

Investigating Gender Differences in Physical Activity Behavior and Social Cognitions among First-Year Medical Students

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Abstract

Background: Applying the Theory of Planned Behavior, we examined gender differences in physical activity (PA) behavior and social cognitions (SC; i.e., attitudes, perceived behavioral control, intentions and subjective norms) among first-year medical students.

Methods: In October 2015, first-year medical students from across Ontario [$n=95$; 23 ± 2 years (31 males)] completed questionnaires assessing PA levels and SC.

Results: Men reported greater moderate-to-vigorous PA (MVPA) per week compared to women (243.3 ± 224.7 min/week vs. 145.4 ± 127.8 min/week, $p=0.042$). No differences in SC toward PA were observed between genders (all $ps>0.05$). Bivariate correlations revealed that perceived behavioral control and intentions to participate in PA correlated with MVPA in both genders (all $rs>0.348$; all $ps<0.05$); however, attitudes (pleasantness and enjoyment) predicted MVPA solely amongst men (all $rs>0.492$; all $ps<0.001$).

Conclusions: Findings provide insight into the theoretical constructs that influence medical students' PA, and how these factors may differ between genders. Findings can be used to tailor interventions to increase PA among medical students.

Keywords: theory of planned behaviour; counselling; lifestyle medicine; curriculum

Introduction

Regular physical activity (PA) participation is strongly associated with improved overall health (Warburton, Nicol and Bredin, 2006); however, the proportion of adults meeting guideline-recommended PA levels remains low (Hallal *et al.*, 2012) and promotional efforts to increase PA participation have found variable success (Vuori, Lavie and Blair, 2013). Physicians are recognized as respected sources of health information and play a significant role in promoting and improving patient PA behavior (King *et al.*, 1998). Considerable evidence suggests that a physician's personal PA levels correlate with their PA counseling habits (Abramson *et al.*, 2000; Lobelo, Duperly and Frank, 2009; Lobelo and de Quevedo, 2016). Further, patients are more likely to be motivated by a physician's PA counseling if the physician demonstrates a healthy lifestyle themselves (Frank, Breyan and Elon, 2000). Thus, the promotion of PA habits among physicians may be an important step in improving both physicians' personal health and, by extension, the quality of care they provide. The undergraduate medical school curriculum represents an important opportunity to develop evidence-based health promotion interventions that encourage future physicians to adopt and promote active lifestyles (Chen *et al.*, 2013). Indeed, recent reports indicate that in the 2016 – 2017 academic term, 11 698 (*Enrollment in Canadian Faculties of Medicine*, 2017) and 88 222 (*Association of American Medical Colleges*, 2018) medical students were enrolled in Canadian and American faculties of medicine, respectively; thus, highlighting the potential student health impact of evidence-based PA promotion interventions within the medical school curriculum.

Despite knowledge regarding the health benefits of PA, many medical students remain physically inactive (Lobelo, Duperly and Frank, 2009; Dabrowska-Galas *et al.*, 2013). In fact, just over half of Canadian and American medical students meet the exercise guidelines for their respective country (Frank *et al.*, 2004; Holtz *et al.*, 2013; Ng and Irwin, 2013). Based on this evidence, it is not surprising that only 25% of medical students counsel their patients on PA (Ng and Irwin, 2013). Importantly, there appears to be gender discrepancies in adherence to regular PA, wherein male freshmen (first-year) medical students from the United States (U.S.) are more likely to comply with exercise recommendations compared to their female peers (Frank *et al.*, 2004). Gender-differences in college student PA awareness, beliefs, social pressures, and past behavior have been cited as possible factors influencing observed differences in PA behavior (Behrens *et al.*, 2005). Ransdell *et al.* (2004) offer additional insight into unique barriers that have been reported by women such as low self-confidence, high social physique anxiety, dislike of sweating and vigorous activity, failure to gain instant gratification, lack of programming for girls and women, and caregiving responsibilities. Evidence also suggests that college women report unique barriers to on-campus PA, such as facilities being over-crowded, additional fees to participate in group fitness classes, and feeling intimidated by unfamiliar equipment and/or exercising with men (LaCaille *et al.*, 2011). It is possible that differences in PA behavior and its determinants between genders may also be prevalent among medical students given their context is similar to college students in general.

