R consists of seven subscales: Thin/Low Body Fat Internalization, Muscular Internalization, General Attractiveness Internalization, and Family, Peers, Significant others, and Media Pressures. The SATAQ-4R has demonstrated varying factor structures in men and women; therefore, both male and female versions have been developed (Schaefer et al., 2017). The SATAQ-4R male and female versions have also demonstrated appropriate fit in the present sample of sexual minority men and women, respectively (Convertino et al., 2019). For the present study, in which the purpose was to explore heterogeneity around thinness- and muscularity-oriented body image, only the Thin/Low Body Fat and Muscular Ideal Internalization subscales of the male and female SATAQ-4R versions were used. Item scores range from 1 *(definitely disagree*) to 5 (*definitely*

agree), and an average score was calculated for each subscale. In men, internal consistency was adequate for the Muscular Ideal Internalization subscale (α and ω = .90) and the two-item Thin/Low Body Fat Internalization subscale (ρ = .77). In women, internal consistency was also adequate for the female versions of the Muscular Ideal Internalization subscale (α and ω = .91) and the Thin/Low Body Fat Internalization subscale (α = .84 and ω = .85).

Negative Health Outcomes

Appearance and Performance Enhancing Drug Misuse. Illicit appearance and performance enhancing drug (APED) misuse was assessed using items derived from the Growing Up Today Study (GUTS; see Field et al., 1999)—a national study of adolescent children of women participating in the Nurse's Health Study II (Solomon et al., 1997). The frequency of using dehydroepiandrosterone (DHEA), growth hormone (without Doctor's prescription), and anabolic/injectable steroids (AAS; without Doctor's prescription), during the past year, was evaluated on a scale ranging from 0 (*never*) to 4 (*daily*). In the present study, a dichotomous outcome was created, to indicate the presence (*yes*) or absence (*no*) of any AAS, DHEA, or growth hormone use during the past year.

Muscle-Building Behavior. Muscle-building behavior, such as excessive exercise, was evaluated using the Muscle-Oriented Behavior subscale of the 14-item DMS (DMS-MB; Klimek, Convertino, Gonzales et al., 2021; McCreary et al., 2004). Internal consistency was adequate for the Muscle-Oriented Behavior subscale in the current samples of men (α = .91, ω = .91) and women (α = .92, ω = .92).

Eating Disorder Symptoms. The Dietary Restraint, Preoccupation and Restriction, and Eating Shame subscales of Friborg et al.'s (2013) factor structure of the EDE-Q (Fairburn &

Beglin, 1994) were used to evaluate ED symptoms. Internal consistency of these subscales was adequate in both men and women, ranging from α and ω = .83 to .91 across both samples.

Body Dysmorphic Disorder Symptoms. The Dysmorphic Concern Questionnaire (DCQ; Oosthuizen et al., 1998) was used to evaluate BDD symptoms. The DCQ seven-item, one-factor structure has demonstrated appropriate fit in the present sample of sexual minority men and women (Rozzell et al., 2020). The total sum score of the DCQ can range from 0 to 21, with higher scores indicating higher levels of dysmorphic concerns and scores above a 9 indicative of clinically significant levels of BDD symptoms (Mancuso et al., 2010). Internal consistency of the DCQ was adequate in both men and women, (α and ω = .90 in men and .91 in women).

Possible Covariates

Possible covariates included race/ethnicity, body mass index (BMI), and age. Prior research has indicated racial and ethnic differences in body image concerns and related health risk behaviors among men and women (e.g., Gluck & Geliebter, 2002; Gonzales & Blashill, 2021). Moreover, BMI has a well-documented, strong relationship with body image and EDs and has been included as a covariate in prior mixture modeling investigations of body image patterns (e.g., Calzo et al., 2016; Gluck & Geliebter, 2002; Thompson et al., 1995). Finally, research indicates that age may impact presentation of body image disorders and related health risk behaviors (e.g., appearance and performance enhancing drug use; Calzo et al., 2015); thus, it may be important to control for this variable. Race/ethnicity was dummy coded, with White non-Hispanic race/ethnicity as the reference group compared with (a) Non-Hispanic Black or African American, (2) Asian American/Pacific Islander, or (3) Hispanic/Latino/a individuals of any race.

Participants were asked for their height (in inches) and weight (in lbs.) as part of the EDE-Q (Fairburn & Beglin, 1994), and a BMI was subsequently calculated as a continuous variable.

Statistical Analysis

Latent Profile Analyses

Latent profile analyses were conducted using Mplus software Version 7.31 (Asparouhov & Muthén, 2014). Analyses were conducted separately for men and women, given that the SATAQ-4R—the measure of internalization of appearance ideals—includes different versions for men and women. Normality of continuous indicator and outcome variables (muscle-building behavior and ED symptoms) were assessed by examining frequency histograms and Q-Q plots. A simulation study (Nylund et al., 2007) indicated that latent class analyses perform very well in sample sizes of $n = 500$; therefore, the sample sizes of men ($n = 479$) and women ($n = 483$) in the present study were adequate, though slightly below this ideal threshold.

The profile enumeration stage of latent profile analyses involved testing unconditional models using only the latent indicators (muscularity- and thinness-oriented body image attitudes and internalization). Models with two-to-five profiles were explored, maintaining parsimony and aligning with prior studies examining body image patterns in men and women (e.g., Calzo et al., 2015; Hoffmann & Warschburger, 2018). Missing data in indicator variables was handled using full information maximum likelihood estimation (Spurk et al., 2020).

The best fitting profile solutions in the samples of men and women were determined based on model fit information criteria, such as the Bayesian Information Criterion (BIC; Schwarz, 1978), sample-size adjusted BIC (s-BIC; Yang, 2006), and Akaike Information Criterion (AIC; Akaike, 1974). Lower AIC, BIC, and s-BIC values of a specified model would indicate improved model fit (Berlin et al., 2014). Additionally, entropy, which evaluates

classification accuracy, was also examined, such that higher entropy (preferably > .80) would demonstrate greater classification accuracy (Tein et al., 2013). In addition, the bootstrap likelihood ratio test (BLRT; McLachlan & Peel, 2000) and the Lo-Mendell-Rubin adjusted likelihood ratio test (LMRT; Lo et al., 2001) were examined. A *p*-value of < .05 would indicate that a specified model provides a better fit than a model with one less class (Nylund et al., 2007). Finally, probabilities of group classification (posterior classification probabilities) were also examined for all competing models, with average probabilities greater than or equal to 0.70 indicating an appropriate class solution (Nylund-Gibson & Choi, 2018). Means and standard deviations (*SD*) of all latent profile indicator variables were reported for all latent profiles of the best fitting solutions in both the samples of men and women.

Subsequent steps involved testing for possible covariates (race/ethnicity, body mass index, and age), and associations between profile membership and distal outcomes (illicit APED misuse, muscle-building behavior, ED symptoms, BDD symptoms). Covariate influence on profile membership was firstly evaluated using the manual Bolck, Croons, and Hagenaars (BCH) approach (Asparouhov & Muthén, 2021; Bolck et al., 2004). Missing data on covariates was handled using multiple imputation guidelines (Asparouhov & Muthén, 2021).

For adjusted models investigating associations between profile membership and distal outcomes controlling for covariates, the manual BCH approach (Asparouhov & Muthén, 2021; Bolck et al., 2004) was used for evaluating continuous distal outcomes (Muscle-building behavior, ED symptoms, and BDD symptoms), and the manual 3-step approach (Asparouhov & Muthén, 2014) was used for both the adjusted and unadjusted models using the categorical distal outcome (illicit APED misuse). For adjusted models, omnibus Wald Chi-square (χ^2) tests and pairwise comparisons, using *z*-tests, were used to evaluate latent profile differences on distal

outcomes. The *z*-tests for pairwise comparisons evaluated differences between intercepts or thresholds. For unadjusted models, the automatic BCH method (Asparouhov & Muthén, 2021; Bolck et al., 2004), using the AUXILIARY function in Mplus, was used for models with continuous distal outcomes. Omnibus and pairwise comparison Wald χ^2 tests were used to evaluate latent profile differences for unadjusted models with continuous distal outcomes. Adjusted and unadjusted models were compared, and the most parsimonious models were reported. An alpha correction procedure, Benjamini-Hochberg (B-H), was applied to correct for Type I error associated with multiple statistical tests, using a false discovery rate of .05 (Thissen et al., 2002).

Estimated latent means and standard deviations (*SD*) of all continuous distal outcomes were also reported. Additionally, Hedge's *g* effect sizes were calculated for each pairwise comparison, adjusting the pooled standard deviation with weights for sample sizes (Hedges & Olkin, 1985). Cohen's (1992) guidelines were adapted to assess magnitude of effect sizes, as Hedge's *g* is interpreted similarly to Cohen's *d*, with a range of $g = 0.10$ to 0.30 denoting a small effect, $g = 0.40$ to 0.60 a medium effect, $g = 0.70$ to 0.90 a large effect, and $g > 1.00$ for a very large effect. Further, estimated proportions for latent profiles were reported for the binary outcome of illicit APED misuse.

Sensitivity Analyses

Because of a considerable number of errors in self-reported height, BMI data were modified, and sensitivity analyses were conducted using varying BMI variables. Each individual's height and BMI was manually evaluated using the U.S. height and BMI 5th to 95th percentile norms based on age, race, and ethnicity. Two modified BMI variables were created–a more liberally modified BMI and a conservatively modified BMI. For both BMI calculations,

self-reported heights such as ‘5’ or ‘6’ or ‘511’ were treated as feet metrics and were transformed into inches. All other, less clear height errors were treated as missing data for the conservatively modified BMI variable. However, for the liberally modified BMI calculation, additional height modifications were based on individual comparisons to U.S. norms of both height and BMI. *Z*-scores for both BMI variables were then evaluated for outliers. In the conservatively modified BMI, *z*-scores +/- 3.3 standard deviations were deleted. In the liberally modified BMI, *z*-scores of +/- 3.3 standard deviations were transformed to the highest BMI in the sample that fell within +/- 3.3 standard deviations +/- 1, to maintain rank order (Tabachnick & Fidell, 2007). Sensitivity analyses including either the conservatively or liberally modified BMI were conducted for latent profile analyses.

Results

Descriptives

Table 3.1 provides a summary of demographic information of both the sample of men (*n* = 479) and women (*n* = 483). Table 3.1 also provides the means and standard deviations of all indicator and outcome variables included in latent profile analyses. Further, Table 3.2 demonstrates bivariate correlations between covariates, indicator variables, and outcome variables.

Latent Profile Analysis: Profile Enumeration Stage

Indicators such as muscularity internalization and muscularity dissatisfaction in women, and thinness concerns in both men and women, demonstrated nonnormal distributions; thus, latent profile analyses were conducted using maximum-likelihood with robust SE. Model fit indices for 2- to 5-profile solutions for men and women samples are presented in Table 3.3. Unstandardized and standardized profile means on the four indicator variables were then

compared within each sample. To guide interpretations of unstandardized means, the possible mean ranges per indicator variable are: (a) 1 to 6 for muscularity dissatisfaction, measured with the DMS-MBI subscale; (b) 1 to 5 for muscularity and thinness internalization, measured with the SATAQ-4R; and (c) 0 to 6 for thinness concerns, measured with the EDE-Q—with higher scores indicating higher body image concerns for all indicators.

