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Adherence to adjuvant endocrine therapy among White British and ethnic minority breast cancer survivors in the United Kingdom

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Abstract

Objective: Around half of women do not take adjuvant endocrine therapy (AET) as prescribed. Research suggests that adherence rates vary across ethnic groups. This study compared AET adherences rates in White British women and women from minority ethnic groups in the United Kingdom.

Methods: This is an observational study with 2001 breast cancer survivors recruited from outpatient clinics. Eligible women were diagnosed with primary breast cancer and prescribed AET within the last 3 years. Adherence was measured using the Medication Adherence Rating Scale. Eligible women were asked to complete a questionnaire pack that collected sociodemographic data such as age, relationship status and ethnicity. Independent samples t tests and χ^2 tests were used to compare White British women and women from minority ethnic groups on self-reported adherence to AET.

Results: Of White British women, 27.8% were classed as non-adherent, compared to 44.4% of women from minority ethnic groups. A logistic regression controlling for relevant demographics indicated that women from minority ethnic groups had a significantly higher risk of non-adherence than women who were White British (odds ratio $= 1.50$, $p = 0.03$)

Conclusion: Rates of non-adherence to AET are higher in women from minority ethnic groups, which may contribute towards racial disparities in breast cancer outcomes. Research with larger and more diverse samples is needed to explore this further and to investigate the psychosocial factors driving differences in adherence.

KEYWORDS
aromatase inhibitor, breast neoplasms, cancer, ethnic groups, patient adherence, tamoxifen

1 | INTRODUCTION

Breast cancer is the most common cancer in women in the United Kingdom with approximately 55,000 cases diagnosed each year (Breast Cancer UK, 2021) and around 2.3 million cases diagnosed worldwide in 2020 (Sung et al., 2020). Although exact figures are hard to obtain due to poor reporting of ethnicity within the NHS, there is consistent evidence to show that overall incidence of breast cancer is higher in White women (Gathani et al., 2014; Gathani, Chaudhry, et al., 2021; NCRAS, 2021; Shirley et al., 2014) although incidence in younger women (<50 years) is equal across White and Black women (DeSantis et al., 2014; Smigal et al., 2006; Stapleton et al., 2018). Despite overall lower incidence, inequalities in breast cancer outcomes and survival by race or ethnicity have been consistently shown across both the United States and the United Kingdom, with women from Black African and Black Caribbean backgrounds having been shown to have significantly lower odds of survival in comparison with White women (Davies et al., 2013; Møller et al., 2016; Silber et al., 2013).

Younger Black women tend to be diagnosed at a later stage, with more aggressive tumours such as triple-negative phenotype and with more metastases than White women (Hirko et al., 2022; Stringer-Reasor et al., 2021). However, although inequalities in survival are partially explained by differences in tumour biology, stage of presentation and socio-economic status (Carey et al., 2006; Linnenbringer et al., 2020; O'Brien et al., 2010; Shariff-Marco et al., 2015; Silber et al., 2013; Warner et al., 2015), residual disparities remain after controlling for these factors. Although the reasons for this currently remain unclear, there is likely to be a complex interplay between physiological and pharmacokinetic differences, systemic barriers to timely diagnosis and treatment, and health behaviours, which are influenced by psychosocial, geopolitical and cultural factors (Smigal et al., 2006).