To our knowledge, no studies to date have investigated gender differences in PA behavior and its determinants among first-year medical students. The Theory of Planned Behavior (TPB), a psychological model for investigating social cognitions - factors that influence behavior (Godin and Kok, 1996) - suggests that an individual's intentions to perform a certain behavior (e.g., participating in PA) are influenced by his/her attitudes, subjective norms, and perceived behavioral control (PBC) for the behavior. Furthermore, intentions and PBC appear to serve as direct predictors of the targeted behavior (Ajzen, 1991). Based on existing research suggesting gender-based differences in PA levels amongst medical students (Frank *et al.*, 2004), we must consider whether gender differences in TPB social cognitions (i.e., attitudes, subjective norms, PBC, and intentions) towards PA influence the PA behavior of first-year medical students. Understanding gender differences in PA behavior and its determinants among first-year medical students may provide useful insights for the development of interventions that instill healthy PA habits at the onset of medical training that can then be maintained for the duration of medical school.

Therefore, the primary purpose of this study is to characterize gender differences in PA behavior and social cognitions among first-year medical students. A secondary purpose of this study is to examine gender differences in the relationships between PA behavior and social cognitions among first-year medical students. Given previous reports of gender differences in PA among first-year medical students in the U.S. (Frank *et al.*, 2004), we hypothesize that male medical students will participate in more PA than their female counterparts. Furthermore, in accordance with the TPB (Ajzen, 1991), we also expect male medical students will report more positive social cognitions towards PA.

Methods

Participants

Individuals were recruited via convenience sampling and were considered eligible to participate if they were in their first year of medical school and attended the 2015 Ontario Medical Students' Weekend, a provincial conference introducing first-year medical students across Ontario to foundational clinical skills and information. Of the 136 students who demonstrated interest upon registration for the provincial conference, 126 agreed to participate in the study. However, only 95 students followed through with full completion of the questionnaire.

Protocol

The study protocol was approved by the Health Sciences Research Ethics Board at Queen's University. During online conference registration, students were able to check a box indicating that they would like to receive information regarding study participation. Students interested in participating were e-mailed and asked to read and sign the Letter of Information/Consent before completing the first online questionnaire.

Online questionnaires were administered at three time points over a four-month period in the first semester of participants' first year of medical school. The data reported represents the first questionnaire responses received from each participant.

Questionnaire Measures

Demographics

Participants were asked questions about their general demographic information (i.e., included age, gender, and ethnicity), as well as questions regarding their academic background (i.e., highest level of education completed, previous academic program, and current medical school). Complete demographic information was obtained from 95 students (70% response rate).

TPB Social Cognitions

Participants were asked about their attitudes, subjective norms, PBC, and intentions towards engaging in PA during their medical studies. Refer to Table 3 for specific items. The questionnaire used in this study is a modified version of a questionnaire shown to be reliable for examining health care professional trainees' PA-related social cognitions (Tomasone *et al.*, 2017).

PA Behavior

Participants were asked about their current PA behavior using questions adapted from the short form version of the International PA Questionnaire (IPAQ) (Vandelandotte *et al.*, 2005). To facilitate accurate PA recall, questions assessing both hours-per-day and minutes-per-day were included in the questionnaire.

Statistical Analysis

Descriptive statistics were calculated for each demographic, social cognition, and PA behavior item. The IPAQ data was converted to minutes of MVPA per week to allow for comparisons of self-report PA behavior to the Canadian PA Guidelines, which recommend adults accumulate at least 150 minutes of MVPA aerobic PA per week, in bouts of 10 minutes or more (Tremblay *et al.*, 2011). The following equation was used to determine total minutes of MVPA per week: MVPA = Moderate [PA (min/day) * number of days/week] + Vigorous [PA (min/day) * number of days/week]. Independent t-tests were conducted to determine differences between genders for all TPB constructs and PA behavior. Pearson correlation coefficients examining the relationships between the TPB constructs and MVPA were calculated separately for each gender (see Table 4).

Results/Analysis

Participants

Participants were 95 first-year medical students from five universities across Ontario. The majority of participants were female (67.4%) and held a bachelor level degree (74.7%). Few participants (4.2%) had previous academic experience in kinesiology, exercise science, or physical education. Participants had a mean age of 23 (\pm 2) years. Complete participant demographics are presented in Table 1.