Latent Profiles for Sexual Minority Men

Results indicated that a 5-profile solution demonstrated both statistical and theoretical fit for men. Profile 1 accounted for approximately 12% of the sample (n = 57) and was best characterized as the Low Thinness/Low Muscularity profile, with the lowest means of thinness concerns (M = 1.05, SD = 1.19), thinness internalization (1.68, SD = 0.91), muscularity dissatisfaction (M = 1.58, SD = 0.63), and muscularity internalization (M = 1.41, SD = 0.69). Profile 2 accounted for approximately 49% of the sample (n = 233) and was best characterized as the Moderate Thinness/Moderate Muscularity profile, with a mean of 2.08 (SD = 1.94) for thinness concerns, 2.85 (SD = 1.13) for thinness internalization, 3.2 (SD = 1.16) for muscularity dissatisfaction, and 3.08 (SD = 0.87) for muscularity internalization. Profile 3 accounted for approximately 6% of the sample (n = 29) and was characterized as the High Thinness/Low Muscularity profile, with high means of thinness concerns (M = 4.64, SD = 1.23) and thinness internalization (M = 4.18, SD = 0.80), but low means of muscularity dissatisfaction (M = 1.90, SD = 0.94) and muscularity internalization (M = 1.82, SD = 1.28). Profile 4 accounted for 8% of the sample (n = 39) and was characterized as the Low Thinness/High Muscularity profile, with low-to-moderate thinness concerns (M = 2.37, SD = 1.54), low thinness internalization (M = 1.84, SD = 0.89), but high muscularity dissatisfaction (M = 5.18, SD = 0.82) and internalization (M = 4.22, SD = 0.71). Finally, Profile 5 accounted for 25% of the sample (n = 121) and was best

characterized as the High Thinness/High Muscularity profile, with high levels in thinness concerns (M = 4.16, SD = 1.51) and internalization (M = 4.04, SD = 0.89) as well as muscularity dissatisfaction (M = 4.60, SD = 1.32) and internalization (M = 4.10, SD = 0.96). Figure 3.1 illustrates the standardized means and standard error (SE) of profile indicators for each latent profile in men.

Latent Profiles for Sexual Minority Women

Results indicated that a 4-profile solution demonstrated both statistical and theoretical fit for women. Profile 1 accounted for approximately 24% of the sample (n =115) and was best characterized as the High Thinness/Low Muscularity profile, with high means of thinness concerns (M = 4.52, SD = 1.90) and internalization (M = 3.80, SD = 1.18), and low means of muscularity dissatisfaction (M = 1.67, SD = 1.45) and internalization (M = 1.62, SD = 1.02). Profile 2 accounted for approximately 22% of the sample (n = 108) and was best characterized as the Low Thinness/Low Muscularity profile, with the lowest means of muscularity dissatisfaction (M = 1.55, SD = 0.95) and internalization (M = 1.69, SD = 1.10), thinness concerns (M = 1.43, SD = 2.12), and low-to-moderate thinness internalization (M = 2.31, SD = 1.51). Profile 3 accounted for approximately 12% of the sample (n = 56) and was characterized as the High Thinness/High Muscularity profile, with high levels in thinness concerns (M = 4.39, SD = 3.26) and internalization (M = 4.04, SD = 2.10) as well as muscularity dissatisfaction (M = 4.81, SD = 1.18) and internalization (M = 4.14, SD = 0.77). Profile 4 accounted for 42% of the sample (n = 204) and was characterized as the Moderate Thinness/Moderate Muscularity profile, with a mean of 3.00 (SD = 2.81) for thinness concerns, 3.27 (SD = 1.39) for thinness internalization, 3.12 (SD = 1.80) for muscularity dissatisfaction, and 3.02 (SD = 1.47) for muscularity internalization.

Figure 3.2 illustrates the standardized means and SE of profile indicators for each latent profile in women.

Covariates Influence on Latent Profile Membership

Given the substantial amount of missing data for BMI variables in samples of both men (liberally modified BMI: $n = 119$; conservatively modified BMI: $n = 167$) and women (liberally modified BMI: $n = 80$; conservatively modified BMI: $n = 117$), the manual BCH method with multiple imputations (Asparouhov & Muthén, 2021) was used to explore covariate influence on class membership. Thus, sensitivity analyses were conducted using the imputed liberally modified BMI and the imputed conservatively modified BMI. Because the results were almost identical, Tables 4.4 and 4.5 demonstrate pairwise comparisons of latent profiles on the liberally modified BMI, race/ethnicity, and age, for men and women, respectively. Results indicated that in men, after alpha correction, a one unit increase in BMI was associated with lower odds of having moderate thinness and moderate muscularity concerns (Profile 2) than high thinness and high muscularity concerns (Profile 5), $OR = 0.91$, 95% CI[0.87, 0.96], $p < .001$. In women, higher BMI was associated with higher odds of being classified as having high thinness and low muscularity concerns versus co-occurring low ($OR = 1.09$, 95% CI[1.04, 1.15], $p < .001$) or moderate ($OR = 1.06$, 95% CI[1.03, 1.10], $p < .001$) thinness and muscularity concerns. After alpha correction, no other covariates were significantly associated with class membership in both men and women.

Associations Between Latent Profiles and Behavioral Health Outcomes

No differences emerged between adjusted models which used the imputed conservatively modified versus the imputed liberally modified BMI. Thus, adjusted models using the liberally modified BMI imputed data were compared to unadjusted models. For both samples of men and

women, adjusted model outcomes were nearly identical to unadjusted models. Thus, results of unadjusted models are subsequently reported. Figures 3.3 and 3.4 illustrate the estimated means (and *SE*) or proportions of distal outcomes and differences across latent profiles in men and women, respectively.

Illicit APED Misuse

Panel A of Figure 3.3 and Figure 3.4 illustrates the estimated proportions of individuals endorsing and denying past year illicit APED misuse per latent profile.

Sample 1: Men. The omnibus test demonstrated statistically significant associations between latent profiles and endorsement of illicit APED misuse in the past year in men, $\chi^2(4) = 18.82$, $p < .001$. The High Thinness/High Muscularity profile (Profile 5) had significantly higher probability of endorsing past year illicit APED misuse (44%) than the Low Thinness/Low Muscularity profile (Profile 1: 15%; $z = 3.33$, $p = .001$), and the High Thinness/Low Muscularity profile (Profile 3: 9%; $z = 2.66$, $p = .01$). However, no statistically significant differences emerged between the High Thinness/High Muscularity profile and either the Moderate Thinness/Moderate Muscularity profile (Profile 2: 42%; $z = 0.23$, $p = .82$) or the Low Thinness/High Muscularity profile (Profile 4: 30%; $z = 1.35$, $p = .18$).

Additionally, the Moderate Thinness/Moderate Muscularity profile had a significantly higher probability of endorsing past year illicit APED misuse than both the Low Thinness/Low Muscularity Profile ($z = 3.25$, $p = .001$) and the High Thinness/Low Muscularity profile ($z = -2.61$, $p = .01$). However, no statistically significant differences emerged between the Moderate Thinness/Moderate Muscularity profile and the Low Thinness/High Muscularity profile ($z = -1.28$, $p = .20$). Further, no statistically significant differences emerged between the Low Thinness/High Muscularity profile and either the Low Thinness/Low Muscularity profile ($z =$

1.54, $p = .12$) or the High Thinness/Low Muscularity profile ($z = 1.74$, $p = .08$). Finally, no statistically significant differences emerged between the Low Thinness/Low Muscularity and High Thinness/Low Muscularity profiles ($z = -0.71$, $p = .48$).

Sample 2: Women. The omnibus test demonstrated statistically significant associations between latent profiles and endorsement of illicit APED misuse in the past year in women, $\chi^2(3) = 33.90$, $p < .001$. The High Thinness/High Muscularity profile (Profile 3) had a significantly higher probability of endorsing past year illicit APED misuse (48%) than both the High Thinness/Low Muscularity profile (Profile 1: 14%; $z = 4.01$, $p < .001$), and the Low Thinness/Low Muscularity profile (Profile 2: 9%; $z = 4.37$, $p < .001$). Additionally, the Moderate Thinness/Moderate Muscularity profile (Profile 4) also had a significantly higher probability of endorsing past year illicit APED misuse (35%) than both the High Thinness/Low Muscularity profile ($z = 3.32$, $p = .001$) and the Low Thinness/Low Muscularity Profile ($z = 3.75$, $p < .001$). However, no statistically significant differences emerged between the High Thinness/High Muscularity profile and Moderate Thinness/Moderate Muscularity profile ($z = -1.43$, $p = .15$) or between the High Thinness/Low Muscularity profile and the Low Thinness/Low Muscularity profile ($z = -0.95$, $p = .34$).

Muscle-Building Behavior

Panel B of Figure 3.3 and Figure 3.4 illustrates the estimated means and *SE* of muscle-building behavior per latent profile. To guide interpretations of unstandardized distal outcome means, muscle-building behavior, as measured by the DMS, can range from 1 to 6.

Sample 1: Men. The omnibus test demonstrated statistically significant associations between latent profiles and muscle-building behavior, $\chi^2(4) = 315.60$, $p < .001$. The High Thinness/High Muscularity profile (Profile 5) had significantly greater muscle-building behavior

(M = 3.31, SD = 1.53) than the Low Thinness/Low Muscularity profile (Profile 1: M = 1.53, SD = 0.58; $\chi^2[1] = 127.99$, $p < .001$, $g = 1.37$), the Moderate Thinness/Moderate Muscularity profile (Profile 2: M = 2.50, SD = 1.11; $\chi^2[1] = 24.36$, $p < .001$, $g = 0.64$), and the High Thinness/Low Muscularity profile (Profile 3: M = 1.21, SD = 0.45; $\chi^2[1] = 165.39$, $p < .001$, $g = 1.51$). However, they did not significantly differ from the Low Thinness/High Muscularity profile (Profile 4: M = 3.05, SD = 1.19; $\chi^2[1] = 1.21$, $p = .27$, $g = 0.18$).

The Low Thinness/High Muscularity profile also had significantly greater muscle-building behavior than the Low Thinness/Low Muscularity profile ($\chi^2[1] = 54.39$, $p < .001$, $g = 1.73$), Moderate Thinness/Moderate Muscularity profile $\chi^2[1] = 6.72$, $p = .01$, $g = 0.48$), and the High Thinness/Low Muscularity profile ($\chi^2[1] = 78.07$, $p < .001$, $g = 1.93$). Moreover, the Moderate Thinness/Moderate Muscularity profile had significantly greater muscle-building behavior than the Low Thinness/Low Muscularity profile ($\chi^2[1] = 81.00$, $p < .001$, $g = 0.95$) and the High Thinness/Low Muscularity profile ($\chi^2[1] = 131.74$, $p < .001$, $g = 1.22$). Finally, the Low Thinness/Low Muscularity profile had significantly greater muscle-building behavior than the High Thinness/Low Muscularity profile ($\chi^2[1] = 7.53$, $p = .01$, $g = 0.58$).

Sample 2: Women. The omnibus test demonstrated statistically significant associations between latent profiles and muscle-building behavior, $\chi^2(3) = 196.57$, $p < .001$. The High Thinness/High Muscularity profile (Profile 3) had significantly greater muscle-building behavior (M = 3.49, SD = 1.56) than any other profile, including the Moderate Thinness/Moderate Muscularity profile (Profile 4: M = 2.32, SD = 1.14; $\chi^2[1] = 25.36$, $p < .001$, $g = 0.94$), the Low Thinness/Low Muscularity profile (Profile 2: M = 1.35, SD = 0.58; $\chi^2[1] = 98.37$, $p < .001$, $g = 2.09$), and the High Thinness/Low Muscularity profile (Profile 1: M = 1.47, SD = 0.73; $\chi^2[1] = 84.82$, $p < .001$, $g = 1.93$). The Moderate Thinness/Moderate Muscularity profile (Profile 4) also

had significantly greater muscle-building behavior than the Low Thinness/Low Muscularity ($\chi^2[1] = 93.27$, $p < .001$, $g = 0.99$) and High Thinness/Low Muscularity profiles ($\chi^2[1] = 60.40$, $p < .001$, $g = 0.84$). However, no statistically significant differences emerged between the High Thinness/Low Muscularity profile and the Low Thinness/Low Muscularity profile ($\chi^2[1] = 1.70$, $p = .19$, $g = 0.18$).

Eating Disorder Symptoms

Panels C, D, and E of Figure 3.3 and Figure 3.4 illustrate the estimated means and *SE* of dietary restraint, preoccupation and restriction, and eating shame per latent profile, respectively. To guide interpretations of unstandardized distal outcome means, ED symptoms, as measured by subscales of the EDE-Q, can range from 0 to 6.