One important health behaviour, which is relatively under-studied and may help to explain inequalities in outcomes, is differences in adherence to cancer treatment (Roberts et al., 2015; Warner et al., 2015). Adjuvant endocrine therapy (AET) is prescribed for up to 10-years post-primary treatment and has been shown to reduce the risk of recurrence by 40% and mortality by a third in oestrogen receptor positive early breast cancer (EBCTCG, 2011). However, research suggests that 28%–59% of women do not take their AET as prescribed for the full duration, resulting in significantly reduced survival (Hershman et al., 2011; Murphy et al., 2012). Some clinical-demographic factors have been identified as being related to treatment adherence and could provide useful screening indicators. There is inconsistent evidence for the role of clinical factors such as being prescribed tamoxifen, longer time since initial prescription and having had a mastectomy and/or chemotherapy, in driving AET non-adherence (Moon, Moss-Morris, Hunter, Carlisle, & Hughes, 2017; Moon, Moss-Morris, Hunter, & Hughes, 2017). However, some demographic factors such as younger age and being from a minority ethnic group have more consistently been associated with AET non-adherence (Brett et al., 2018; Farias et al., 2018; Moon, Moss-Morris, Hunter, Norton, et al., 2019). Several studies have highlighted that women from minority ethnic groups demonstrate higher levels of non-adherence and lower initiation rates of AET compared to White women in the United States (Farias et al., 2018; Hershman et al., 2015). For example, in a sample of over 10,000 women in the United States, Black women were around 25% more likely to be non-adherent than White women (Hershman et al., 2015). Another study of over 18,000 women in the United States found that Black women had significantly lower initiation rates to their AET than White women (Camacho et al., 2017). However, there is very limited research exploring potential differences in adherence behaviours between women of differing ethnicities and cultural backgrounds in the United Kingdom. Minority ethnic communities in the United Kingdom may not be comparable with those in the United States due to differences in patterns of migration, cultural backgrounds and disparate healthcare systems, which present different challenges (Gathani, Chiuri, et al., 2021). Exploring whether these differences are also present in a UK sample may be an important part of understanding and improving racial/ethnic disparities in cancer outcomes (Farias et al., 2018).

Furthermore, as research carried out in the United States typically utilises insurance data to calculate the medication procession ratio to define (non)adherence, little is known about the pattern of or motivation behind non-adherence. Identifying both intentional non-adherence, where patients make an active decision to not take their medication, and unintentional non-adherence, where patients may miss their medication due to forgetfulness or lack of understanding (Unni & Farris, 2011), allows for tailored support to address the drivers of non-adherence (Moon et al., 2021). This distinction has not been investigated in the United Kingdom or the United States to our knowledge, making the current study novel in providing essential information to better tailor interventions to change behaviour and improve outcomes.

The aim of this study is to compare self-reported AET adherence rates across White British women and women from minority ethnic groups in a large UK community sample. The study will explore both intentional and unintentional non-adherence. This study is one of the first to report detailed behaviours of AET adherence across ethnic groups in the United Kingdom within a naturalistic community setting, providing essential real-world data beyond clinical trials which tend to overestimate adherence (van de Velde et al., 2011). Based on previous research, we hypothesise that women from minority ethnic groups will report lower adherence to AET than White British women after controlling for clinical and demographic factors.

2 | METHODS

2.1 | Participants and procedures

Cross-sectional analyses of baseline data from a longitudinal, multicentre observational study are presented. There were 2009 women recruited from outpatient breast clinics across 18 different National Health Service (NHS) trusts in England and Wales. Eligible participants were female, over the age of 18, diagnosed with primary breast cancer

and prescribed AET within the last 3 years. Participants were excluded if they were under the age of 18, had secondary breast cancer and were not prescribed AET within the last 3 years. Eligible participants were given written and verbal information about the study. Informed consent was obtained from all participants who then completed the baseline questionnaire on paper or via a secure online survey platform (Online Surveys, Jisc). This study followed current guidelines for ethical research and was given approval by London—City and East Research Ethics Committee (18/LO/1674).

2.2 | Materials

Participants self-reported data on clinical (stage at diagnosis, comorbidities, previous treatment and current treatment), demographic (age, ethnicity, employment status, age left full-time education, relationship status and menopausal status at diagnosis) and treatment-related factors (previous treatment, date prescribed AET and duration of AET treatment). Ethnicity was coded using 2011 UK census categories (Office National Statistics, 2021). Socio-economic status was measured using the UK Government measure of relative neighbourhood; the Index of Multiple Deprivation (IMD) (Noble et al., 2019). The IMD is ranked into five different groups from 1 (*most deprived*) to 5 (*least deprived*).

