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Perceived Discrimination, Trust in Physicians and Prolonged Symptom Duration before Ovarian Cancer Diagnosis in the African American Cancer Epidemiology Study

Running title: Discrimination and Prolonged Symptoms

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Conflict of interest

All authors report no conflict of interest.

Author Contributions

Megan Mullins conceived of this work, analyzed the data and drafted the initial manuscript. Lauren C. Peres, Anthony J. Alberg, Elisa V. Bandera, Jill S. Barnholtz-Sloan, Melissa L. Bondy, Ellen Funkhouser, Patricia G. Moorman, Edward S. Peters, Paul D. Terry, Ann G. Schwartz, Joellen M. Schildkraut, and Michele L. Cote were responsible for enrolling study participants and data collection. All authors gave substantive feedback on manuscript drafts, approve the final version of this work and agree to be accountable.

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Precis

Racial disparities throughout the ovarian cancer care continuum are well-established and cannot be explained by traditional access to care determinants alone. These results suggest interpersonal barriers like everyday discrimination may contribute to these disparities and warrant further investigation.

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Abstract

Background: Discrimination and trust are known barriers to accessing healthcare. Despite well documented racial disparities in the ovarian cancer care continuum, the role of these barriers has not been examined. This study evaluates the association of everyday discrimination and trust in physicians with a prolonged interval between symptom onset and ovarian cancer diagnosis (hereon referred to as prolonged symptom duration).

Methods: Subjects include cases enrolled in the African American Cancer Epidemiology Study, a multisite case-control study of epithelial ovarian cancer among black women. Logistic regression was used to calculate odds ratios and 95% confidence intervals for associations between everyday discrimination and trust in physicians with a prolonged symptom duration (one or more symptom lasting longer than the median symptom-specific duration), controlling for access to care covariates and potential confounders.

Results: Among 486 cases in this analysis, 302 women had prolonged symptom duration. In the fully adjusted model, a one unit increase in frequency of everyday discrimination increased the odds of prolonged symptom duration 74% (OR 1.74, 95% CI 1.22, 2.49), but trust in physicians was not associated with prolonged symptom duration (OR 0.86, 95% CI 0.66, 1.11).

Conclusions: Perceived everyday discrimination was associated with prolonged symptom duration whereas more commonly evaluated determinants of access to care and trust in physicians were not. These results suggest more research on the effects of interpersonal barriers impacting ovarian cancer care is warranted.

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Keywords

Access to care; racial disparity; ovarian cancer; prolonged symptoms; perceived discrimination

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Introduction

Ovarian cancer is the most lethal gynecologic cancer with less than 50% of women surviving 5 years or longer after their diagnosis.[1] Compared to white women, black women have a lower five-year survival rate for all histologic subtypes of ovarian cancer at all stages of diagnosis.[2] Moreover, compared to 1975 rates, 5-year survival has improved about 10% for white women with ovarian cancer but declined about 5% for black women.[3]

Racial disparities in ovarian cancer care are well-documented at all stages of the care continuum.[4,5] Access to care is one key component of high quality cancer care that may explain differences in ovarian cancer treatment. While health insurance and socioeconomic status (SES) impact access to care, these factors alone fail to account for racial disparities in ovarian cancer treatment.[6,7] Trust in physicians and perceived discrimination are two interpersonal factors that could contribute to these racial differences. Previously unstudied among women with ovarian cancer, these factors are associated with lower healthcare utilization, less preventive screening, non-adherence to care recommendations, and delay in care-seeking in other patient populations.[8–10]

Here, we examine the association between everyday discrimination and trust in physicians with a prolonged interval between symptom onset and ovarian cancer diagnosis

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(hereon referred to as prolonged symptom duration) in the African American Cancer Epidemiology Study (AACES). As depicted in Figure 1, prolonged symptom duration encompasses a series of events that must occur between a symptomatic change in the body and a woman receiving a diagnosis of ovarian cancer. This portion of the care continuum is particularly important for women with ovarian cancer because there is no screening or annual exam with clear guidelines on when to seek care, and ovarian cancer symptoms are non-specific. This places more burden on patients to initiate and continue seeking/accessing care when symptoms do not resolve (Figure 1).[12,13] We hypothesize that low trust in physicians and more frequent perceived discrimination contribute to prolonged symptom duration.