Dietary Restraint.

Sample 1: Men. The omnibus test demonstrated statistically significant associations between latent profiles and dietary restraint ($\chi^2[4] = 105.43$, $p < .001$). The High Thinness/High Muscularity profile (Profile 5: $M = 3.20$, $SD = 1.96$) had significantly higher dietary restraint than the Moderate Thinness/Moderate Muscularity profile (Profile 2: $M = 1.37$, $SD = 1.65$; $\chi^2[1] = 70.45$, $p < .001$, $g = 1.04$), the Low Thinness/Low Muscularity profile (Profile 1: $M = 0.95$, $SD = 1.46$; $\chi^2[1] = 73.44$, $p < .001$, $g = 1.24$), and the Low Thinness/High Muscularity profile (Profile 4: $M = 1.76$, $SD = 1.64$; $\chi^2[1] = 19.46$, $p < .001$, $g = 0.76$). Additionally, the High Thinness/Low Muscularity profile had higher dietary restraint (Profile 3: $M = 3.18$, $SD = 1.97$) than the Moderate Thinness/Moderate Muscularity profile ($\chi^2[1] = 21.79$, $p < .001$, $g = 1.08$), the Low Thinness/Low Muscularity profile ($\chi^2[1] = 28.47$, $p < .001$, $g = 1.36$), and Low Thinness/High Muscularity profile ($\chi^2[1] = 10.02$, $p = .002$, $g = 0.80$). Finally, the Low Thinness/High Muscularity profile had significantly higher dietary restraint than the Low

Thinness/Low Muscularity profile ($\chi^2[1] = 6.29$, $p = .01$, $g = 0.53$). However, the High Thinness/Low muscularity profile did not significantly differ from the High Thinness/High Muscularity profile in dietary restraint ($\chi^2[1] = 0.002$, $p = .96$, $g = 0.01$). The Moderate Thinness/Moderate Muscularity profile also did not significantly differ from the Low Thinness/High Muscularity profile ($\chi^2[1] = 1.82$, $p = .18$, $g = 0.24$) or the Low Thinness/Low Muscularity profile $\chi^2[1] = 3.48$, $p = .06$, $g = 0.26$).

***Sample 2: Women*.** The omnibus test demonstrated statistically significant associations between latent profiles and dietary restraint ($\chi^2[3] = 87.42$, $p < .001$). Specifically, the High Thinness/High Muscularity profile had higher dietary restraint (Profile 3: $M = 3.17$, $SD = 2.24$) than both the Moderate Thinness/Moderate Muscularity profile (Profile 4: $M = 2.17$, $SD = 1.86$; $\chi^2[1] = 8.78$, $p = .003$, $g = 0.52$) and the Low Thinness/Low Muscularity profile (Profile 2: $M = 0.80$, $SD = 1.70$; $\chi^2[1] = 48.31$, $p < .001$, $g = 1.25$). Additionally, the High Thinness/Low Muscularity profile had higher dietary restraint (Profile 1: $M = 2.99$, $SD = 2.12$) than both the Moderate Thinness/Moderate Muscularity profile ($\chi^2[1] = 11.16$, $p = .001$, $g = 0.42$) and the Low Thinness/Low Muscularity profile ($\chi^2[1] = 63.83$, $p < .001$, $g = 1.14$). The Moderate Thinness/Moderate Muscularity profile also had higher dietary restraint than the Low Thinness/Low Muscularity profile ($\chi^2[1] = 40.00$, $p < .001$, $g = 0.76$). However, the High Thinness/High Muscularity profile did not significantly differ from the High Thinness/Low Muscularity profile in dietary restraint ($\chi^2[1] = 0.26$, $p = .61$, $g = 0.08$).

Preoccupation and Restriction.

Sample 1: Men. The omnibus test demonstrated statistically significant associations between latent profiles and preoccupation and restriction ($\chi^2[4] = 123.20$, $p < .001$). Specifically, the High Thinness/High Muscularity profile had higher preoccupation and restriction (Profile 5:

$M = 2.62$, $SD = 1.83$) than the Moderate Thinness/Moderate Muscularity profile (Profile 2: $M = 1.32$, $SD = 1.59$; $\chi^2[1] = 70.45$, $p < .001$, $g = 1.04$), the Low Thinness/Low Muscularity profile (Profile 1: $M = 0.51$, $SD = 0.95$; $\chi^2[1] = 103.86$, $p < .001$, $g = 1.32$), and the Low Thinness/High Muscularity profile (Profile 4: $M = 1.22$, $SD = 1.63$; $\chi^2[1] = 19.47$, $p < .001$, $g = 0.79$). Additionally, the High Thinness/Low Muscularity profile had higher preoccupation and restriction (Profile 3: $M = 2.78$, $SD = 1.69$) than the Moderate Thinness/Moderate Muscularity ($\chi^2[1] = 18.77$, $p < .001$, $g = 0.91$), the Low Thinness/Low Muscularity ($\chi^2[1] = 44.01$, $p < .001$, $g = 1.83$), and Low Thinness/High Muscularity ($\chi^2[1] = 14.70$, $p < .001$, $g = 0.94$) profiles. However, the High Thinness/Low muscularity profile did not significantly differ from the High Thinness/High Muscularity profile in preoccupation and restriction ($\chi^2[1] = 0.20$, $p = .66$, $g = 0.09$).

Further, the Moderate Thinness/Moderate Muscularity profile had significantly higher preoccupation and restriction than the Low Thinness/Low Muscularity profile ($\chi^2[1] = 23.73$, $p < .001$, $g = 0.55$). The Low Thinness/High Muscularity profile also had significantly higher preoccupation and restriction than the Low Thinness/Low Muscularity profile ($\chi^2[1] = 6.10$, $p = .01$, $g = 0.56$). However, the Moderate Thinness/Moderate Muscularity profile did not significantly differ from the Low Thinness/High Muscularity profile ($\chi^2[1] = 0.12$, $p = .72$, $g = 0.06$).

***Sample 2: Women*.** The omnibus test demonstrated statistically significant associations between latent profiles and preoccupation and restriction ($\chi^2[3] = 160.23$, $p < .001$). Specifically, the High Thinness/High Muscularity profile had higher preoccupation and restriction (Profile 3: $M = 2.75$, $SD = 1.98$) than both the Moderate Thinness/Moderate Muscularity profile (Profile 4: $M = 1.67$, $SD = 1.67$) and the Low Thinness/Low Muscularity profile (Profile 2: $M = 0.30$, $SD =$

1.15; $\chi^2[1] = 72.60$, $p < .001$, $g = 1.64$). The High Thinness/Low Muscularity profile also had higher preoccupation and restriction (Profile 1: $M = 2.57$, $SE = 1.89$) than both the Moderate Thinness/Moderate Muscularity profile ($\chi^2[1] = 16.53$, $p < .001$, $g = 0.51$) and the Low Thinness/Low Muscularity profile ($\chi^2[1] = 105.09$, $p < .001$, $g = 1.44$). Additionally, the Moderate Thinness/Moderate Muscularity profile had higher preoccupation and restriction than the Low Thinness/Low Muscularity profile ($\chi^2[1] = 68.54$, $p < .001$, $g = 0.91$). However, the High Thinness/High Muscularity profile did not significantly differ from the High Thinness/Low Muscularity profile in preoccupation and restriction ($\chi^2[1] = 0.31$, $p = .58$, $g = 0.09$).

Eating Shame.

Sample 1: Men. The omnibus test demonstrated statistically significant associations between latent profiles and eating shame ($\chi^2[4] = 142.03$, $p < .001$). Specifically, the High Thinness/High Muscularity profile had higher eating shame (Profile 5: $M = 2.24$, $SD = 1.64$) than the Moderate Thinness/Moderate Muscularity profile (Profile 2: $M = 0.95$, $SD = 1.30$; $\chi^2[1] = 51.32$, $p < .001$, $g = 0.91$), the Low Thinness/Low Muscularity profile (Profile 1: $M = 0.35$, $SD = 0.63$; $\chi^2[1] = 123.51$, $p < .001$, $g = 1.35$), and the Low Thinness/High Muscularity profile (Profile 4: $M = 0.73$, $SD = 1.14$; $\chi^2[1] = 38.53$, $p < .001$, $g = 0.98$). Additionally, the High Thinness/Low Muscularity profile had higher eating shame (Profile 3: $M = 2.11$, $SD = 1.60$) than the Moderate Thinness/Moderate Muscularity ($\chi^2[1] = 13.45$, $p < .001$, $g = 0.87$), the Low Thinness/Low Muscularity ($\chi^2[1] = 31.48$, $p < .001$, $g = 1.67$), and Low Thinness/High Muscularity ($\chi^2[1] = 15.62$, $p < .001$, $g = 1.02$) profiles. However, the High Thinness/Low Muscularity profile did not significantly differ from the High Thinness/High Muscularity profile in eating shame ($\chi^2[1] = 0.14$, $p = .70$, $g = 0.08$).

Further, the Moderate Thinness/Moderate Muscularity profile also had significantly higher eating shame than the Low Thinness/Low Muscularity profile ($\chi^2[1] = 24.54$, $p < .001$, $g = 0.51$). No statistically significant differences emerged between the Moderate Thinness/Moderate Muscularity profile and the Low Thinness/High Muscularity profile ($\chi^2[1] = 1.14$, $p = .29$, $g = 0.17$) or between the Low Thinness/High Muscularity profile and the Low Thinness/Low Muscularity profile ($\chi^2[1] = 3.70$, $p = .06$, $g = 0.44$).

***Sample 2: Women*.** The omnibus test demonstrated statistically significant associations between latent profiles and eating shame ($\chi^2[3] = 125.12$, $p < .001$). Specifically, the High Thinness/High Muscularity profile had higher eating shame (Profile 3: $M = 2.19$, $SD = 1.75$) than both the Moderate Thinness/Moderate Muscularity profile (Profile 4: $M = 1.28$, $SD = 1.41$; $\chi^2[1] = 11.83$, $p = .001$, $g = 0.61$) and the Low Thinness/Low Muscularity profile (Profile 2: $M = 0.28$, $SD = 0.95$; $\chi^2[1] = 58.25$, $p < .001$, $g = 1.50$). Additionally, the High Thinness/Low Muscularity profile had higher eating shame (Profile 1: $M = 1.93$, $SD = 1.61$) than both the Moderate Thinness/Moderate Muscularity profile ($\chi^2[1] = 12.01$, $p < .001$, $g = 0.44$) and the Low Thinness/Low Muscularity profile ($\chi^2[1] = 77.98$, $p < .001$, $g = 1.24$). Additionally, the Moderate Thinness/Moderate Muscularity profile had higher eating shame than the Low Thinness/Low Muscularity profile ($\chi^2[1] = 52.57$, $p < .001$, $g = 0.79$). However, the High Thinness/High Muscularity profile did not significantly differ from the High Thinness/Low Muscularity profile in eating shame ($\chi^2[1] = 0.88$, $p = .35$, $g = 0.16$).

BDD Symptoms

Panel F of Figure 3.3 and Figure 3.4 illustrates the estimated means and *SE* of BDD symptoms per latent profile. To guide interpretations of unstandardized distal outcome means,

BDD symptoms, as measured by the DCQ sum score, can range from 0 to 21—with higher scores indicating higher pathology.

Sample 1: Men. The omnibus test demonstrated statistically significant associations between latent profiles and BDD symptoms, $\chi^2(4) = 139.04$, $p < .001$. The High Thinness/High Muscularity profile had significantly higher BDD symptoms (Profile 5: $M = 12.01$, $SD = 5.62$) than the Low Thinness/High Muscularity profile (Profile 4: $M = 9.34$, $SD = 5.66$; $\chi^2[1] = 6.19$, $p = .01$, $g = 0.47$), the Moderate Thinness/Moderate Muscularity profile (Profile 2: $M = 7.03$, $SD = 5.19$; $\chi^2[1] = 60.20$, $p < .001$, $g = 0.93$), and the Low Thinness/Low Muscularity Profile (Profile 1: $M = 4.13$, $SD = 4.51$; $\chi^2[1] = 100.91$, $p < .001$, $g = 1.49$). However, the High Thinness/High Muscularity and High Thinness/Low Muscularity profiles (Profile 3: $M = 13.47$, $SD = 5.41$) did not significantly differ from each other ($\chi^2[1] = 1.67$, $p = .20$, $g = 0.26$).