2.2.1 | Adherence

Adherence was measured using the Medication Adherence Rating Scale (MARS) (Horne et al., 2001), which includes five statements and is scored on a 5-point scale from never to always with higher scores indicating better adherence (range 5–25). The measure includes questions on both intentional (4 items, range 4–20) and unintentional non-adherence (1 item, range 1–5). As the scale was positively skewed towards higher adherence, it was dichotomised into a total score of adherent (score of 25) vs non-adherent (score 24 or below), an unintentional non-adherence score of unintentionally non-adherent (score 4 or below) versus adherent (score of 5), and an intentional non-adherence score of intentionally non-adherent (score 19 or below) and adherent (score of 20), as recommended by previous research (de Vries et al., 2014). The scale has demonstrated good internal reliability and test–retest reliability across a range of conditions (Horne et al., 2001) including breast cancer (Boonstra et al., 2013). In this sample, Cronbach's alpha for the MARS total (0.523) and MARS intentional (0.566) scales are below the generally accepted threshold of 0.7, although the justification for the requirement of 0.7 is unspecified (Helms et al., 2006). However, scale length (Cronbach, 1951; Voss et al., 2000) and non-normal distribution (Helms et al., 2006) can both reduce Cronbach's alpha considerably without necessarily representing a lack of reliability. Coupled with good reported concordance with objective measures of medication taking (Inauen et al., 2017; O'Carroll et al., 2013) and its suitability for the research question, analysis proceeded.

2.3 | Statistical methods

Statistical analyses were performed using SPSS v26. Descriptive statistics were generated to determine the means, standard deviations and frequencies of clinical and demographic data. Missing data were less than 5% and were handled by pro-rating (mean imputation), allowing for total scores to be calculated.

A one-way ANOVA of total MARS scores was carried out to test for significant differences between the five ethnic groups (see Appendix A). No significant differences were seen across the groups that were not White British (White other, Mixed, Asian, Black and other groups). We therefore followed the UK Government guidance, which suggests using the phrase 'ethnic minorities' to refer to all ethnic groups that are not White British (GOV.UK, 2021). Independent samples t tests and χ^2 tests were used to compare White British women and women from minority ethnic groups on adherence to AET (total, intentional and unintentional) and on clinical and demographic variables (age, age left education, relationship status, IMD, employment status, presence of comorbidity, stage at diagnosis, time since diagnosis, menopausal stage at diagnosis, previous treatment and current treatment). A 5% alpha level was applied throughout. Hierarchical logistic regressions were carried out to examine the association between ethnicity and adherence while controlling for relevant clinical and demographic factors, which had shown an association with adherence via Pearson's correlation.

3 | RESULTS

3.1 | Descriptive statistics

A total of 2009 women responded to the survey (response rate of 64%). Eight people did not provide their ethnicity and were therefore removed from the analysis, leaving a sample of 2001. From them, 91.8% ($n = 1845$) were from a White British background, 4% ($n = 80$) were from White other backgrounds, 0.9% ($n = 19$) were from mixed or multiple ethnic backgrounds, 1.1% ($n = 23$) from Asian or Asian British backgrounds, 0.9% ($n = 19$) from Black, African, Caribbean or Black British backgrounds and 0.7% ($n = 15$) from other ethnic groups. A total of 7.8% ($n = 157$) of participants were classified as from a minority ethnic group. The mean age of the total sample was 60.54 ($SD = 11.27$). Women from minority ethnic groups were significantly younger ($M = 53.67$, $SD = 10.93$) than White British women ($M = 61.11$, $SD = 11.11$) (Table 1). The majority of women were married/in a civil partnership (63.2% and 58.4%). The majority (42.1%) of White British women were retired whereas the majority of women from minority ethnic groups were in full-time employment (54.3%). Women from minority ethnic groups left full-time education at an older age than White British women. Over two thirds of White British women were post-menopausal at diagnosis (68.2%), compared to 42.6% of women from minority ethnic groups. White British women were significantly more likely than women from minority ethnic groups to have been treated with a lumpectomy (67.9% vs. 59.0%),

TABLE 1 Descriptive statistics to compare white British women and women from minority ethnic groups