Table 1. Participants Demographic Characteristics

Characteristic	Participants (N=95)
Gender	
Male	31 (32.6)
Female	64 (67.4)
Ethnicity	
Caucasian	52 (54.7)
Asian	26 (27.4)
Other	17 (17.8)
Age (Years)	23 \pm 2
Highest Level of Education Completed	
Bachelor - Level Degree	71 (74.7)
Master - Level Degree	17 (17.9)
Doctorate – Level Degree	2 (2.1)
Professional Post-Graduate	3 (3.2)
Other	2 (2.1)
Previous Academic Program	
Life Science/Health Science	74 (77.9)
Kinesiology/Exercise Science/Physical Education	4 (4.2)
Other	16 (16.8)
Medical Program	
McMaster University	20 (21.1)
University of Ottawa	11 (11.6)
Queen’s University	31 (32.6)
University of Toronto	27 (28.4)
Western University	6 (6.3)

Note. All values are n (%) except for age which is mean \pm standard deviation. Some participants declined to respond to certain questions; hence, n < 95 for some variables. Examples of "Other" Academic Programs include nursing and physiotherapy/occupational therapy.

Gender Differences in PA Behavior and Social Cognitions

Men reported significantly higher MVPA minutes per week compared to women ($p=0.042$; Table 2). Neither moderate nor vigorous PA alone were significantly different between genders ($p=0.121$ and $p=0.095$, respectively). In addition, no significant differences in self-reported walking minutes-per-week were observed between genders ($p=0.995$).

Overall, medical students reported favorable values for each TPB social cognition (all $M_s \geq 5.61$ out of 7), with the exception of the items assessing perceived difficulty for participating in PA throughout their medical studies and intentions to seek out additional PA information (3.95 ± 1.52 and 4.13 ± 1.57 , respectively). No significant gender-differences in social cognitions were observed (all $p_s > 0.05$). For complete results, refer to Table 3.

Table 2. Self-Reported PA Levels among Male and Female First-Year Medical Students

	Male ($n = 31$)	Female ($n = 64$)	p value
Walking (min/wk)	243.1 \pm 164.9	242.9 \pm 166.0	0.995
Moderate (min/wk)	84.1 \pm 93.0	53.6 \pm 61.6	0.121
Vigorous (min/wk)	151.6 \pm 164.1	94.9 \pm 98.5	0.095
MVPA (min/wk)	243.3 \pm 224.7	145.4 \pm 127.8	0.042

Note. MVPA, moderate-to-vigorous physical activity; wk, week. Some participants declined to respond to certain questions; hence, $n < 31$ and < 64 for some variables in males and females, respectively.

Relationships between TPB Social Cognitions and MVPA

For males ($n=31$), two attitude constructs (pleasantness and enjoyable) demonstrated low and moderate positive correlations with MVPA, respectively ($p<0.01$). (Cohen, 1988) In addition, low positive correlations were also observed between MVPA and two other constructs (PBC and intentions to participate in PA; $p<0.05$) (Cohen, 1988). For females ($n=64$), the constructs PBC and intentions to participate in PA demonstrated low positive correlations with MVPA ($p<0.01$) (Cohen, 1988).

Table 3. TPB Social Cognition Items and Descriptive Statistics for Male and Female First-Year Medical Students

Questionnaire Item	Response Scale	Average Score ($M \pm SD$)			t (df); p value
		Total ($N = 95$)	Male ($n = 31$)	Female ($n=64$)	
Attitudes					
Participating in PA throughout my medical studies would be:					
1. Harmful	1: Harmful, 7: Not Harmful	6.69 \pm 0.92	6.74 \pm 0.77	6.67 \pm 0.99	$t(93)= 0.345$; $p = 0.731$ $t(92)= -0.190$; $p = 0.850$ $t(91)= -0.345$; $p = 0.731$ $t(92)= 0.044$; $p = 0.965$ $t(92)= 0.129$; $p = 0.898$
2. Worthless	1: Worthless, 7: Worth-while	6.61 \pm 0.92	6.58 \pm 0.81	6.62 \pm 0.97	
3. Difficult	1: Difficult, 7: Easy	3.95 \pm 1.52	3.87 \pm 1.48	3.98 \pm 1.56	
4. Unpleasant	1: Unpleasant, 7: Pleasant	5.77 \pm 1.23	5.77 \pm 1.15	5.76 \pm 1.32	
5. Unenjoyable	1: Unenjoyable, 7: Enjoyable	5.98 \pm 1.12	6.00 \pm 0.89	5.97 \pm 1.22	
Perceived-Behavioral Control					
How confident are you in your ability to participate in PA during your medical studies?	1: Not at all Confident 7: Completely Confident	6.12 \pm 1.03	6.19 \pm 1.05	6.08 \pm 1.03	$t(93)= 0.510$; $p = 0.611$