The High Thinness/Low Muscularity profile also had significantly higher BDD symptoms than the Low Thinness/High Muscularity profile ($\chi^2[1] = 9.35$, $p = .002$, $g = 0.74$), the Moderate Thinness/Moderate Muscularity profile ($\chi^2[1] = 35.62$, $p < .001$, $g = 1.24$), the Low Thinness/Low Muscularity Profile ($\chi^2[1] = 62.44$, $p < .001$, $g = 1.94$). Moreover, the Low Thinness/High Muscularity profile had significantly higher BDD symptoms than both the Moderate Thinness/Moderate Muscularity profile ($\chi^2[1] = 5.45$, $p = .02$, $g = 0.44$) and the Low Thinness/Low Muscularity profile ($\chi^2[1] = 23.12$, $p < .001$, $g = 1.04$). Finally, the Moderate Thinness/Moderate Muscularity profile had significantly higher BDD symptoms than the Low Thinness/Low Muscularity profile ($\chi^2[1] = 16.99$, $p < .001$, $g = 0.57$).

Sample 2: Women. The omnibus test demonstrated statistically significant associations between latent profiles and BDD symptoms, $\chi^2(3) = 186.42$, $p < .001$. The High Thinness/High Muscularity profile had significantly higher BDD symptoms (Profile 3: $M = 12.75$, $SD = 6.28$)

than both the Moderate Thinness/Moderate Muscularity profile (Profile 4: $M = 8.95$, $SD = 5.63$; $\chi^2[1] = 15.56$, $p < .001$, $g = 0.66$) and the Low Thinness/Low Muscularity Profile (Profile 2: $M = 3.42$, $SD = 4.71$; $\chi^2[1] = 96.11$, $p < .001$, $g = 1.76$). However, the High Thinness/High Muscularity and High Thinness/Low Muscularity (Profile 1: $M = 12.26$, $SD = 5.86$) profiles did not significantly differ from each other ($\chi^2[1] = 0.24$, $p = .62$, $g = 0.08$).

The High Thinness/Low Muscularity profile also had significantly higher BDD symptoms than the Moderate Thinness/Moderate Muscularity profile ($\chi^2[1] = 22.46$, $p < .001$, $g = 0.58$) and the Low Thinness/Low Muscularity profile ($\chi^2[1] = 140.38$, $p < .001$, $g = 1.66$). Finally, the Moderate Thinness/Moderate Muscularity profile had significantly higher BDD symptoms than the Low Thinness/Low Muscularity profile ($\chi^2[1] = 80.50$, $p < .001$, $g = 1.04$).

Summary

Overall, the samples of both men and women had the following four profiles: (1) Low Thinness/Low Muscularity; (2) High Thinness/High Muscularity; (3) Moderate Thinness/Moderate Muscularity; and (4) High Thinness/Low Muscularity Concerns. Additionally, men demonstrated a Low Thinness/High Muscularity Concerns profile. Statistically significant differences emerged between profiles on all outcomes of unadjusted models, after a Benjamini-Hochberg alpha correction for multiple comparisons. Among men and women, the High Thinness/High Muscularity profile had significantly higher probability of illicit APED misuse and greater muscle-building behavior (e.g., excessive exercise, supplement use) than all profiles characterized by low muscularity concerns. In men, no significant differences in either of these outcomes emerged between the High Thinness/High Muscularity and the Low Thinness/High Muscularity profiles. Additionally, in both men and women, no significant differences in probability of illicit APED misuse emerged between the High Thinness/High

Muscularity and Moderate Thinness/Moderate Muscularity profiles. However, in both men and women, the High Thinness/High Muscularity profile had significantly greater muscle-building behavior than the Moderate Thinness/Moderate Muscularity profile.

Moreover, across all models of ED and BDD symptoms in both men and women, the High Thinness/High Muscularity profiles had significantly higher ED symptoms than all profiles except the High Thinness/Low Muscularity profile. In men, the Low Thinness/High Muscularity profile also had significantly higher dietary restraint, preoccupation and restriction, and BDD symptoms than the Low Thinness/Low Muscularity profile. Additionally, in both men and women, the Moderate Thinness/Moderate Muscularity profile had significantly greater muscle-building behavior, probability of illicit APED misuse, ED symptoms, and BDD symptoms than the Low Thinness/Low Muscularity profile.

Discussion

The present study explored the heterogeneity in body image concerns and the subsequent associations between varying body image patterns and ED symptoms, muscle-building behaviors, and BDD symptoms. Results indicated four distinct body image patterns in women and five distinct patterns in men, all of which were characterized by either co-occurring thinness and muscularity concerns or predominant thinness or muscularity concerns. Moreover, significant differences emerged between varying body image patterns and severity of disordered eating, muscle-building behaviors, and BDD symptoms. Sexual minority men and women with co-occurring high thinness and muscularity concerns had the highest overall risk profile—with high engagement in muscle-building behavior (e.g., excessive exercise, supplement use), illicit APED misuse, ED symptoms, and BDD symptoms compared with other profiles. However, differences did not emerge between these individuals and predominantly thinness-concerned

body image profiles for ED and BDD outcomes. Additionally, no differences emerged between individuals with co-occurring high thinness and muscularity concerns and predominantly muscularity-concerned profiles for muscle-building behaviors including illicit APED misuse. Overall, this study provides a novel characterization of body image patterns and subsequent body change behaviors.

Body image patterns in men and women could not be directly compared because of the measurement differences of indicators, although similar general patterns emerged. In both sexual minority men and women, levels of thinness or muscularity concerns consistently clustered with similar levels of thinness or muscularity internalization. For example, if individuals had high levels of thinness or muscularity concerns, they also had high levels of thinness or muscularity internalization, respectively. These findings are consistent with positive associations found between internalization of appearance ideals and body dissatisfaction (e.g., Hazzard et al., 2019; Tylka, 2011; Tylka & Andorka, 2012). Moreover, both samples of men and women had profiles characterized by (a) low thinness, low muscularity; (b) high thinness, high muscularity; (c) moderate thinness, moderate muscularity; and (d) high thinness, low muscularity. However, the sample of sexual minority men also included individuals who uniquely had low thinness combined with high muscularity concerns, which may characterize men who prioritize size over low body fat. Although this may be unique to the study samples, these findings also align with existing accounts of muscularity concerns in women, which focus on definition and muscle tone rather than bulk and size (Grogan et al., 2004; Homan et al., 2012). Additionally, latent profile analyses in the present study are consistent with prior findings of co-occurring thinness and muscularity concerns (Calzo et al., 2015; 2016; Hoffmann & Warschburger, 2018) and with prior findings of a muscularity concern-only class in men (Calzo et al., 2015; 2016). Further, the

results of this latent profile analysis corroborate existing evidence of both thinness and muscularity concerns in sexual minority men (e.g., Tylka & Andorka, 2012) and women (e.g., Hazzard et al., 2019). However, inconsistent with prior mixture modeling studies (e.g., Hoffmann & Warschburger, 2018), the present study demonstrated the presence of both co-occurring high thinness and muscularity concerns as well as predominantly muscularity-concerned and predominantly thinness-concerned individuals. Calzo et al. (2015) also identified a latent class of sexual minority men with high thinness concerns and moderate muscularity concerns as well as a predominantly muscularity-concerned latent class, although it is difficult to compare severity of body image concern symptoms of this group to the profiles found in the present study because of the different measures used. Thus, the present study suggests considerable heterogeneity in body image patterns among both sexual minority men and women.

The most striking finding was that sexual minority men and women with co-occurring high thinness and muscularity concerns had high concurrent engagement in muscle-building behavior, illicit APED misuse, ED and BDD symptoms compared with other profiles. This finding is consistent with prior mixture modeling investigations in which body image patterns characterized by high thinness and muscularity concerns demonstrated the most severe body image disorder symptoms (e.g., Hildebrandt et al., 2006; 2010; Hoffman & Warschburger, 2018). Sexual minority men and women with co-occurring high thinness and muscularity concerns may represent individuals with a drive for leanness (i.e., desire for lean muscle mass; Smolak & Murnen, 2008) and mesomorphic ideal internalization (i.e., lean and muscular ideal; Pope et al., 1997), which have been positively correlated with both disordered eating and muscle-building behavior (Hartmann et al., 2018; Tylka, 2011) and evidenced in muscle dysmorphic disorder—a subtype of BDD (Cafri et al., 2006; Pope et al., 1997). However, prior

findings of positive associations between drive for leanness and body image disorder symptoms have been mixed (e.g., lack of association between drive for leanness and BDD symptoms; Hartmann et al., 2018), with some researchers suggesting drive for leanness may be less maladaptive than drive for thinness or muscularity (e.g., Lang & Rancourt, 2020). In contrast, the present study findings suggest that co-occurring thinness and muscularity concerns may be the most maladaptive profile of body image patterns.

Sexual minority men and women with co-occurring high thinness and muscularity concerns may engage in disordered eating and muscle-building behaviors to reduce body fat and enhance muscle definition, as many of the evaluated muscle-building behaviors (e.g., excessive exercise) and illicit APEDs have dual functions or properties (Pope et al., 2014). For example, adolescent boys who perceived themselves as overweight demonstrated an increased risk of AAS use, demonstrating that individuals with thinness concerns may also engage in illicit APED misuse (Jampel et al., 2016). Additionally, individuals with co-occurring high thinness and muscularity concerns may also demonstrate ED and BDD symptoms to simultaneously alleviate both of these concerns. For example, "bulk-and-cut" dietary practices, which align with goals to attain the lean muscle body ideal, involve bulking phases, characterized by increased protein consumption, and cutting phases, characterized by dietary restriction (e.g., Griffiths et al., 2013). Additionally, as previously discussed, this profile may capture individuals with muscle dysmorphic disorder symptoms, which involves elevated preoccupation and functional impairment associated with the pursuit of the lean and muscular ideal (Hildebrandt et al., 2004). An alternative interpretation is that sexual minority individuals who present with high levels of concern in multiple body areas may demonstrate dysmorphic concerns to a greater extent than individuals with high levels of concern in less body parts; for example, patients with comorbid

ED and BDD who reported dissatisfaction with a larger number of body parts than those with only ED also had higher levels of dysmorphic concerns (Dingemans et al., 2012). However, further research is needed to distinguish associations between patterns of thinness- versus muscularity-oriented as well as non-weight-related body image concerns and severity of BDD symptoms.

An important additional finding was that significant differences did not emerge between sexual minority individuals with co-occurring high thinness and muscularity concerns and predominantly thinness-concerned or muscularity-concerned individuals on varying outcomes. Therefore, predominantly thinness-concerned individuals had comparable levels of ED and BDD symptoms to those with co-occurring high thinness and muscularity concerns, and predominantly muscularity-concerned individuals had comparable levels of muscle-building behavior including illicit APED misuse. These findings are consistent with the dual body image pathways posited in the tripartite influence model, such that muscularity dissatisfaction was linked to greater muscle-building behavior (Tylka & Andorka, 2012), and body fat dissatisfaction was independently associated with greater disordered eating behaviors (Hazzard et al., 2019; Huxley et al., 2015; Tylka & Andorka, 2012). Partially consistent with present study findings, sexual minority men with predominant muscularity concerns have also previously demonstrated higher illicit APED misuse than those with high thinness concerns, although these individuals had concurrent moderate muscularity concerns (Calzo et al., 2015). Moreover, the positive association between thinness concerns and BDD symptoms has also been previously supported (e.g., Hrabosky et al., 2009; Lambrou et al., 2012). The present study, therefore, suggests that high levels of thinness concerns may be most strongly associated with ED and BDD symptoms and high levels of

muscularity concerns may be most strongly associated with engagement in muscle-building behaviors, including illicit APED misuse, in sexual minority individuals.