	White British women, $N = 1845$ (91.8%)	Women from minority ethnic groups, $N = 156$ (7.8%)	p value (t)/ χ^2
Age, mean (*SD*)	61.11 (11.11)	53.67 (10.93)	(t) < 0.001
Age left full-time education, mean (*SD*)	17.78 (4.13)	20.67 (5.85)	(t) < 0.001
Relationship status			(χ^2)0.002
Single	165 (9.0%)	26 (16.9%)	
Married/in a civil relationship/co-habiting	1305 (71.3%)	102(66.2%)	
	180 (9.8%)	7 (4.5%)	
Widowed/separated/divorced	181 (9.9%)	19 (12.3%)	
IMD			(χ^2)0.380
1 (most deprived)	234 (12.9%)	24 (15.9%)	
2	323 (17.8%)	32 (21.2%)	
3	415 (22.9%)	28 (18.6%)	
4	461 (25.4%)	34 (22.5%)	
5 (least deprived)	380 (20.9%)	33 (21.8%)	
Employment status			(χ^2) < 0.001
Employed	756 (41.4%)	83(54.3%)	
Homemaker	89 (4.9%)	7 (4.6%)	
Unemployed (unrelated to breast cancer)	55 (3.0%)	10 (6.5%)	
Retired (unrelated to breast cancer)	768 (42.1%)	25 (16.3%)	
Unemployed/retired (as a result of breast cancer)	80 (4.4%)	15 (9.8%)	
Other	78 (4.3%)	13 (8.5%)	
Presence of comorbidity			(χ^2)0.170
Yes	1027 (55.7%)	78 (50.0%)	
No	817 (44.3%)	78 (50.0%)	
Stage at diagnosis			(χ^2) 0.128
Stage 1	742 (41.2%)	46 (30.5%)	
Stage 2	778 (43.2%)	76 (49.7%)	
Stage 3	201 (11.2%)	22 (14.6%)	
Unsure	79 (4.4%)	8 (5.3%)	
Months since diagnosis (mean, *SD*)	19.52 (11.46)	23.72 (13.38)	(t) < 0.001
Menopausal status at diagnosis			(χ^2) < 0.001
Pre-menopausal	353 (19.7%)	70 (47.3%)	
Menopausal	117 (6.5%)	5 (3.4%)	
Post-menopausal	1224 (68.2%)	63 (42.6%)	
Unsure	102 (5.7%)	10 (6.8%)	
Previous treatment			
Lumpectomy	1253 (67.9%)	92 (59.0%)	(χ^2)0.022
Single mastectomy	532 (28.8%)	65 (41.7%)	(χ^2)0.001
Double mastectomy	63 (3.4%)	2 (1.3%)	(χ^2)0.149
Chemotherapy	654 (35.4%)	75 (48.1%)	(χ^2)0.002
Radiotherapy	1332 (72.2%)	122 (78.2%)	(χ^2)0.106
Current treatment			(χ^2) < 0.001
Tamoxifen	547 (30.0%)	75 (48.7%)	
Anastrozole	435 (23.8%)	27 (17.5%)	
Letrozole	761 (41.7%)	41 (26.6%)	
Exemestane	83 (4.5%)	11 (7.1%)	

Abbreviation: IMD, Index of Multiple Deprivation.

whereas women from minority ethnic groups were significantly more likely to have had a single mastectomy (41.7%) and chemotherapy (48.1%). There were no statistically significant differences in cancer stage at diagnosis.

3.2 | Adherence and ethnicity

Women were categorised as adherent or non-adherent based on their total MARS scores. Adherence rates across different ethnic groups are shown in Figure 1. The highest rates of non-adherence were reported by Black women (66.7%) and women from other minority groups (50.0%). Ethnicity was dichotomised into two groups for further analyses; 'White British' and 'minority ethnic groups', which is consistent with the UK Government guidance, which suggests using the phrase 'ethnic minorities' to refer to all ethnic groups that are not White British (GOV.UK, 2021).