Methods

Study population

The AACES has been described in detail elsewhere.[14] In brief, AACES is a multisite population-based case-control study of ovarian cancer in black women. Study sites include Alabama, Georgia, Illinois, Louisiana, metropolitan Detroit, Michigan, North Carolina, New Jersey, Ohio, South Carolina, Tennessee, and Texas. Institutional review board approval was obtained from all participating sites. Cases were identified via rapid case ascertainment through state or Surveillance, Epidemiology and End Results cancer registries and hospital gynecologic oncology departments, and enrolled between December 2010 and December 2015. Self-identified black women between the ages of 20 and 79 who were newly diagnosed with histologically-confirmed invasive epithelial ovarian cancer and could complete an interview in English were eligible to participate.

Data collection

AACES participants completed a computer-assisted telephone interview. A short version was offered to women who would have otherwise refused to participate. Cases were excluded from this analysis if they had missing data (Figure 2). Confounding variables were selected *a priori* based on published literature. Selected confounders included: age at diagnosis, geographic region, marital status, body mass index (BMI), Charlson Comorbidity Index, education, and income.

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Independent Variables

Perceived discrimination was evaluated using the 5-question version of Williams' Everyday Discrimination Scale (Table 2).[15] We averaged each woman's responses (range 0-5) for the score such that a higher score reflects more frequent discrimination. Scale items were evaluated for internal consistency with Cronbach's alpha.

Trust in physicians was measured with the Trust in Physicians Scale (Table 3).[16] Questions were coded so that a higher score indicated higher trust, and responses were summed across the 11 questions (range 0-55). Scale items were evaluated for internal consistency with Cronbach's alpha.

Outcome

The primary outcome for this study was prolonged symptom duration. Given the lack of symptom specific durations in the literature, we defined prolonged symptom duration relative to other women in the AACES. Women were asked whether/how long in the year prior to diagnosis they had symptoms (Appendix 1). Because each symptom has unique meaning and urgency, and most women do not have all possible symptoms, a median duration was calculated for each symptom only among women who had the symptom. Women who had any symptom longer than the median symptom specific duration were classified as having prolonged symptom duration.

Statistical analyses

Demographic characteristics were summarized using t-tests, Mann Whitney U test (for everyday discrimination and income based on histogram distributions), or X^2 tests to compare distributions between women who had prolonged symptom duration to those who did not. Unconditional multivariable logistic regression was performed to calculate odds ratios (ORs) and 95% confidence intervals (CI) for the associations between trust in physicians and everyday discrimination with prolonged symptom duration (greater than or equal to, ≥, median duration for any symptom).

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The baseline model was adjusted for demographic covariates including age at diagnosis (years), region (North: Ohio, New Jersey, metropolitan Detroit, Michigan, Illinois, and South: Tennessee, Alabama, South Carolina, North Carolina, Georgia and Texas); BMI categories (< 25, 25 to< 30, 30 to <35 and 35+ (kg/m^2)), marital status (single, partnered, widowed/divorced); and modified Charlson comorbidity index (0, 1, 2, 3, 4+). [17] Model 2 was also adjusted for SES measures including education (high school or less, some post high school training, college or graduate degree), and income. Income data were collected using categorical ranges and modeled as the midpoint of each bounded category ($10,000, $17,500, $37,500, $62,500, $87,500, and $100,000). The final model also included measures of access to care including health insurance (Medicare, Medicaid, private, uninsured), not having a regular physician (yes/no), self-reported barrier to seeking care (yes/no), and primary care provider density (number of clinically active primary care providers in primary care referral area/ 100,000 population).[18]

Two sensitivity analyses were performed using different definitions of prolonged symptom duration. Overall median symptom duration and overall mean symptom duration were used as cut points to define the outcome indicator instead of symptom specific durations. Time to interview was also evaluated as a possible source of bias.

Statistically significant p-values were considered <0.05, and all analyses were performed using SAS version 9.4 (SAS Institute).

Results

Median symptom duration and symptom frequency are presented in Appendix 1. This resulted in 302 women who had prolonged symptom duration and 184 women who did not. On average, women had three symptoms lasting longer than the median duration.

Descriptive characteristics are presented in Table 1. On average, women were diagnosed in their late 50's and obese (BMI > 30 kg/m^2). Most women reported having a regular family physician and were insured by private health insurance or Medicare. The average supply of clinically active primary care providers in their primary care service area was about 70

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providers/100,000 population, and 80% of women reported no barriers to seeking care (Table 1).

We observed measurable differences in the Charlson index, marital status, self-reported barriers to care-seeking, attitudes towards physicians, and perceived discrimination between women who did and did not experience prolonged symptom duration. The proportion of women with a Charlson index of four or more was three times greater among women with symptom delay compared to those without (Table 1).