Although the prominent role of thinness concerns in ED symptoms is well established and replicated (e.g., Fairburn, 2008; Tylka, 2011; Tylka & Andorka, 2012; Hazzard et al., 2019; Huxley et al., 2015), the link between thinness concerns and BDD has not been as frequently investigated. The present study indicated that thinness concerns may be more greatly associated with BDD symptoms than muscularity concerns. Thinness concerns are the primary focus in traditional thinness-oriented EDs (Fairburn, 2008), whereas common concerns in BDD include face, skin, and hair (Veale et al., 1996). Nonetheless, thinness-oriented EDs have a well-documented, high comorbidity with BDD (e.g., Dingemans et al., 2012; Kollei et al., 2013), with comparable thinness-oriented shape and weight concerns found in individuals with BDD and EDs (Hrabosky et al., 2009; Ruffolo et al., 2006). Thus, the results of this study may be capturing this comorbidity and, additionally, may indicate a weaker relationship between muscularity concerns versus thinness concerns and BDD. Alternatively, the measurement of body image concerns may play a role in these study findings. For example, the chosen self-report measure of thinness concerns was the EDE-Q Shape and Weight concern subscale using Friborg et al.'s (2013) model, which includes items not specific to solely thinness concerns, such as discomfort with seeing one's body or other people seeing their body—attitudes which may overlap with BDD symptoms. Thus, the results may be an indication of measurement error because of the conceptual overlap between items of thinness concerns and BDD symptoms. Given the paucity of literature on thinness and muscularity concerns and their associations with BDD, the strong link between thinness concerns and BDD symptoms, found in the present sample of sexual minority men and women, must be further investigated.

However, in the sample of sexual minority men, individuals with low thinness and high muscularity concerns had a mean level of BDD symptoms reflective of clinically significant levels (Mancuso et al., 2010), albeit significantly lower than individuals with high thinness concerns. Consistent with these findings, individuals with BDD have demonstrated higher muscularity dissatisfaction than healthy controls (Hrabosky et al., 2009). This finding may also be capturing the symptom overlap between BDD and the muscle dysmorphia subtype of BDD (e.g., appearance intolerance; Hildebrandt et al., 2004). However, prior research has found that college men of unknown sexual orientation with high muscularity internalization, but low thinness internalization may experience more severe muscle dysmorphic disorder symptoms than those with high thinness internalization (Klimek et al., 2018). Thus, associations between body image patterns and muscle dysmorphic disorder symptoms may be different from present study findings which evaluated broad BDD symptoms.

Another interesting finding was that although profiles with high thinness concerns demonstrated the highest levels of ED symptoms, sexual minority men with low thinness and high muscularity concerns also had significantly higher dietary restraint as well as preoccupation and restriction compared with those with low thinness but low muscularity concerns. Thus, high muscularity concerns may be independently associated with ED symptoms in sexual minority men. Results are consistent with prior investigations demonstrating that both thinness and muscularity internalization and concerns may be independently associated with ED symptoms (Klimek et al., 2018; Schaefer et al., 2021). These results may reflect the presence of muscularity-oriented disordered eating in sexual minority men with low thinness and high muscularity concerns, for example food avoidance or rigid dietary rules (Murray et al., 2016), which are measured by the EDE-Q—a primarily thinness-oriented ED measure. The absence of

latent profiles characterized as low thinness, high muscularity concerns preclude the observation of the independent association between muscularity concerns and ED symptoms in sexual minority women.

Although no differences emerged between individuals with co-occurring high thinness and muscularity concerns and other body image profiles for individual body image disorder symptoms or behaviors, combined engagement in multiple negative health outcomes may have synergistic effects on general mental health and quality of life. For example, engagement in multiple health risk behaviors compared with single health risk behaviors (e.g., truancy, substance abuse, smoking) has been associated with higher levels of suicidality and depression (e.g., Harel-Fisch et al., 2012; Katon et al., 2010; Kim et al., 2020). Moreover, patients with comorbid BDD and ED have demonstrated more severe general mental health than individuals with only an ED diagnosis (Dingemans et al., 2012). Future studies are needed to evaluate if sexual minority individuals with co-occurring high thinness and muscularity concerns demonstrate more severe mental health outcomes (e.g., suicidality, anxiety) than individuals with only high thinness or only high muscularity concerns.

Study Limitations

The present study is not without its limitations. Firstly, body image patterns and associations with behavioral health outcomes were evaluated separately in samples of sexual minority men and women because the measure of internalization of thin and muscular ideals (SATAQ-4R; Schaefer et al., 2017) has differing factor structures and items by gender. Thus, gender differences in body image patterns and behavioral health outcomes could not be statistically compared. Additionally, the present study's samples included only cisgender individuals and excluded individuals with a heterosexual identity; thus, results are limited to

cisgender sexual minority men and women. Additionally, only 20% of the sample of women identified as lesbian; experience of lesbian-identifying women may have, therefore, been underrepresented. Hazzard et al. (2019), for example, found stronger associations between thin-ideal internalization and body dissatisfaction as well as dietary restraint among bisexual women compared with lesbian women. Further, another limitation is the cross-sectional evaluation of the associations between body image profiles and behavioral outcomes. Profile membership and associations with body image-related disorders may, however, vary over time, as demonstrated in sexual minority and heterosexual adolescents (Calzo et al. 2015; 2016). For example, risky health behaviors may vary as a function of the training phase (bulking or cutting) in which individuals with muscularity concerns are currently participating (Lavender et al., 2017). Latent transition analyses may provide additional information about the variability in thinness and muscularity concerns over time and subsequent changes in related behaviors.

Another important limitation is the measurement of both indicators and outcomes. For example, thinness concerns were measured using the Shape and Weight Concerns subscale of Friborg et al.'s (2013) model of the EDE-Q, which assesses more pathological cognitions and attitudes (e.g., overvaluation of shape and weight) than the Muscularity-Oriented Body Image subscale of the DMS, which was used to evaluate muscularity dissatisfaction. Body image patterns or their associations with problematic health behaviors may have differed if measures were matched in symptom severity. Future studies may aim to re-evaluate body image patterns in sexual minority individuals and use body image indicator variables more closely matched in capturing pathological symptoms.

Further, although the present study demonstrated associations between muscularity concerns and ED symptoms, the EDE-Q—used to measure ED symptoms—does not fully

capture muscularity-oriented disordered eating behaviors (e.g., excessive protein consumption and avoidance of catabolic eating patterns; Lavender et al., 2017). Thus, varying body image patterns may be differentially associated with engagement in muscularity-oriented disordered eating. Future studies should evaluate associations between varying body image patterns and muscularity-oriented ED behaviors. Further, different illicit APEDs that were not measured in the present study (e.g., thyroid hormones, ephedra) aim to exclusively reduce body fat and are often stacked with AASs to enhance fat and water loss (Hildebrandt et al., 2006; Hildebrandt et al., 2010; Pope et al., 2014). It is possible that individuals with predominantly high thinness concerns may be at increased risk for illicit APEDS that are primarily used for their fat-burning properties. Moreover, past year illicit APED misuse was dichotomized as any use versus no use, although Hildebrandt et al. (2007) demonstrated heterogeneity in APED-using groups characterized by the duration of use, degree of polypharmacy used, and the primary purpose—muscle-building versus fat-burning. Thus, varying body image patterns may be associated with particular patterns of illicit APED use duration and polypharmacy profiles. Future researchers may wish to design a study examining heterogeneity in body image concerns and their associations with behavioral health outcomes whilst keeping these measurement decisions in mind.

Another limitation may be the nonnormal distributions of the continuous distal outcomes across classes. However, the BCH approach has yielded unbiased and robust estimates under conditions of nonnormality (Shin et al., 2019). Additionally, the latent profile analysis model fit indices for both sexual minority men and women did not favor a single solution; in such cases, theoretical and practical considerations are recommended (Masyn, 2013). Moreover, two latent profiles in the 5-profile solution among sexual minority men had a relatively small number of

individuals (n = 29 in the High Thinness, Low Muscularity profile; n = 39 in the Low Thinness, High Muscularity profile), thus, potentially limiting the generalizability of findings; however, these profiles still exceeded the recommended cutoff of <1% of the sample size or 25 cases (Lubke & Neale, 2006).

Nevertheless, the present study has several strengths that should be considered. For example, the use of continuous measures for indicators may have played a key role in capturing larger variability in body image concerns than found in previous investigations (e.g., Calzo et al., 2015). Further, the present study used validated measures of almost all continuous indicator and outcome variables, with confirmed factor structures in sexual minority men and women. Additionally, the exploration of variability in body image concerns and associated body image-related behaviors in sexual minority women is nascent.

Clinical and Research Implications

The present study findings may have important research and clinical implications. For instance, the presence of varying levels of thinness and muscularity concerns highlights the need for researchers and clinicians to evaluate both types of concerns in sexual minority men and women. Moreover, the present study findings demonstrate that theoretical models of body image disorders (e.g., tripartite influence model) may need to be modified and investigated to consider co-occurring high thinness and muscularity concerns as an additional pathway to muscle-building, disordered eating behaviors, and other body change behaviors. Additionally, ED and BDD treatment and prevention efforts may need to address both muscularity and thinness concerns in both sexual minority men and women. For example, the *Body Project* dissonance-based ED prevention program has been adapted to address thinness and muscularity concerns in men and has demonstrated preliminary efficacy in heterosexual and sexual minority men (Brown

et al., 2017; Brown & Keel, 2015). However, it is unclear if this program's efficacy differs between individuals with varying body image patterns (e.g., co-occurring thinness and muscularity concerns versus predominant thinness or muscularity concerns). In addition, although the *Body Project* targeting thinness internalization has demonstrated similar efficacy in heterosexual and sexual minority women (Shaw et al., 2020), the present study results suggest that the adapted dissonance-based program targeting both thinness and muscularity internalization may be relevant in sexual minority women. Further, cognitive behavioral therapy for BDD provides optional modules for muscularity, shape, or weight concerns (Wilhelm et al., 2014); however, little is known about treatment efficacy when including these modules. Thus, evidence-based cognitive behavioral interventions of EDs and BDD may need to be re-evaluated and adapted to assess for and address both thinness and muscularity concerns in sexual minority men and women.

Conclusion

The present study, therefore, contributes to the paucity of literature characterizing the heterogeneity in body image patterns in sexual minority individuals. This study demonstrated considerable heterogeneity in body image concerns, compared with prior mixture modeling investigations of thinness and muscularity-oriented body image patterns. Moreover, this study significantly contributes to the limited understanding of body image concerns and body image-related disorders in sexual minority women. Importantly, the results highlight that thinness and muscularity concerns can co-occur in both sexual minority men and women, but that individuals may also prioritize thinness or muscularity concerns independently. The present study also provides insight into the roles of thinness and muscularity concerns in body image disorders and related health risk behaviors, such as APED misuse, among sexual minority men and women.

Specifically, for traditionally thinness-oriented ED symptoms, body image patterns with high thinness concerns may play the largest role, and for muscle-building behaviors, body image patterns with high muscularity concerns may play the largest role–regardless of levels of the opposing concerns. However, individuals engaging in higher levels of thinness-oriented ED symptoms may still experience high levels of muscularity concerns and, thus, may engage in additional muscle-building behavior. Similarly, individuals engaging in high levels of muscle-building behavior may still be experiencing high thinness concerns and, thus, may additionally engage in ED behaviors. Therefore, individuals with co-occurring concerns may be at higher risk for engagement in multiple problematic health behaviors. However, future research is needed to support the present study's characterization of heterogeneity in body image patterns among sexual minority men and women. Variability in body image patterns should also be explored in gender minority individuals, cisgender heterosexual samples, and sexual minority subgroups of men and women.