Subject Norms Other medical professionals think I should participate in PA throughout my medical studies.	1: Strongly Disagree 7: Strongly Agree	5.83 ± 1.13	5.55 ± 1.23	5.97 ± 1.06	$t(52) = -1.622$; $p = 0.111$
Intentions In the next four weeks, I intend to:	1: Strongly Disagree 7: Strongly Agree				
1. To seek out more additional information about PA for myself.		4.13 ± 1.57	3.87 ± 1.57	4.25 ± 1.57	$t(93) = -1.103$; $p = 0.273$
2. To participate in at least 150 minutes of MVPA per week.		5.61 ± 1.56	5.65 ± 1.62	5.59 ± 1.54	$t(93) = 0.150$; $p = 0.881$

Note. TPB; Theory of Planned Behavior, PA; Physical Activity, MVPA; moderate-to-vigorous physical activity. Independent t-tests compared male and female scores.

Table 4. Pearson Correlation Coefficients of TPB Constructs and MVPA of a Sample of First-Year Medical Students

	Harmful	Worthless	Difficult	Unpleasant	Unenjoyable	SN	PBC	Intent (I)	Intent (P)	MVPA
Harmful	-	0.960**	0.141	0.564**	0.614**	0.218	0.259*	0.175	0.046	-0.233
Worthless	0.675**	-	0.113	0.607**	0.656**	0.160	0.286*	0.151	0.044	-0.176
Difficult	-0.210	-0.249	-	0.461**	0.373**	0.233	0.360**	-0.031	0.224	0.251
Unpleasant	0.383*	0.471**	0.241	-	0.871**	0.041	0.404**	0.315*	0.235	0.185
Unenjoyable	0.434*	0.554**	0.232	0.878**	-	-0.001	0.373**	0.257*	0.223	0.038
SN	0.118	-0.130	0.322	0.043	0.121	-	0.207	-0.034	0.011	0.045
PBC	0.641**	0.573**	0.103	0.427*	0.463**	0.122	-	-0.012	0.301*	0.348**
Intent (I)	-0.139	0.220	-0.099	0.169	0.048	-0.480**	-0.066	-	0.213	0.089
Intent (P)	0.403*	0.595**	-0.051	0.654**	0.574**	-0.282	0.473**	0.178	-	0.450**
MVPA	0.192	0.266	0.201	0.492**	0.503**	-0.010	0.427*	0.062	0.484**	-

Note. Females (above diagonal): $n = 64$; Males (below diagonal): $n = 31$. SN, subjective norms; PBC; perceived-behavioral control; Intent (I), Intentions to seek out additional information; Intent (P), Intentions to participate in physical activity; MVPA, moderate-to-vigorous physical activity.

** $p < 0.01$; * $p < 0.05$.

Discussion

To our knowledge, this is the first study to examine gender-differences in PA behavior and social cognitions in a sample of first-year Canadian medical students. The findings of this cross-sectional study indicate that male students report participating in significantly more MVPA per week than females. No significant differences in TPB social cognitions towards PA were observed between genders; however, bivariate analysis revealed unique relationships between the TPB constructs and MVPA behavior between genders. These findings suggest that it may be beneficial to make recommendations and tailor health promotion programs uniquely for male and female first-year medical students.