Women with prolonged symptom duration had lower trust in physician scores, and both groups had response averages below "agree" (response sum=44) across the 11 questions. Women with prolonged symptom duration also had more frequent experiences of everyday discrimination. Both groups had average discrimination scores between zero and one, which reflects an average discrimination frequency between never and less than once a year ($p<0.001$).

The distribution of responses to the everyday discrimination scenarios in the interview are displayed in Table 2. Notably, 32% of women reported being treated with less courtesy or respect than other people, 33% perceived receiving poorer service than other people at restaurants or stores, and 32% felt people act as if they were not smart. Cronbach's alpha for the everyday discrimination scale was 0.73 in this analytic sample.

Table 3 presents the trust in physicians statements and responses. Generally responses more frequently indicated trust; however, several scenarios had substantial numbers of responses indicating low trust (Table 3). Cronbach's alpha for the trust in physicians scale was 0.92 in this analytic sample.

Table 4 presents the ORs (and 95% CI) from the multivariable logistic regression models for prolonged symptom duration. Model one is adjusted for demographic characteristics. A one unit increase in the everyday discrimination score (e.g., from never to almost monthly) was associated with 77% higher odds of prolonged symptom duration (OR 1.77, 95% CI 1.25, 2.52). Trust in physician was not associated with increased risk of symptom duration (OR 0.86, 95% CI 0.67-1.11). Further adjustment for measures of socioeconomic status, including education and

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income, resulted in little change in the strength of the associations for discrimination and trust (Table 4, Model 2). Further, accounting for access to care covariates resulted in a negligible change in the magnitude of the association for discrimination (OR 1.74, 95% CI 1.22, 2.49) and physician trust (OR 0.68, 95% CI 0.45-1.20) (Table 4, Model 3).

Noteworthy associations for other variables included in the fully adjusted model were observed. Women with Charlson index 4+ had 4.6 times the odds of prolonged symptom duration compared to women with no co-morbid conditions (OR 4.62, 95% CI 2.12-10.1). Compared to single women, divorced or widowed women had twice the odds of prolonged symptom duration (OR 2.09, 95% CI 1.24, 3.54). Having a self-reported barrier to going to the doctor increased the odds of prolonged symptom duration 96% (OR 1.96, 95% CI 1.10, 3.50).

In sensitivity analyses, no meaningful changes to the results were observed with the different definitions of outcome, except for one covariate, self-reported barriers to care, where the previously observed association was no longer present (data not shown). There was no association between prolonged symptom duration and time to interview in models, nor did including time to interview as a covariate in models change results.

Discussion

In summary, in this sample of 486 black women with ovarian cancer, everyday discrimination, was associated with prolonged symptom duration. Particularly noteworthy was our finding that despite reflecting broader everyday life context, more frequent everyday discrimination increased the odds of prolonged symptom duration 74% in fully-adjusted models, but health system-specific trust in physicians was not associated with prolonged symptom duration. This finding is important because material components for accessing care have not been sufficient in explaining racial disparities in ovarian cancer care, and this is the first study to evaluate possible interpersonal contributions.

While perceived discrimination has not previously been evaluated in women with ovarian cancer, our results are consistent with findings in other populations.[19,20] Although our findings reflect a specific pre-diagnostic window, perceived discrimination has similarly been associated with delay in breast cancer diagnosis after an abnormal mammogram.[9] These results

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align with the Casagrande et al. study finding discrimination experiences were associated with prolonged symptom duration and non-adherence to medical recommendations.[10]

In contrast, other studies have not found an association between perceived discrimination and low healthcare engagement, or have found the opposite relationship.[19,21] These mixed findings are likely due to differences in the burden of comorbid conditions, racial identity of study participants, and measures of healthcare utilization. Many studies evaluate routine or preventive services with a clear guideline for care-seeking. However, seeking care for ovarian cancer symptoms relies more heavily on patient perception and often, persistence.[12,13] Although the individual symptoms are non-specific, combinations of symptoms, onset, and intensity of symptoms can be important indicators of disease.[11]

The Everyday Discrimination scale showed reasonable internal consistency in this analysis, particularly given that the scale has only five items. Although everyday discrimination was modeled as a mean score, to better understand these findings, each discrimination scenario was modeled separately (results not shown), and "people act as if I am not smart" was the only scenario associated with prolonged symptom duration. This suggests one mechanism of this relationship may be stereotype threat, defined as, "a disruptive psychological state that people experience when they feel at risk for confirming a negative stereotype associated with their social identity."[22] Stereotype threat is associated with increased stress, cognitive burden, avoidance of situations that induce the threat, and lower healthcare utilization.[22,23] It may also underlie increased distrust of physicians and lower healthcare satisfaction.[22,23]