There was a statistically significant association between adherence and ethnicity, with 27.8% of White British women classed as non-adherent, compared to 44.4% of women from minority ethnic groups ($\chi^2 = 18.94$, $p < 0.001$) (Table 2.). Hierarchical logistic regression analysis (Table 3) was conducted, controlling for clinical and demographic variables that correlated with adherence (age, previous treatment, medication job status, age left education, time since diagnosis and IMD). Age was significantly related to adherence with every 1-year increase in age resulting in non-adherence being 0.97 (95% confidence interval [CI] [0.96, 0.98], $p < 0.001$) times less likely. For every 1-month increase in time since diagnosis, there was a 1.01 (95% CI [1.00, 1.02], $p < 0.001$) higher chance of non-adherence. Women who are currently prescribed tamoxifen had significantly higher odds of non-adherence (odds ratio [OR] = 1.40, 95% CI [1.08, 1.79], $p = 0.01$). The effect of ethnicity remained significant after controlling for the above variables; women from minority ethnic groups had significantly higher odds of non-adherence than White British women (OR = 1.48, 95% CI [1.01, 2.16], $p = 0.04$). The logistic regression model was statistically significant, $\chi^2(1) = 4.02$, $p < 0.05$. The model explained 7.9% (Nagelkerke R^2) of the variance in adherence and correctly classified 71.3% of cases.

3.3 | Intentional and unintentional non-adherence

Within each group, unintentional non-adherence was reported more than intentional non-adherence (Figure 2). Women from minority ethnic groups reported significantly higher rates of both intentional ($\chi^2 = 17.80$, $p < 0.001$) and unintentional ($\chi^2 = 11.20$, $p < 0.001$) non-adherence, with women from minority ethnic groups being 2.70 (95% CI [1.67, 4.38]) times more likely to self-report intentional non-adherence and 1.76 (95% CI [1.25, 2.48]) times more likely to self-report unintentional non-adherence than White British women.

4 | DISCUSSION

This study explored differences in self-reported adherence to AET between White British women and women from minority ethnic groups in a UK sample of breast cancer survivors. Results showed that being younger, longer time since diagnosis and being currently

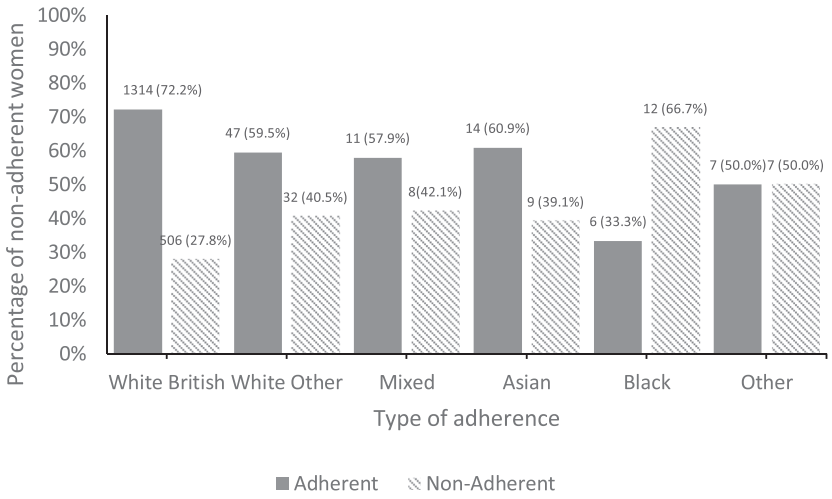

FIGURE 1 Adherence rates across different ethnic groups. *Note*. Adherent (MARS score 25), non-adherent (MARS score of 24 or below). MARS, Medication Adherence Rating Scale.

TABLE 2 Non-adherence to hormone therapy

Adherence to HT	White	Non-White	χ^2 value	Level of significance
Non-adherent	506 (27.8%)	68 (44.4%)	18.94	$p \leq 0.000$
Intentionally non-adherent	111 (6.1%)	23 (15.0%)	17.79	$p \leq 0.000$
Unintentionally non-adherent	464 (25.5%)	58 (37.9%)	11.17	$p \leq 0.001$

Note: Adherent (MARS score 24 and above), non-adherent (MARS score of 23 or below).