As hypothesized, the findings of this study are consistent with previous research reporting higher levels of MVPA in men versus women in general as well as within medical student populations (Troost *et al.*, 2002; Ransdell, Vener and Sell, 2004; Lobelo, Duperly and Frank, 2009; Colley *et al.*, 2011; Hallal *et al.*, 2012; Dabrowska-Galas *et al.*, 2013; American College Health Association-National College Health Assessment II: Canadian Reference Group Data Report Spring 2016, 2016; American College Health Association-National College Health Assessment II: Reference Group Executive Summary Spring 2017, 2017). Importantly, our findings suggest that on average, only male medical

students are achieving the recommended 150 minutes of MVPA per week, as indicated by the Canadian PA Guidelines (Tremblay *et al.*, 2011). It is possible that unique barriers such as over-crowded facilities, additional group fitness class fees, feeling intimidated by unfamiliar equipment and/or exercising with men (LaCaille *et al.*, 2011) may be influencing female medical students' PA, and may help explain our results. Further research investigating gender-specific barriers to PA participation among medical students throughout their training is warranted to strengthen to development of effective PA promotion interventions within this population.

A secondary purpose of this study was to investigate gender-differences in the TPB constructs, and how they might relate to MVPA behavior. Contrary to our hypothesis, we observed no gender-differences in first-year medical students' attitudes, subjective norms, PBC, or intentions to participate in PA at the group level despite observing significant gender-differences in PA behavior. While our sample size may have been too small to detect significant gender-based differences in social cognitions, it is also possible that the constructs evaluated using this tool do not adequately capture gender differences in determinants of PA behavior for this sample. However, it is encouraging that on average, both male and female students report favorable social cognitions towards participating in PA throughout their medical studies, with the exception of perceived difficulty of participating in PA. Taken together, these theoretical findings suggest that this sample of first-year medical students is cognitively well-positioned to participate in PA.

Bivariate analysis revealed that both PBC and intentions to participate in PA were positively correlated with MVPA in both male and female students. For male students, two specific types of attitudes, pleasantness and enjoyment, were also correlated with MVPA behavior. Interestingly, the strongest predictors of MVPA differed between genders; enjoyment was the strongest correlate in males and intentions to participate in PA was the strongest correlate amongst females. For male students, this finding appears to be discrepant with the framework of the TPB, which suggests that intentions are the strongest determinant of behavior (Ajzen, 1991). This finding might be explained by the observation that enjoyment showed a moderate, positive correlation with intentions to participate in males but not females. Specifically, male students reporting higher levels of enjoyment were more likely to report higher intentions to participate in PA and MVPA behavior. It is also possible that the TPB oversimplifies the predictors of behavior in this sample (Sniehotta, Pesseau and Araújo-Soares, 2014).

Chen *et al.* (2013) emphasize the importance of utilizing evidence-based interventions for health promotion efforts to ensure the implementation of best practice programs given not all target populations are alike. The results of the current study are fulfilling the health promotion cornerstone of program need, whereby the health promotion needs of the target population are determined prior to program planning, implementation, and evaluation (Ransdell *et al.*, 2009). Our observations can be utilized in future campus health promotion interventions aimed at increasing first-year medical students' PA engagement. Specifically, PA programs targeting first-year male medical students should emphasize the constructs of attitudes, intentions, and PBC to participate, while PA programs designed for women should aim to enhance PBC and intentions to participate. Importantly, the continued development of promotional strategies that improve PA participation among medical students may have long-term implications on physician and patient PA behavior.

Limitations

Several limitations of this research should be noted. First, as is the case with all self-reported data, it is possible that students inaccurately reported their PA behavior and social cognitions. Future research into this area would benefit from assessing PA using objective measures (i.e., accelerometers) to eliminate recall bias and social desirability bias. Furthermore, this study used convenience sampling of first-year medical students from across Ontario who attended the 2015 annual Ontario Medical Students' Weekend conference. Although these findings may not be generalizable to first-year medical students as a whole, this study is strengthened by the inclusion of medical students

from various medical schools in Ontario. In addition, data was collected within the first semester of medical student training; thus, identifying potential health promotion needs at the onset of medical school. However, future investigations would benefit from assessing behavior and cognitions of medical students across several time points throughout their training. Finally, while the distribution of genders (i.e., higher percentage of women than men) in the present study reflected the population of first-year students enrolled in Canadian faculties of Medicine in the 2015/16 academic term, (*First Year Enrolment in Canadian Faculties of Medicine By Sex 1957/58 - 2015/2016*, 2016) future research should aim for a more equal gender distribution in order to strengthen findings.