Trust in physicians was not associated with prolonged symptom duration. It is well-established that black patients are more likely to mistrust the healthcare system compared to white patients.[24] Because this analysis was limited to black women, trust may contribute less variation. Other studies suggest trust in physicians is predicted by perceived discrimination.[25] In our analysis, bivariate tests did not support discrimination as a mediator of physician trust (data not shown), and trust was not highly correlated with everyday discrimination score (r=-0.11).

Finally, two confounders had significant associations with prolonged symptom duration. Having a 4+ Charlson index had the largest association with prolonged symptom duration in this

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analysis. These findings are expected as many ovarian cancer symptoms overlap with a wide range of health issues. This association likely reflects a masking effect, in which poorer health makes it more difficult to identify symptoms attributable to ovarian cancer. Similarly, women who lost a spouse by either death or divorce were twice as likely as single women to have prolonged symptom duration. This may reflect a decline in mental health or a change in social support.[26]

This study has several strengths. The AACES provides an unprecedented sample size of black women with ovarian cancer. This study was uniquely positioned to analyze previously un-addressed exposures among women with ovarian cancer. Although several studies have documented disparities in ovarian cancer survival and treatment, most data have come from medical claims where studying interpersonal exposures was not possible. Also, our primary exposure measures were validated multi-item scales, which have been found to be more reliable than single item measures.[27] These measures also showed good internal consistency in this analytic dataset. Finally, we used a symptom specific approach which reflects the complexity of changes in the body and their different associated meanings.[28]

Limitations

Study participants were slightly younger and healthier than non-participants which may limit generalizability of these findings, though this is a common challenge in ovarian cancer studies.[14]

Prolonged symptom duration reflects several components (Figure 1). However, it would be nigh impossible to disaggregate this outcome without a prospective design. Although our outcome cannot parse the individual contributions of this time period apart, it reflects a longer time period before diagnosis that could be acted upon. Despite steps in health system control such as timely appointment availability or misattribution of symptoms to other diseases, patient self-efficacy and persistence in pursuing resolution of symptoms are key drivers to navigating those barriers.[12,13]

The outcome measure also relied upon retrospectively reported symptoms. Though measurement error is possible, all participants were recalling symptoms from the recent past so

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this is unlikely to introduce bias. Including time to interview did not impact results and the duration of symptoms in our study are in line with previous findings.[11]

These data were collected cross-sectionally and could be subject to reverse causation. A woman who experienced a prolonged symptom duration despite prompt care-seeking may possibly perceive more discrimination due to her healthcare experience. Our hope is that the discrimination measure, which assessed specific everyday experiences rather than healthcare experiences, minimizes this possible bias.

Finally, discrimination and trust are sensitive topics to ask about in a research survey. These sections were placed towards the end of the survey to allow the interviewer and respondent to develop rapport before approaching them. Despite this, non-response to the trust in physicians section of the questionnaire was the largest exclusion after questionnaire length (Figure 2). These women had higher everyday discrimination scores, but they were not more likely to have prolonged symptom duration, suggesting any selection bias is likely to be minimal.

Conclusion

This work is a novel first step in understanding the relationship between interpersonal exposures and racial disparities in ovarian cancer care. More equitable access to ovarian cancer care necessitates women feeling comfortable to advocate for their needs and trusting their self-assessment of their symptoms. These results point to the social context in daily life playing a role in receiving optimal ovarian cancer care, and suggest more research is needed on the effects of interpersonal barriers in the ovarian cancer care continuum. Future work should include other racial and ethnic groups and consider the role of health providers.

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Table 1: Characteristics of women with and without a prolonged symptom duration in the African American Cancer Epidemiology Study (AACES)

	Prolonged symptom duration (n=302)	Non-prolonged symptom duration (n=184)	P-value
	N (%) or mean (SD)	N (%) or mean (SD)	
Age in years	58.1 (10.5)	57.3 (11.1)	0.40
Histology			0.55
Serous	174 (57.6)	111 (60.3)	
Mucinous	17 (5.6)	7 (3.8)	
Endometrioid	37 (12.3)	20 (10.9)	
Clear Cell	11 (3.6)	3 (1.6)	
Other	63 (20.9)	43 (23.4)	
Stage			0.21
I	67 (22.2)	38 (20.7)	
II	34 (11.3)	15 (8.1)	
III	168 (55.6)	99 (53.8)	
IV	17 (5.6)	20 (10.9)	
Un-staged	16 (5.3)	12 (6.5)	
Region			0.74
North	65 (21.5)	42 (22.8)	
South	237 (78.5)	142 (77.2)	