TABLE 3 Hierarchical logistic regression to predict non-adherence

	B	S.E.	Wald	Df	Sig.	Exp(B)	95% CI for EXP(B)	
							Lower	Upper
Step 1								
Age	−0.03	0.01	22.26	1.00	0.00	0.97	0.95	0.98
Treatment (lumpectomy)	0.29	0.20	2.17	1.00	0.14	1.34	0.91	1.96
Treatment (single mastectomy)	0.37	0.20	3.40	1.00	0.07	1.44	0.98	2.13
Treatment (chemotherapy)	−0.19	0.12	2.32	1.00	0.13	0.83	0.65	1.05
Medication								
Aromatase inhibitors versus tamoxifen	0.34	0.13	6.87	1.00	0.01	1.40	1.09	1.80
Job status								
Not employed versus employed	0.06	0.13	0.24	1.00	0.62	1.06	0.83	1.37
Age left full-time education	0.02	0.01	1.94	1.00	0.16	1.02	0.99	1.04
Time since diagnosis	0.01	0.00	9.20	1.00	0.00	1.01	1.00	1.02
Deprivation score	0.01	0.02	0.26	1.00	0.61	1.01	0.97	1.05
Step 2								
Age	−0.03	0.01	19.70	1.00	0.00	0.97	0.96	0.98
Treatment (lumpectomy)	0.28	0.20	2.03	1.00	0.15	1.32	0.90	1.94
Treatment (single mastectomy)	0.35	0.20	3.11	1.00	0.08	1.42	0.96	2.10
Treatment (chemotherapy)	−0.18	0.12	2.19	1.00	0.14	0.83	0.66	1.06
Medications								
Aromatase inhibitors versus tamoxifen	0.33	0.13	6.73	1.00	0.01	1.39	1.08	1.79
Job status								
Not employed versus employed	0.08	0.13	0.36	1.00	0.55	1.08	0.84	1.39
Age left-full time education	0.01	0.01	1.05	1.00	0.31	1.01	0.99	1.04
Time since diagnosis	0.01	0.00	8.28	1.00	0.00	1.01	1.00	1.02
Deprivation score	0.01	0.02	0.34	1.00	0.56	1.01	0.97	1.05
Ethnicity	0.39	0.19	4.09	1.00	0.04	1.48	1.01	2.16

Note: Medication (current treatment) was dichotomised into aromatase inhibitors/tamoxifen, job status was dichotomised into not employed/employed, and the deprivation score was treated as a continuous variable, time since diagnosis (months).
Abbreviation: CI, confidence interval.

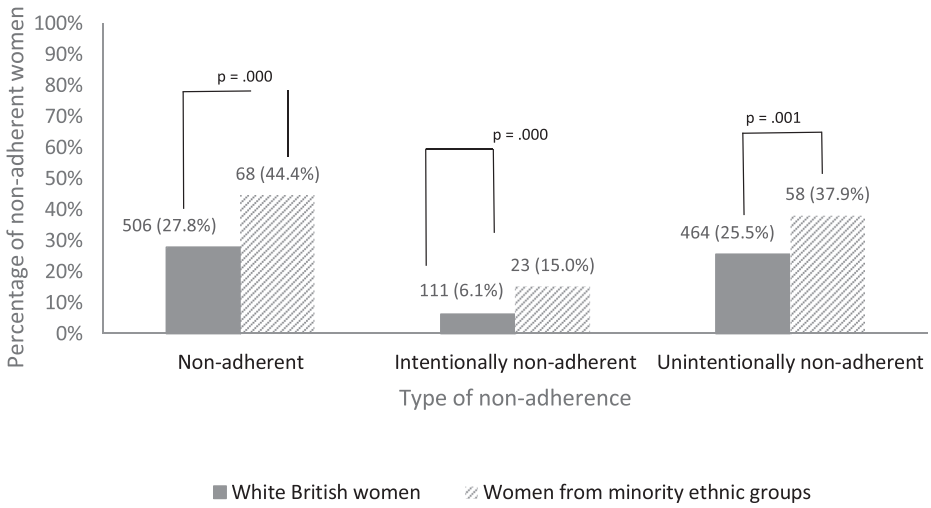

FIGURE 2 Self-reported intentional and unintentional non-adherence rates across different ethnic groups. *Note*. Non-adherent (MARS score of 24 or below). Intentionally non-adherent (4-items, score 19 or below), unintentional non-adherent (1-item, score 4 or below). MARS, Medication Adherence Rating Scale.