Conclusion

In conclusion, the results of this study demonstrate meaningful gender-related differences in PA behavior among first-year medical students. The findings of this study indicate that male, but not female, first-year medical students are achieving the Canadian PA recommendations. Furthermore, the present study extends these observations by providing a more thorough characterization of the theoretical constructs that may influence first-year medical student participation in PA, and how these factors may differ between genders. Although no differences in social cognitions towards PA were reported across genders, differences in the relationships between the constructs and MVPA were observed. Specifically, male student attitudes (pleasantness and enjoyment) towards PA, PBC, and intentions to participate in PA predicted MVPA while, in accordance with the TPB, only PBC and intentions to participate in PA predicted MVPA in women. These findings can inform future health promotion initiatives aimed at increasing PA among medical students; thus, establishing a foundation for future physicians to adopt and promote active lifestyles to their patients.

Take Home Messages

- Active physicians and medical students are more likely to counsel patients about physical activity; yet, many remain inactive
- Gender differences in medical student physical activity behavior have been reported; however, no studies have investigated gender differences in physical activity behavior among first-year medical students
- On average, all students regardless of gender reported favorable social cognitions towards participating in PA throughout their medical studies
- Our findings suggest that only male first-year medical students are achieving the physical activity guideline recommendations
- These results can be utilized in future medical school health promotion interventions aimed at improving first-year medical student physical activity participation

Notes On Contributors

Notes on Contributors

Katrina D'Urzo, BKin, MSc is a medical student at the Royal College of Surgeons in Ireland.

Ashley Johnson is currently a PhD candidate at Queen's University in Kingston, Ontario. Ashley is passionate about supporting communities in their health promotion efforts through her research, work and volunteer efforts. Ashley's research focuses on investigating the structures and conditions that contribute to sustainable multi-sector partnerships in community health promotion.

Brittany McEachern has obtained her Master of Science in Physical Therapy and now works as a Registered Physiotherapist at Humber River Hospital in Toronto, Ontario. She continues to be involved in knowledge

translation research and is eager to incorporate research into her clinical practice.

Iain McPhee defended his MSc at Queens in October 2016. He worked for 2 years on Parliament Hill, and is now medical student at McGill University (grad class 2022).

Andrea Brennan is a current postdoctoral fellow at the Translational Research Institute for Metabolism and Diabetes where she focuses on aging, exercise, and bioenergetics using a variety of cellular, clinical, and intervention methodologies.

Alyssa Fenuta is currently completing her doctorate studies in the Human Vascular Control Laboratory investigating nitrate supplementation's influence on oxygen delivery and exercise performance. Within the School of Kinesiology and Health Studies at Queen's University she is also involved as a teaching assistant for the Exercise, Disability and Aging Mini-stream. This undergraduate certificate specialization program is closely affiliated with the Revved Up program where she serves as a personal trainer creating adapted exercise programs for individuals with mobility impairments and intellectual disabilities.

Rebecca Lau was most recently working on her MSc in Biomechanics, investigating how assistive devices affect walking performance.

Dr. Celina Shirazipour is a Research Scientist and Acting Assistant Professor at the Research Center for Health Equity in the Samuel Oschin Comprehensive Cancer Institute of Cedars-Sinai Medical Center. Dr. Shirazipour's area of expertise is behavioral sciences, particularly health promotion and sport and exercise psychology. The overarching goal of her research is to promote physical activity participation for individuals with illnesses and injuries resulting in impairment.

Badr Hefnawi is currently completing his final year in dentistry at McGill University, Montreal, Quebec, Canada. He is also working as a dental officer in the Canadian Armed Forces.

Dr. Jennifer Tomasone's research to date has focused on knowledge translation, or closing research-to-practice gaps, for physical activity behaviour change for persons with physical disabilities and cancer.

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Appendices

None.

Declarations

The author has declared that there are no conflicts of interest.

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Ethics Statement

The study protocol was approved by the Health Sciences Research Ethics Board at Queen's University. During online conference registration, students were able to check a box indicating that they would like to receive information regarding study participation. Students interested in participating were e-mailed and asked to read and sign the Letter of Information/Consent before completing the first online questionnaire. The ethics reference number for this investigation is PHE-152-15.

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