Dissertation Author's Acknowledgements

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Figures

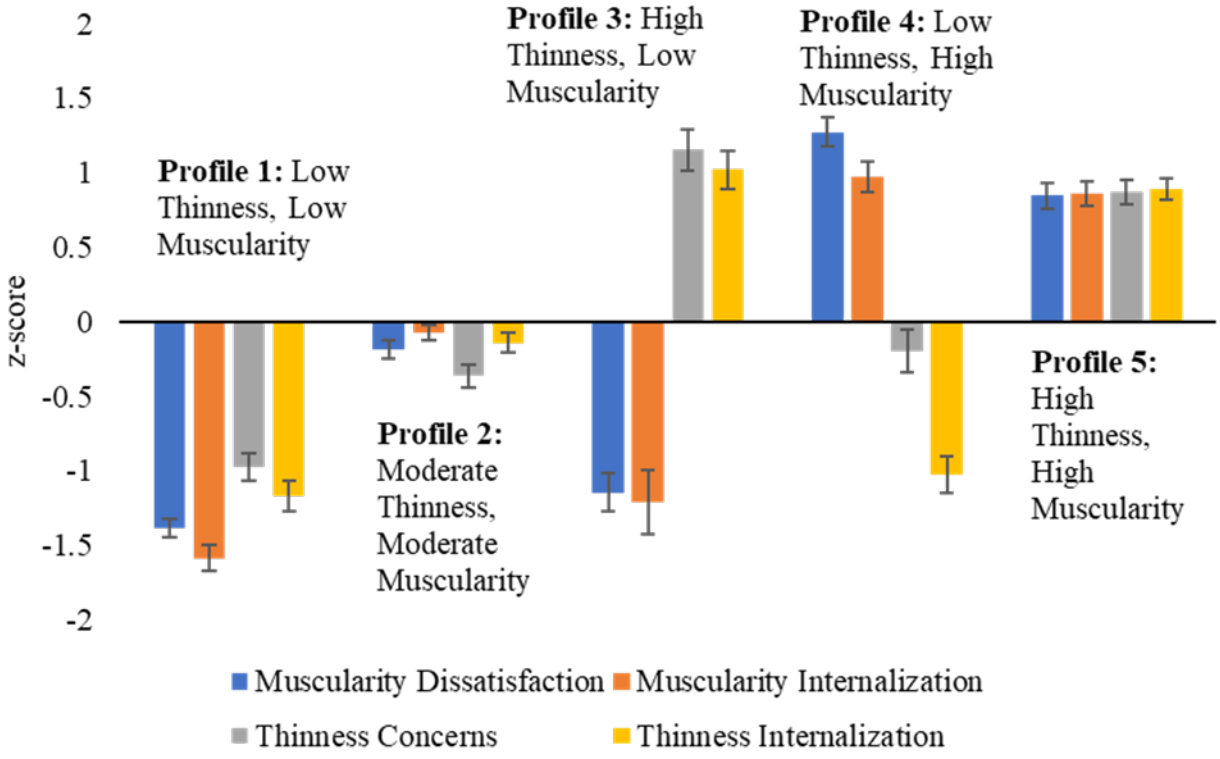

Figure 3.1. *Estimated means for latent profile indicators in men.*

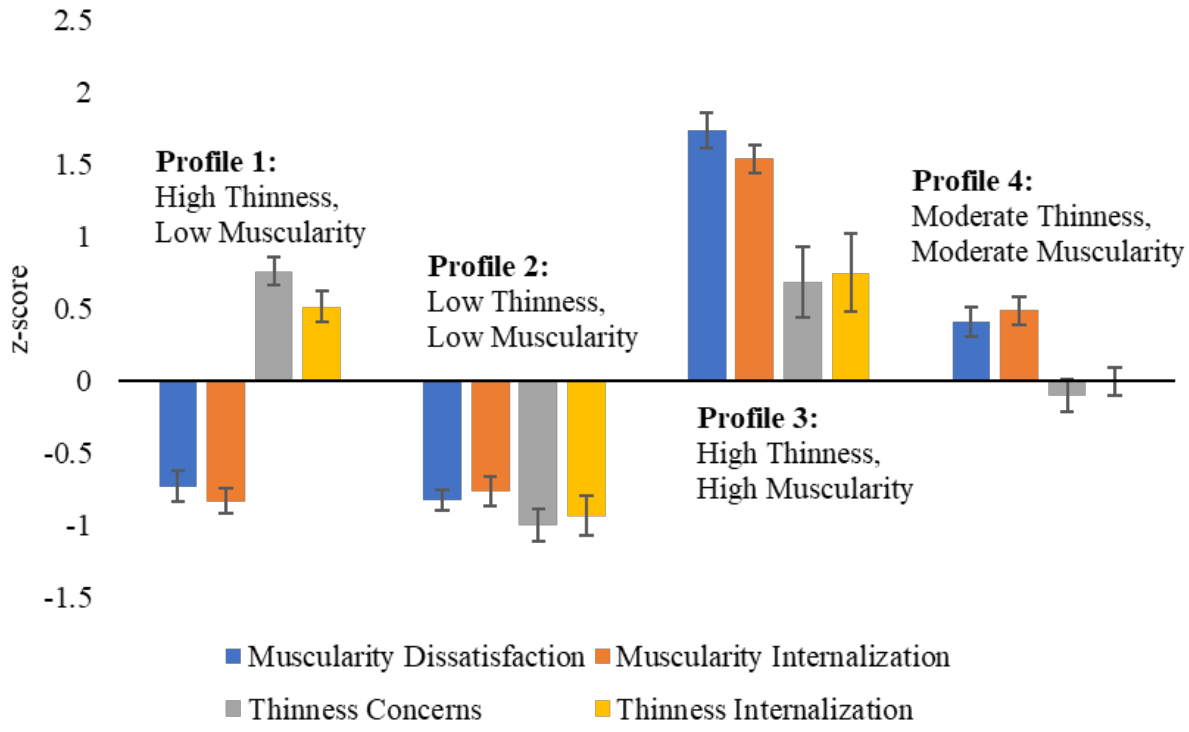

Figure 3.2. *Estimated means for latent profile indicators in women.*

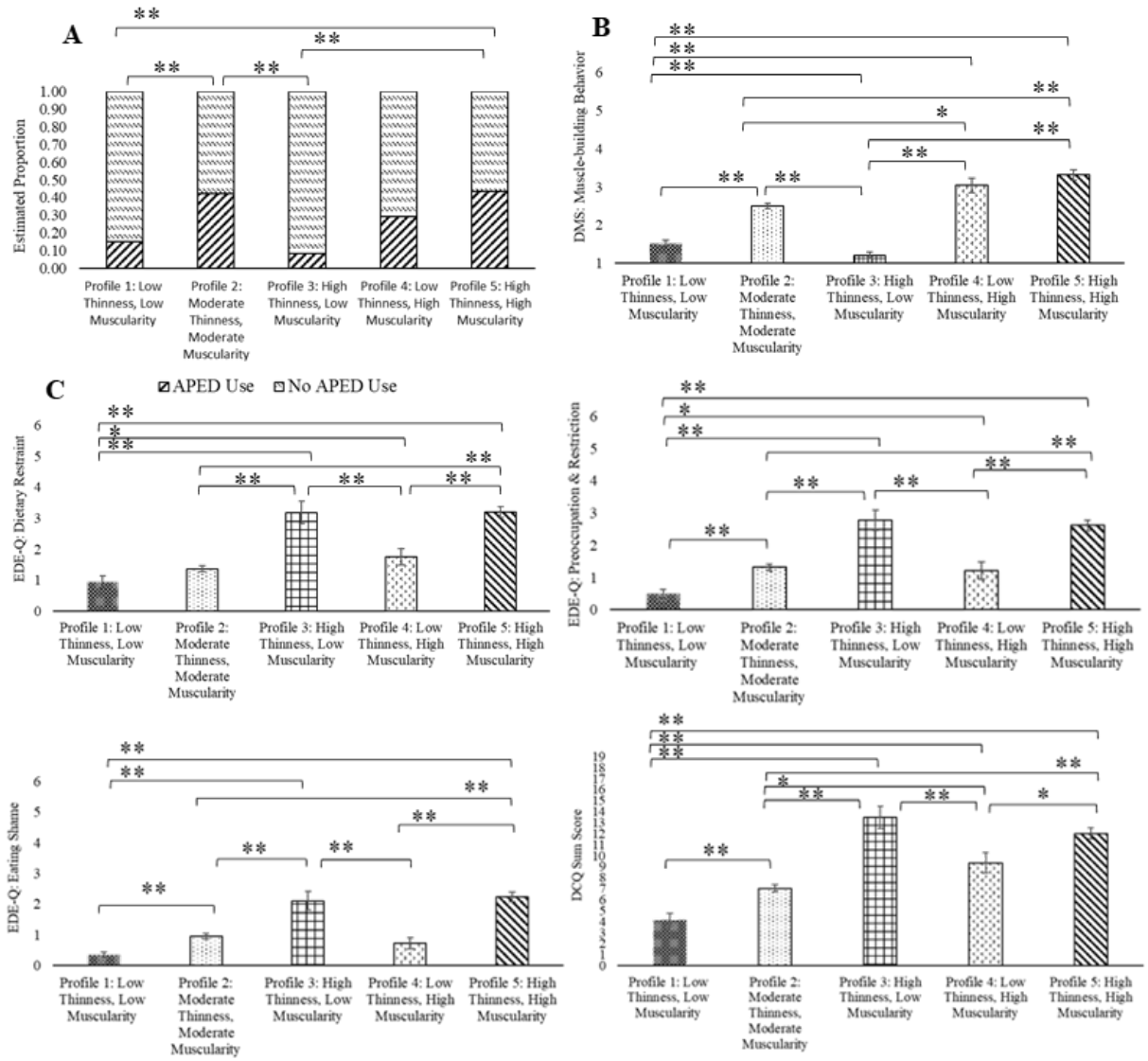

Figure 3.3. *Estimated means of outcomes and differences between latent profiles in men. Panel A: Estimated proportions of men who identified any past year illicit appearance and performance enhancing drug (APED) use versus those who identified no past year use. Panel B: Latent estimate means and standard error (SE) of the Drive for Muscularity Scale: Muscle-Building Behavior subscale, which can range from 1 to 6. Panel C: Latent estimate means and SE of the Eating Disorder Examination-Questionnaire: Dietary Restraint subscale, which can range from 0 to 6. Panel D: Latent estimate means and SE of the Eating Disorder Examination-Questionnaire: Preoccupation & Restriction subscale, which can range from 0 to 6. Panel D: Latent estimate means and SE of the Eating Disorder Examination-Questionnaire: Eating Shame subscale, which can range from 0 to 6. Panel F: Latent estimate means and SE of the Dysmorphic Concern Questionnaire total sum scores, which can range from 0 to 21.*
* $p < .05$. ** $p < .01$.