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Marital status			0.003
Single	58 (19.2)	56 (30.4)	
Partnered	97 (32.1)	64 (34.8)	
Widowed/Divorced	147 (48.7)	64 (34.8)	
Charlson index			<0.001
0	92 (30.4)	86 (46.7)	

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Table 1 continued

	Prolonged symptom duration (n=302)	**Non-prolonged symptom duration (n=184)**	**P-value**
	N (%) or mean (SD)	**N (%) or mean (SD)**	
1	74 (24.5)	44 (23.9)	
2	51 (16.9)	25 (13.6)	
3	31 (10.3)	18 (9.8)	
4+	54 (17.9)	11 (6.0)	
Body mass index (kg/m^2)			0.15
<25	37 (12.3)	35 (19.0)	
25-<30	77 (25.5)	47 (25.5)	
30-<35	88 (29.1)	54 (29.4)	
35+	100 (33.1)	48 (26.1)	
Annual Household income ($10,000)	4.00 (3.0)	3.87 (2.8)	0.92[†]
Education			0.70
High school or less	126 (41.7)	84 (45.6)	
Some post high school training	79 (26.2)	45 (24.5)	
College or graduate degree	97 (32.1)	55 (29.9)	
Have regular physician			0.67
Yes	265 (87.7)	159 (86.4)	

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Table 1 continued

No	37 (12.3)	25 (13.6)	
Self-reported barrier to seeking care			0.02
Yes	70 (23.2)	27 (14.7)	
No	232 (76.8)	157 (85.3)	
Primary care provider density (per 100,000 pop.)	70.9 (19.8)	69.8 (17.0)	0.52
	Prolonged symptom duration (n=302)	**Non-prolonged symptom duration (n=184)**	**P-value**
	N (%) or mean (SD)	**N (%) or mean (SD)**	
Insurance			0.86
Private	116 (38.4)	75 (40.8)	
Medicare	90 (29.8)	49 (26.6)	
Medicaid	64 (21.2)	42 (22.8)	
Uninsured	32 (10.6)	18 (9.8)	
Total trust in physician score	41.3 (8.4)	42.7 (7.0)	0.06
Mean everyday discrimination score	0.53 (0.72)	0.31 (0.52)	< 0.001[†]

[†] Mann Whitney U test used due to distribution

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Table 2: Everyday discrimination scenario frequencies in the AACES

Discrimination Scenario[†]	Number of AACES participants
You are treated with less courtesy or respect than other people.	
Almost everyday	13 (2.7)
At least once a week	5 (1.0)
A few times a month	17 (3.5)
A few times a year	38 (7.8)
Less than once a year	84 (17.3)
Never	329 (67.7)
You receive poorer service than other people at restaurants or stores.	
Almost everyday	0 (0.0)
At least once a week	4 (0.8)
A few times a month	11 (2.3)
A few times a year	54 (11.1)
Less than once a year	89 (18.4)
Never	326 (67.4)
People act as if they think you are not smart.	
Almost everyday	9 (1.9)
At least once a week	6 (1.2)
A few times a month	22 (4.5)
A few times a year	46 (9.5)
Less than once a year	74 (15.3)
Never	327 (67.6)
People act as if they are afraid of you.	
Almost everyday	9 (1.9)
At least once a week	4 (0.8)
A few times a month	10 (2.1)
A few times a year	22 (4.5)

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Less than once a year	22 (4.5)
Never	418 (86.2)
You are threatened or harassed.	
Almost everyday	1 (0.2)
At least once a week	3 (0.6)
A few times a month	5 (1.0)
A few times a year	11 (2.3)
Less than once a year	25 (5.2)
Never	440 (90.7)

† May not sum to total due to missing responses on some discrimination scenarios

Table 3: Trust in physicians response frequencies in the AACES

Trust in physician scenario	**Number of AACES Participants**
I doubt that my doctor really cares about me as a person †	
Strongly disagree	168 (34.5)
Disagree	226 (46.5)
Neither agree nor disagree	30 (6.2)
Agree	48 (9.9)
Strongly Agree	14 (2.9)
My doctor is usually considerate of my needs and puts them first	
Strongly disagree	12 (2.4)
Disagree	34 (7.0)
Neither agree nor disagree	28 (5.8)
Agree	261 (53.7)
Strongly Agree	151 (31.1)
I trust my doctor so much I always try to follow his/her advice	
Strongly disagree	9 (1.8)
Disagree	31 (6.4)