prescribed tamoxifen were all related to increased odds of non-adherence, which is consistent with previous research (Brett et al., 2018; Makubate et al., 2013; Yussof et al., 2022). Women from minority ethnic groups were 1.48 times more likely to report non-adherence than White British women, even after controlling for clinical-demographic variables, demonstrating a unique contribution of

ethnicity beyond socio-economic status, younger age or tamoxifen prescription which are known to be related to non-adherence (Linnenbringer et al., 2020; Shariff-Marco et al., 2015). The higher self-reported non-adherence in women from minority ethnic groups is consistent with previous research from the United States (Hershman et al., 2015). It has been suggested that some of the racial disparities in the United States may be explained by financial barriers and reduced access to healthcare (Zavala et al., 2021), so it is of relevance that these differences in adherence are also seen in a country such as the United Kingdom with universal healthcare, and that these differences persist after socio-economic status was controlled for. An important novel contribution of this study was the independent investigation of intentional and unintentional non-adherence with both being more prevalent in women from minority ethnic groups. Unintentional non-adherence or forgetting was 1.76 times more likely to be reported and intentional non-adherence was more than 2.5 times more likely to be reported by ethnic minority women than White British women in the unadjusted analysis. This distinction in adherence behaviour has not been reported previously in ethnic minority groups in the United Kingdom, and results highlight the need to understand the type of non-adherence in order to select appropriate behaviour change interventions, which can be targeted to the specific behavioural outcome (Conn et al., 2014).

Race and ethnicity are social constructs, and it is likely that the observed differences in adherence are driven at least somewhat by cultural differences in the way that breast cancer and its treatment are perceived. For example, there is evidence that cancer beliefs such as perceived risk and fatalistic beliefs differ across different ethnic groups (Assari et al., 2019). The women in the current study from minority ethnic groups were also more likely to have received more invasive primary treatment for their cancer, despite there being no differences in cancer stage at diagnosis, which may have influenced their perceptions of the purpose of their AET, or how necessary it is to prevent a recurrence (Lambert et al., 2018; Partridge et al., 2003). Comorbidity is typically higher and evident at a younger age in ethnic minority groups as a result of socio-economic inequality (Ellis et al., 2018; Lundqvist et al., 2016; Sparano & Brawley, 2021), which may impact on medication beliefs and adherence. Stigma, perceived discrimination and lack of social support (Jones et al., 2014; Kang et al., 2020) might be associated with adherence due to mistrust of healthcare professionals (Fujisawa & Hagiwara, 2015) and have been found to be higher in African American women compared to White women (Jones et al., 2014; Poteat et al., 2021) with perceived empathy from healthcare professionals being lower in women from minority ethnic groups (Moon et al., 2020).

The current results have implications for clinical practice in managing breast cancer survivorship and adjuvant therapy. Clinicians should be aware of the higher potential risk of both intentional and unintentional AET non-adherence in women from ethnic minority groups and provide opportunities for open discussion and problem solving about medication taking to ensure high trust, self-efficacy and perceived need for the treatment. It is now imperative that further research investigates the reasons for non-adherence, to tailor interventions effectively (Conn et al., 2014) and increase cultural sensitivity of healthcare practitioners (Wilhelmsen & Eriksson, 2019) to improve medication adherence. This study also highlights the importance of AET adherence behaviour as a potential contributor to cancer disparities in the United Kingdom. Further exploration is needed across the spectrum of medication taking behaviours, from initiation (Hershman et al., 2015) to forgetting and intentionally missing doses, and early discontinuation (Farias et al., 2018).