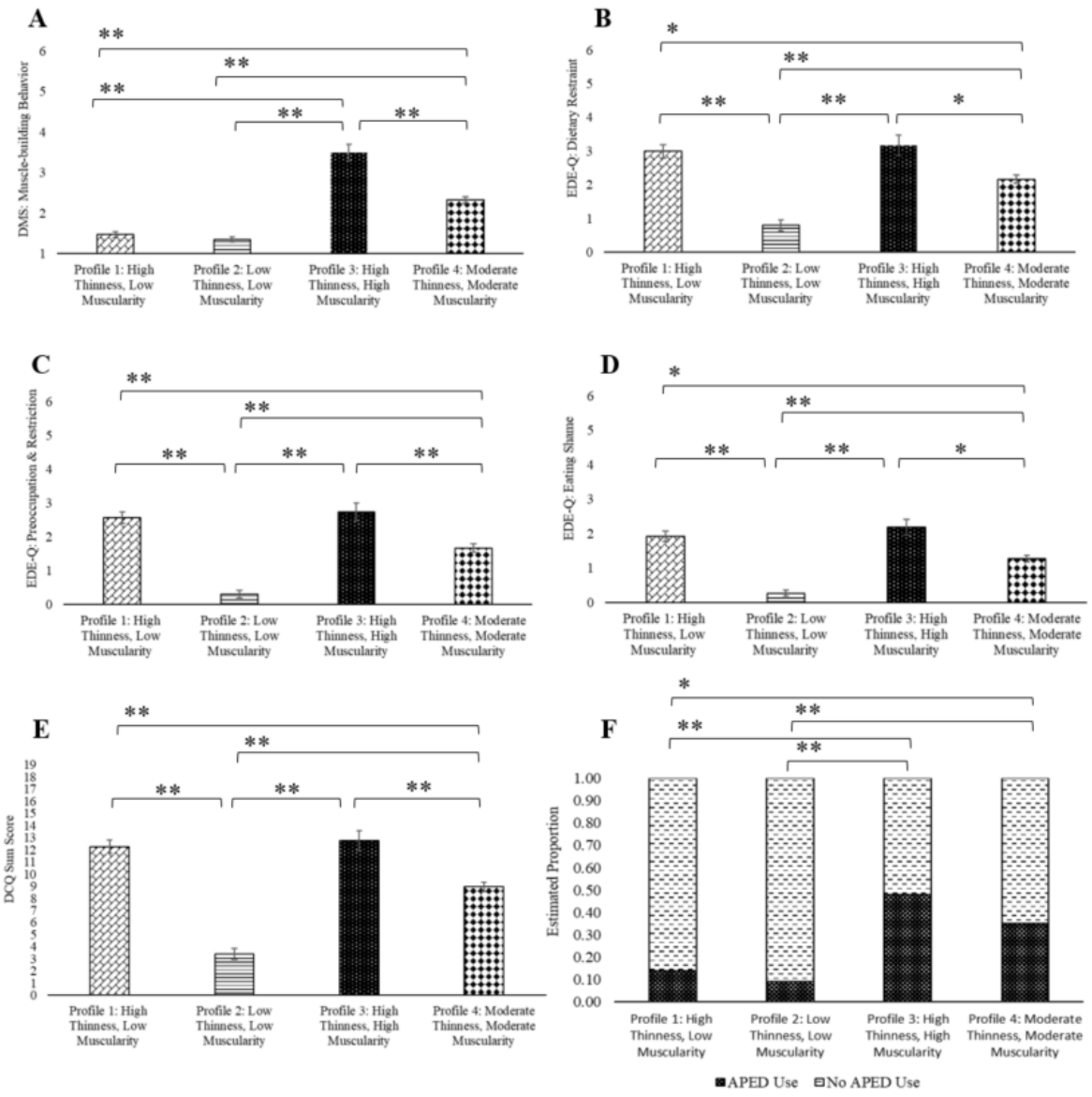

Figure 3.4. *Estimated means of outcomes and differences between latent profiles in women. Panel A: Estimated proportions of women who identified any past year illicit appearance and performance enhancing drug (APED) use versus those who identified no past year use. Panel B: Latent estimate means and standard error (SE) of the Drive for Muscularity Scale: Muscle-Building Behavior subscale, which can range from 1 to 6. Panel C: Latent estimate means and SE of the Eating Disorder Examination-Questionnaire: Dietary Restraint subscale, which can range from 0 to 6. Panel D: Latent estimate means and SE of the Eating Disorder Examination-Questionnaire: Preoccupation & Restriction subscale, which can range from 0 to 6. Panel D: Latent estimate means and SE of the Eating Disorder Examination-Questionnaire: Eating Shame subscale, which can range from 0 to 6. Panel F: Latent estimate means and SE of the Dysmorphic Concern Questionnaire total sum scores, which can range from 0 to 21.*
* $p < .01$. ** $p < .001$.

Tables

Table 3.1. *Demographic characteristics of study samples.*

Variable	Sample 1: Men (n = 479)	Sample 2: Women (n = 483)
Sociodemographic Variables	*n* (%)	*n* (%)
Race/Ethnicity		
White	116 (24.2%)	125 (25.9%)
Black/African American	118 (24.6%)	118 (24.4%)
Asian/Pacific Islander	124 (25.9%)	125 (25.9%)
Hispanic/Latino/a	120 (25.1%)	114 (23.6%)
Native American/American Indian	1 (0.2%)	1 (0.2%)
Sexual Identity		
Lesbian/Gay	239 (49.9%)	97 (20.1%)
Bisexual	206 (43.0%)	358 (74.1%)
Asexual	10 (2.1%)	10 (2.1%)
Other[a]	24 (5%)	18 (3.7%)
Sexual Attraction		
Only attracted to same gender	203 (42.4%)	92 (19.0%)
Mostly attracted to same gender	89 (18.6%)	53 (11.0%)
Equally attracted to same gender	187 (39.0%)	338 (70.0%)
	M(*SD*)	*M*(*SD*)
Age	24.03 (3.76)	23.33 (3.68)
Body Mass Index[b]	26.85 (7.69)	28.86 (8.86)
Profile Indicator Variables		
DMS Muscularity-Oriented Body Image	3.45 (1.35)	2.60 (1.27)
SATAQ Muscularity Internalization	3.16 (1.10)	2.50 (1.07)
EDE-Q Shape & Weight Concerns	2.70 (1.69)	3.19 (1.75)
SATAQ Thinness Internalization	3.02 (1.14)	3.27 (1.03)
Distal Outcome Variables		
DMS Muscle- Building Behavior	2.55 (1.20)	2.03 (1.10)
EDE-Q Dietary Restraint	1.95 (1.74)	2.18 (1.84)
EDE-Q Preoccupation & Restriction	1.65 (1.58)	1.71 (1.63)
EDE-Q Eating Shame	1.28 (1.35)	1.32 (1.36)
DCQ Total score	8.62 (5.38)	8.97 (5.61)
	n (%)	*n* (%)
Presence of Past Year Illicit APED Use	171 (35.7%)	123 (25.5%)

[a] Other sexual identities included, but were not limited to Pansexual, Demisexual, or Queer
[b] n = 119 missing in Men sample ; n = 80 missing in Women sample

Table 3.2. *Bivariate correlations between covariates, profile indicators, and outcome variables.*

Variable	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
1. Age	—	-.08	.01	-.09	.10	.04	.08	-.01	-.01	.02	.04	-.08	-.04	-.11*	<.001
2. Black Race/Ethnicity	-.05	—	-.34*	-.32*	.15*	-.03	-.06	-.12*	-.17*	.14*	-.04	.02	-.03	-.02	.13*
3. Asian/Pacific Islander Race/Ethnicity	-.08	-.34*	—	-.33*	-.25*	-.02	-.06	-.05	.05	-.09	.01	-.11*	-.05	-.08	-.16*
4. Hispanic/Latino/a Race/Ethnicity	.001	-.33*	-.34*	—	.09	.04	.08	.13*	.09	.04	.09*	.15*	.09*	.13*	.13*
5. Body Mass Index	.003	.01	-.14*	.05	—	-.06	-.08	.34*	-.05	-.08	.23*	.19*	.26*	.12*	-.05
6. DMS Muscularity-Oriented Body Image	.06	-.01	.05	.03	-.05	—	.72*	.18*	.16*	.65*	.21*	.24*	.26*	.26*	.38*
7. SATAQ Muscularity Internalization	.11*	-.001	.07	.01	.02	.73*	—	.07	.22*	.47*	.12*	.13*	.11*	.18*	.21*
8. EDE-Q Shape & Weight Concerns	-.01	-.20*	-.04	.14*	.36*	.31*	.27*	—	.56*	.07	.57*	.65*	.61*	.61*	.07
9. SATAQ Thinness Internalization	-.02	-.18*	-.05	.16	.09	.21*	.29*	.54*	—	07	.35*	.46*	.38*	.45*	.10*
10. DMS Muscle-Building Behavior	.10*	-.02	-.04	.14*	-.10	.52*	.40*	.20*	.13*	—	.27*	.28*	.25*	.19*	.52*
11. EDE-Q Dietary Restraint	.03	-.19*	-.03	.13*	.19*	.27*	.19*	.67*	.37*	.36*	—	.66*	.49*	.38*	.22*
12. EDE-Q Preoccupation & Restriction	-.04	-.13*	-.12	.17*	.21*	.25*	.15*	.72*	.38*	.38*	.72*	—	.67*	.60*	.33*
13. EDE-Q Eating Shame	-.08	-.08	-.09	.18*	.15*	.27*	.15*	.67*	.40*	.40*	.60*	.73*	—	.53*	.31*
14. DCQ Sum	-.11*	-.13*	-.12*	.19*	.13*	.32*	.19*	.59*	.39*	.32*	.46*	.57*	.57*	—	.29*
15. Past Year Illicit APED Use	-.001	-.001	-.15*	.19*	-.10	.19*	.08	.16*	.07	.54*	.23*	.38*	.37*	.30*	—

Note. Correlations are above the diagonal for women and below the diagonal for men. DMS = Drive for Muscularity Scale; SATAQ = Sociocultural Attitudes Towards Appearance Questionnaire; EDE-Q = Eating Disorder Examination Questionnaire; DCQ = Dysmorphic Concern Questionnaire; APED = appearance and performance enhancing drugs.
* $p < .05$.

Table 3.3. *Fit indices for latent profile enumeration in men and women.*

Number of Profiles	AIC	BIC	s-BIC	LMRT	BLRT *p*	Entropy	Posterior Classification Probabilities	Final Profile Proportions
Sample 1: Men (*n* = 479)								
2	5132.64	5186.88	5145.62	316.47**	<.001	.71	.90/.92	.40/.60
3	4968.12	5043.21	4986.08	169.05**	< .001	.80	.90/.93/.92	.53/.19/.28
4	4881.5	4977.45	4904.45	93.59*	< .001	.84	.93/.90/.93/.92	.12/.52/.30/.06
5	4790.06	4906.87	4818	98.25**	< .001	.85	.95/.90/.95/.90/.91	.12/.49/.06/.08/.25
Sample 2: Women (*n* = 483)								
2	5729.94	5784.28	5743.02	326.01**	< .001	.76	.93/.92	.61/.39
3	5576.23	5651.47	5594.34	158.58*	<.001	.84	.94/.92/.91	.45/.42/.13
4	5454.74	5550.88	5477.88	127.37*	<.001	.80	.89/.88/.91/.89	.24/.22/.12/.42
5	5406.48	5523.52	5434.65	56.43**	<.001	.80	.91/.91/.84/.81/.90	.23/.22/.34/.11/.11

Note. AIC = Akaike Information Criterion; BIC = Bayesian Information Criterion; s-BIC = sample-size adjusted BIC; LMRT = Lo-Mendell-Rubin adjusted likelihood ratio test; BLRT *p* = *p*-value for the bootstrapped likelihood ratio test; Entropy = classification quality.
* $p < .05$. ** $p < .001$