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Neither agree nor disagree	53 (10.9)
Agree	272 (56.0)
Strongly Agree	121 (24.9)
If my doctor tells me something is so, then it must be true	
Strongly disagree	15 (3.1)
Disagree	94 (19.3)
Neither agree nor disagree	98 (20.2)
Agree	227 (46.7)
Strongly Agree	52 (10.7)
I sometimes distrust my doctor's opinion and would like a second one [†]	
Strongly disagree	58 (11.9)
Disagree	218 (44.9)
Neither agree nor disagree	49 (10.1)
Agree	137 (28.2)
Strongly Agree	24 (4.9)
I trust my doctor's judgements about my medical care	
Strongly disagree	10 (2.1)
Disagree	35 (7.2)
Neither agree nor disagree	33 (6.8)
Agree	304 (62.5)
Strongly Agree	104 (21.4)

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Trust in physician scenario	**Number of AACES Participants**
I feel my doctor does not do everything he/she should for my medical care [†]	
Strongly disagree	82 (16.9)
Disagree	272 (56.0)
Neither agree nor disagree	38 (7.8)
Agree	70 (14.4)
Strongly Agree	24 (4.9)
I trust my doctor to put my medical needs above all other considerations when treating my medical problems	
Strongly disagree	10 (2.1)
Disagree	35 (7.2)
Neither agree nor disagree	40 (8.2)
Agree	306 (62.9)
Strongly Agree	95 (19.6)
My doctor is a real expert in taking care of medical problems like mine	
Strongly disagree	16 (3.3)
Disagree	54 (11.1)
Neither agree nor disagree	57 (11.7)
Agree	264 (54.3)
Strongly Agree	95 (19.6)
I trust my doctor to tell me if a mistake was made about my treatment	
Strongly disagree	10 (2.1)
Disagree	59 (12.1)
Neither agree nor disagree	59 (12.1)
Agree	276 (56.8)
Strongly Agree	82 (16.9)
I sometimes worry that my doctor may not keep the	

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information we discuss totally private †	
Strongly disagree	136 (28.0)
Disagree	293 (60.3)
Neither agree nor disagree	36 (7.4)
Agree	18 (3.7)
Strongly Agree	3 (0.6)

† Responses coded so a higher score indicates higher trust

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Table 4 continued

Table 4: Adjusted ORs for the associations between trust in physicians and everyday discrimination with prolonged symptom duration in the AACES

	Model 1[†]	**Model 2**[‡]	**Model 3**[§]
	OR (95% CI)	OR (95% CI)	OR (95% CI)
Trust in physician score (10 units)	0.86 (0.67, 1.11)	0.84 (0.65, 1.09)	0.86 (0.66, 1.11)
Mean discrimination score	1.77** (1.25, 2.52)	1.75**(1.23, 2.48)	1.74** (1.22, 2.49)
Age (years)	1.00 (0.98, 1.02)	1 (0.98, 1.02)	1 (0.98, 1.02)
Region			
South	1.0 (Reference)	1.00 (Reference)	1.00 (Reference)
North	0.82 (0.51, 1.32)	0.78 (0.48, 1.26)	0.7 (0.41, 1.21)
Marital Status			
Single	1.00 (Reference)	1.00 (Reference)	1.00 (Reference)
Partnered	1.41 (0.84, 2.38)	1.29 (0.75, 2.22)	1.34 (0.77, 2.34)
Divorced/Widowed	2.06** (1.23, 3.46)	2.03** (1.21, 3.42)	2.09** (1.24, 3.54)
BMI (kg/m^2)			
<25	1.00 (Reference)	1.00 (Reference)	1.00 (Reference)
25-<30	1.48 (0.80, 2.73)	1.51 (0.81, 2.82)	1.55 (0.83, 2.93)
30-<35	1.33 (0.73, 2.44)	1.34 (0.73, 2.46)	1.31 (0.70, 2.44)
35+	1.52 (0.82, 2.80)	1.56 (0.84, 2.89)	1.55 (0.83, 2.90)
Charlson Index			
0	1.00 (Reference)	1.00 (Reference)	1.00 (Reference)
1	1.43 (0.87, 2.36)	1.46 (0.89, 2.40)	1.48 (0.89, 2.46)
2	1.73 (0.96, 3.11)	1.8 (0.99, 3.27)	1.73 (0.94, 3.18)
3	1.31 (0.66, 2.60)	1.39 (0.69, 2.78)	1.32 (0.65, 2.72)
4+	4.13** (1.96, 8.72)	4.45** (2.09, 9.47)	4.62** (2.12, 10.1)
Education			
College or	--	1.00 (Reference)	1.00 (Reference)

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Table 4 continued

graduate degree			
Some post high school training	--	1.03 (0.60, 1.76)	1.07 (0.62, 1.85)
≤High school	--	0.82 (0.49, 1.40)	0.85 (0.49, 1.45)
	Model 1[†]	**Model 2**[‡]	**Model 3**[§]
	OR (95% CI)	OR (95% CI)	OR (95% CI)
Income ($10,000)	--	1.04 (0.95, 1.13)	1.06 (0.97, 1.16)
Insurance			
Private	--	--	1.00 (Reference)
Medicare	--	--	1.08 (0.59, 1.96)
Medicaid	--	--	0.99 (0.53, 1.86)
Uninsured	--	--	1.15 (0.53, 2.48)
No Regular Physician	--	--	0.91 (0.48, 1.73)
Barrier to care seeking	--	--	1.96[*] (1.10, 3.50)
Primary care provider density (10 physicians per 100,000 population)	--	--	1.06 (0.94, 1.19)

[†]Model 1: trust in physician score, mean everyday discrimination score, age, region, marital status, BMI, Charlson co-morbidity index

[‡]Model 2: trust in physician score, mean everyday discrimination score, age, region, marital status, BMI, Charlson co-morbidity index, education, income

[§]Model 3: trust in physician score, mean everyday discrimination score, age, region, marital status, BMI, Charlson co-morbidity index, education, income, insurance, no regular physician, barrier to care-seeking, primary care provider density

[*]$p < 0.05$

[**] $p < 0.01$

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Table 4 continued

Figure Legends

Figure 1: Patient flow prior to ovarian cancer diagnosis

Figure 2: Patient exclusion flow diagram

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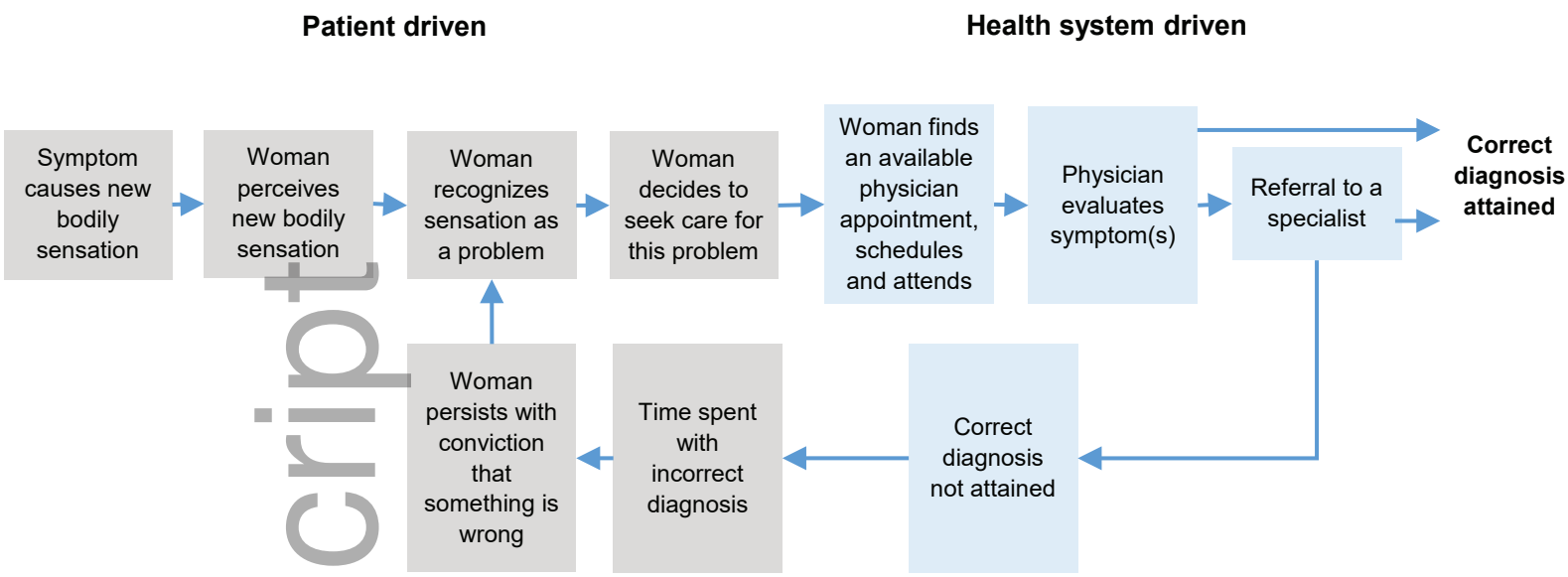