Table 3.4. *Covariate influences on latent profile membership in men.*

Pairwise Profile Comparison	Age	Black or African American Race/Ethnicity	Asian/Pacific Islander Race/Ethnicity	Hispanic/Latino Race/Ethnicity	Body Mass Index
	Odds Ratio, 95% Confidence Interval, and *p*-value				
Profile 1 vs Profile 2	OR = 0.99, 95% CI [0.91,1.09], *p* = .90	OR = 0.88, 95% CI [0.38,2.04], *p* = .76	OR = 0.82, 95% CI [0.34,2.01], *p* = .67	OR = 0.38, 95% CI [0.13,1.12], *p* = .08	OR = 1.04, 95% CI [0.98,1.09], *p* = .17
Profile 1 vs Profile 3	OR = 1.15, 95% CI [1.00,1.32], *p* = .06	OR = 11.97, 95% CI [1.76,81.52], *p* = .01	OR = 1.70, 95% CI [0.46,6.24], *p* = .42	OR = 0.83, 95% CI [0.21,3.34], *p* = .79	OR = 0.94, 95% CI [0.88,1.01], *p* = .09
Profile 1 vs Profile 4	OR = 0.91, 95% CI [0.80,1.04], *p* = .16	OR = 0.49, 95% CI [0.13,1.86], *p* = .30	OR = 0.25, 95% CI [0.07,0.91], *p* = .04	OR = 0.78, 95% CI [0.11,5.37], *p* = .80	OR = 1.02, 95% CI [0.95,1.09], *p* = .67
Profile 1 vs Profile 5	OR = 0.99, 95% CI [0.90,1.08], *p* = .78	OR = 2.16, 95% CI [0.81,5.71], *p* = .12	OR = 0.87, 95% CI [0.34,2.24], *p* = .78	OR = 0.37, 95% CI [0.12,1.10], *p* = .07	OR = 0.95, 95% CI [0.90,1.00], *p* = .06
Profile 2 vs Profile 3	OR = 1.15, 95% CI [1.01,1.31], *p* = .06	OR = 13.67, 95% CI [2.14,87.28], *p* = .01	OR = 2.07, 95% CI [0.62,6.88], *p* = .24	OR = 2.16, 95% CI [0.68,6.52], *p* = .19	OR = 0.91, 95% CI [0.85,0.97], *p* = .003
Profile 2 vs Profile 4	OR = 0.92, 95% CI [0.82,1.03], *p* = .14	OR = 0.56, 95% CI [0.16,1.92], *p* = .36	OR = 0.30, 95% CI [0.09,1.00], *p* = .05	OR = 2.04, 95% CI [0.35,11.79], *p* = .42	OR = 0.98, 95% CI [0.92,1.05], *p* = .52
Profile 2 vs Profile 5	OR = 0.99, 95% CI [0.92,1.07], *p* = .83	OR = 2.46, 95% CI [1.05,5.78], *p* = .04	OR = 1.06, 95% CI [0.46,2.43], *p* = .89	OR = 0.96, 95% CI [0.46,2.03], *p* = .92	**OR = 0.91, 95% CI [0.87,0.96], *p* < .001**
Profile 3 vs Profile 4	OR = 0.80, 95% CI [0.68,0.93], *p* = .01	OR = 0.04, 95% CI [0.01,0.34], *p* = .003	OR = 0.15, 95% CI [0.03,0.67], *p* = .01	OR = 0.95, 95% CI [0.13,6.76], *p* = .96	OR = 1.08, 95% CI [0.99,1.17], *p* = .07
Profile 3 vs Profile 5	OR = 0.86, 95% CI [0.76,0.98], *p* = .02	OR = 0.18, 95% CI [0.03,1.22], *p* = .08	OR = 0.51, 95% CI [0.15,1.70], *p* = .28	OR = 0.45, 95% CI [0.14,1.37], *p* = .16	OR = 1.01, 95% CI [0.95,1.07], *p* = .81
Profile 4 vs Profile 5	OR = 1.08, 95% CI [0.96,1.22], *p* = .21	OR = 4.39, 95% CI [1.13,17.12], *p* = .03	OR = 3.49, 95% CI [0.98,12.47], *p* = .05	OR = 0.47, 95% CI [0.08,2.81], *p* = .41	OR = 0.93, 95% CI [0.87,1.00], *p* = .05

Note. Bolded estimates indicate statistical significance after Benjamini-Hochberg alpha correction using a .05 false discovery rate. Profile 1 = Low Thinness, Low Muscularity Concerns; Profile 2 = Moderate Thinness, Moderate Muscularity Concerns; Profile 3 = High Thinness, Low Muscularity Concerns; Profile 4 = Low Thinness, High Muscularity Concerns; Profile 5 = High Thinness, High Muscularity Concerns.

Table 3.5. *Covariate influences on latent profile membership in women.*

Pairwise Profile Comparison	Age	Black or African American Race/Ethnicity	Asian/Pacific Islander Race/Ethnicity	Hispanic/Latino Race/Ethnicity	Body Mass Index
	Odds Ratio, 95% Confidence Interval, and *p*-value				
Profile 1 vs Profile 2	OR = 1.01, 95% CI [0.92,1.11], *p* = .89	OR = 0.32, 95% CI [0.11,0.93], *p* = .04	OR = 1.85, 95% CI [0.70,4.87], *p* = .21	OR = 1.01, 95% CI [0.92,1.11], *p* = .89	**OR = 1.09, 95% CI [1.04,1.15], *p* < .001**
Profile 1 vs Profile 3	OR = 0.93, 95% CI [0.84,1.03], *p* = .19	OR = 0.45, 95% CI [0.14,1.42], *p* = .17	OR = 1.83, 95% CI [0.61,5.45], *p* = .28	OR = 0.84, 95% CI [0.30,2.38], *p* = .75	OR = 1.07, 95% CI [1.02,1.13], *p* = .01
Profile 1 vs Profile 4	OR = 0.98, 95% CI [0.91,1.05], *p* = .55	OR = 0.77, 95% CI [0.31,1.92], *p* = .57	OR = 2.70, 95% CI [1.22,5.96], *p* = .01	OR = 1.41, 95% CI [0.65,3.09], *p* = .38	**OR = 1.06, 95% CI [1.03,1.10], *p* = .001**
Profile 2 vs Profile 3	OR = 0.93, 95% CI [0.83,1.03], *p* = .17	OR = 1.41, 95% CI [0.50,4.01], *p* = .52	OR = 0.99, 95% CI [0.33,2.95], *p* = .98	OR = 0.41, 95% CI [0.12,1.33], *p* = .14	OR = 0.98, 95% CI [0.93,1.03], *p* = .44
Profile 2 vs Profile 4	OR = 0.97, 95% CI [0.89,1.05], *p* = .48	OR = 2.39, 95% CI [1.10,5.18], *p* = .03	OR = 1.46, 95% CI [0.65,3.26], *p* = .36	OR = 0.69, 95% CI [0.27,1.77], *p* = .44	OR = 0.97, 95% CI [0.94,1.01], *p* = .17
Profile 3 vs Profile 4	OR = 1.05, 95% CI [0.95,1.15], *p* = .37	OR = 1.69, 95% CI [0.62,4.65], *p* = .31	OR = 1.48, 95% CI [0.52,4.17], *p* = .46	OR = 1.68, 95% CI [0.63,4.45], *p* = .30	OR = 0.99, 95% CI [0.94,1.05], *p* = .81

Note. Bolded estimates indicate statistical significance after Benjamini-Hochberg alpha correction using a .05 false discovery rate. Profile 1 = High Thinness, Low Muscularity Concerns; Profile 2 = Low Thinness, Low Muscularity Concerns; Profile 3 = High Thinness, High Muscularity Concerns; Profile 4 = Moderate Thinness, Moderate Muscularity Concerns.

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CHAPTER 4: Integrated Summary

Research on mental health disparities between sexual minority individuals and heterosexual individuals suggests that sexual minority men and women are a vulnerable population at high risk of severe mental health concerns (e.g., Eaton, 2014). Among these mental health concerns, sexual minority individuals are at disproportionate risk of developing eating disorders (Kamody et al., 2020), engaging in anabolic-androgenic steroid use (Blashill, 2017), and have demonstrated high occurrence rates of positive body dysmorphic disorder (BDD) screens (Gonzales et al., 2021; Oshana et al., 2020). Collectively, the three studies completed in this dissertation project contribute to our knowledge of body image-related disorders in sexual minority individuals.

Studies 1 and *2* examined the factor structure and measurement invariance by gender of two commonly used measures in the field of body image. *Study 1* examined factorial validity and measurement invariance of the Drive for Muscularity Scale (DMS; McCreary & Sasse, 2000), a measure of muscularity-oriented concerns and behaviors. *Study 2* examined factorial validity and measurement invariance of the Eating Disorder Examination-Questionnaire (EDE-Q; Fairburn & Beglin, 1994), a measure of eating disorder symptoms. Confirmation of the most appropriate factor structures of key self-report measures in sexual minority individuals is needed to increase the rigor and validity of research on these important topics.

Key findings of *Study 1* indicated that the two-factor DMS without item 10 (“I think about taking anabolic steroids”) demonstrated appropriate fit in both sexual minority men and women. The 14-item two-factor DMS was also invariant by gender, supporting the use of this measure with both cisgender sexual minority men and women. An additional finding was that the 15-item two factor solution, including the item on steroid use, demonstrated adequate fit in the

sample of sexual minority women. Findings from *Study 1* are inconsistent with prior factor structure evaluations in sexual minority men and men and women of unknown sexual orientation, among whom a one-factor solution has also been supported (e.g., McCreary et al., 2004; de Carvalho et al., 2019; Nerini et al., 2016). However, a two-factor structure has been supported in a sample of sexual minority men, although they found support for the inclusion of item 10 (De Blaere & Brewster, 2017). Thus, future research is needed to corroborate *Study 1* findings.

Key findings in *Study 2* indicated that two separate factor structures—Friborg et al.'s four-factor model (Dietary Restraint, Preoccupation and Restriction, Eating Shame, and Weight & Shape Concern) and Grilo et al.'s seven-item three-factor model (Dietary Restraint, Shape/Weight Overvaluation, and Body Dissatisfaction)—demonstrated the most appropriate fit in both sexual minority men and women. Additionally, both factor structures demonstrated measurement invariance by gender, thus supporting their use with both cisgender sexual minority men and women. Although both factor structures may be appropriate in sexual minority individuals, Friborg et al.'s model of the EDE-Q incorporates all items evaluating disordered eating attitudes and behaviors, whereas Grilo et al.'s model largely evaluates shape and weight concerns with only three items evaluating dietary restraint. Thus, recommendations from *Study 2* were to use Grilo et al.'s model with caution. *Study 2* also contributed to the body of literature which has consistently found poor support of the original four-factor structure of the EDE-Q (Dietary Restraint, Eating Concern, Weight Concern, and Shape Concern). However, the present study found no support for this factor structure because the model converged with warnings of negative factor loadings and variances, which may not generalize to other samples. Thus, the

most appropriate factor structure in samples of sexual minority individuals may need to be verified.

Studies 1 and 2 were critical first steps in increasing the validity of findings from *Study 3,* which aimed to examine the heterogeneity in body image patterns among sexual minority individuals and their subsequent associations with muscle-building behaviors, BDD symptoms, and eating disorder symptoms. Specifically, the DMS, which was evaluated in *Study 1,* was deemed appropriate to measure muscularity-oriented body image and muscle-building behavior in both sexual minority men and women. Additionally, the EDE-Q, which was evaluated in *Study 2*, was deemed appropriate to measure eating disorder symptoms in both sexual minority men and women. Prior studies using the same sample have demonstrated factorial validity and measurement invariance of other self-report measures involved in *Study 3* (Convertino et al., 2019; Rozzell et al., 2020). Thus, *Study 3* was unique in ensuring the use of empirically supported factor structures in samples of sexual minority men and women.

Study 3 involved the use of latent profile analyses to identify body image patterns across both thinness-related concerns and internalization and muscularity-related concerns and internalization. Key findings indicated that the samples of sexual minority men and women included individuals with co-occurring high thinness and muscularity concerns as well as individuals with only high thinness concerns. In the sexual minority sample of men, an additional profile including individuals with only high muscularity concerns emerged. *Study 3* also demonstrated varying roles of thinness and muscularity concerns in behavioral health outcomes among sexual minority men and women. Specifically, body image patterns with high thinness concerns had the highest thinness-oriented eating disorder symptoms and body image patterns with high muscularity concerns had the highest levels of muscle-building behaviors including

high odds of past year illicit appearance and performance enhancing drug misuse (e.g., anabolic androgenic steroids). However, co-occurring high thinness and high muscularity concerns may pose an augmented mental health risk as folks may be more likely to engage in multiple problematic health behaviors. Overall, *Study 3* demonstrated the importance of considering both thinness and muscularity concerns and related behaviors in both sexual minority men and women.

Collectively, findings from the three studies highlighted the need for further research on body image disorders in sexual minority men and women. Little is known about body image profiles and their associations with problematic health outcomes in sexual minority women, and the present study was novel in exploring this topic. Additionally, no prior research has examined the factor structure of commonly used body image-related measures such as the EDE-Q and DMS in samples of sexual minority women. The present findings may inform future research and treatment or prevention efforts of eating disorders and body dysmorphic concerns in sexual minority women as well as men, highlighting the need to consider varying combinations of thinness and muscularity concerns in diagnostic presentations.