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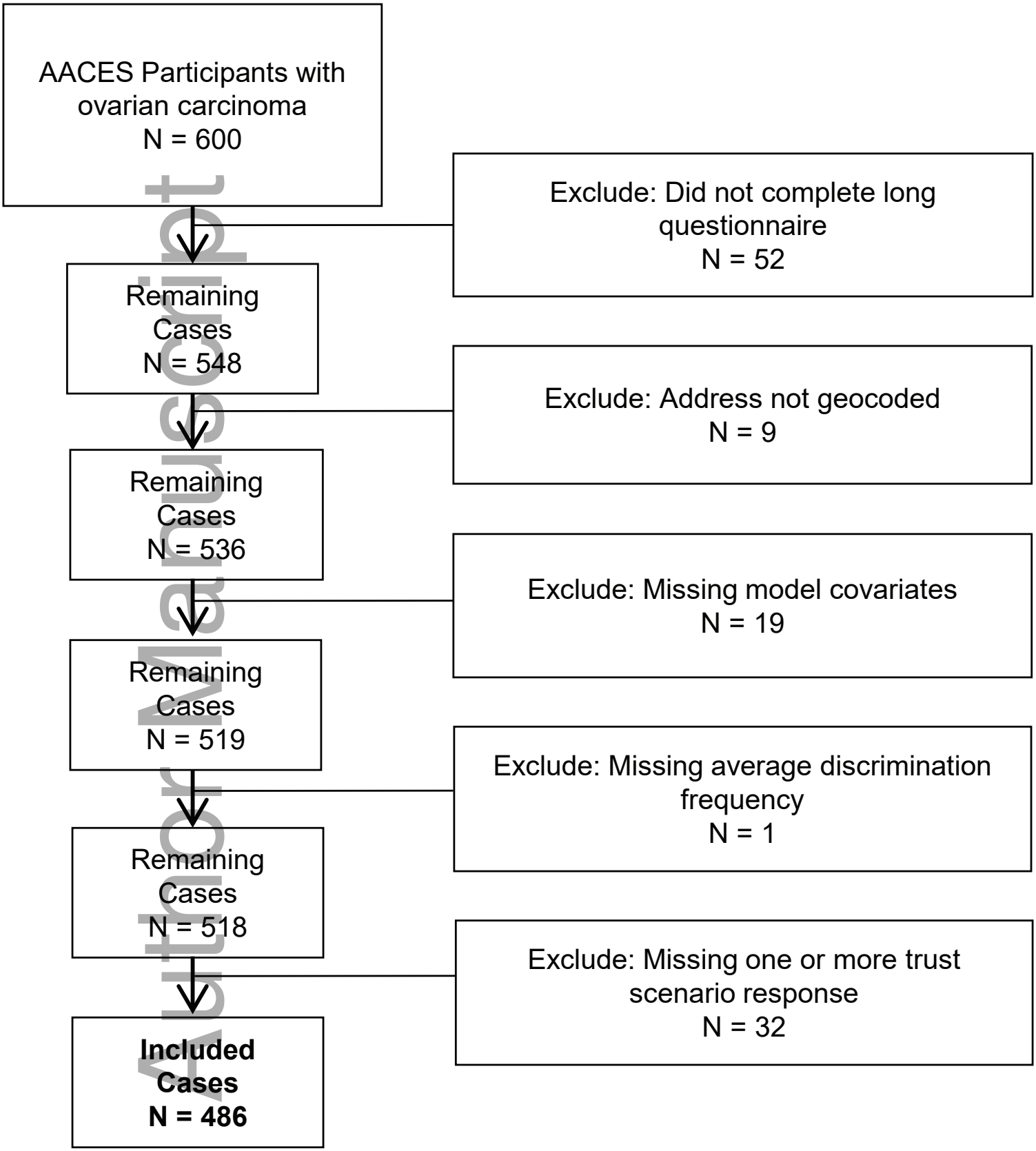

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