4.1 | Study limitations

This was a large nationwide community study and one of the first to our knowledge to explore racial/ethnic differences in AET adherence in the United Kingdom. However, there are several limitations associated with the study. First, although this sample was somewhat representative of the UK breast cancer population, which is largely made up of White British women (NCRAS, 2021), the proportion of women from different minority ethnic groups in this study was small, and we were unable to compare across all different ethnic groups. This is a significant limitation to this study, as there is likely to be substantial diversity across and within each ethnic group (Vrinten, Wardle, & Marlow, 2016). Therefore, research with much more diverse samples is needed. Women from a South Asian background are particularly under-researched, probably because most research is conducted in North America where there are larger populations of people from African American, Hispanic and East Asian backgrounds (Jones et al., 2022). Moving forward, quota sampling should be used to ensure sufficient representation across different ethnic groups. There may also be an element of selection bias as women from minority ethnic groups may have been less likely to agree to participate (Smart & Harrison, 2017). Second, adherence rates were assessed using a self-report measure, which is liable to social desirability bias. The MARS is designed to overcome social desirability bias and is thought to underestimate non-adherence rates (Chan et al., 2020), increasing confidence that those who report non-adherence are truly non-adherent. Additionally, it has been widely used (Brett et al., 2018; Grunfeld et al., 2005) and has been found to be highly correlated with objective measures of adherence (O'Carroll et al., 2013). Although Cronbach's alpha was relatively low in this sample, this is likely due to the non-normal distribution of the scores (Helms et al., 2006) as Cronbach's alpha has been shown to be sensitive to even small deviations from normality, which is common in these types of measures (Wilcox, 1992). Cronbach's alpha is also related to the number of items (Cronbach, 1951; Voss et al., 2000), with fewer items resulting in lower reliability estimates, particularly in scales with fewer than seven items (Swailes & McIntyre-Bhatty, 2002). Researchers should therefore be cautious in relying on Cronbach's alpha solely to determine scale suitability, and lower alpha should be accepted for some outcome measures depending on the data characteristics (Spiliotopoulou, 2009) to avoid scales being wrongly discarded (Tavakol & Dennick, 2011). Due to the above, and the benefit of the MARS differentiating between important different intentional and

unintentional adherence behaviours, these results provide an important indicator to inform future research using alternative measures.

To conclude, the results are some of the first in the United Kingdom to highlight that women from minority ethnic groups may be at increased risk of both intentional and unintentional AET non-adherence, which supports previous research in the United States. The community sample provides real-world data which are essential, particularly as clinical trials tend to underrepresent patients from minority ethnic groups, which limits understanding (Bentley et al., 2017).

More research is needed with more diverse samples to confirm these effects and to gain greater understanding of why they may be occurring. This should allow for better support throughout the healthcare system and the development of interventions specifically targeting modifiable behavioural factors, which may help reduce some of the racial inequalities currently seen in cancer outcomes (Davies et al., 2013; Møller et al., 2016; Silber et al., 2013), particularly in younger women.

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CONFLICT OF INTEREST

The authors declare that they have no conflicts of interest.

DATA AVAILABILITY STATEMENT

Data can be made available from the corresponding author upon reasonable request.

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SUPPORTING INFORMATION

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APPENDIX A

One-way ANOVA to test significance between different ethnic groups on MARS

MARS total	Sum of squares	*df*	Mean square	*F*	Significance
Between groups	43.65	5.00	8.73	6.59	0.00
Within groups	2607.06	1967.00	1.33		
Total	2650.71	1972.00			

Post hoc Bonferroni correction

Ethnic groups		Mean difference (I-J)	Std. error	Sig.	95% confidence interval	
					Lower bound	Upper bound
White British	White other	0.25	0.13	0.85	−0.14	0.64
	Mixed or multiple ethnic groups	1	0.27	0.03	0.05	1.61
	Asian or Asian British	0.13	0.24	1.00	−0.58	0.84
	Black, African, Caribbean or black British	0.96	0.27	0.01	0.16	1.76
	Other ethnic group	0.88	0.31	0.07	−0.03	1.78
White other	White British	−0.25	0.13	0.85	−0.64	0.14
	Mixed or multiple ethnic groups	0.58	0.29	0.72	−0.28	1.45
	Asian or Asian British	−0.13	0.27	1.00	−0.93	0.68
	Black, African, Caribbean or black British	0.71	0.30	0.27	−0.17	1.59
	Other ethnic group	0.62	0.33	0.93	−0.36	1.60
Mixed or multiple ethnic groups	White British	−0.83	0.27	0.03	−1.61	−0.05
	White other	−0.58	0.29	0.72	−1.45	0.28
	Asian or Asian British	−0.71	0.36	0.72	−1.76	0.34
	Black, African, Caribbean or black British	0.13	0.38	1.00	−0.98	1.24
	Other ethnic group	0.04	0.41	1.00	−1.15	1.23
Asian or Asian British	White British	−0.13	0.24	1.00	−0.84	0.58
	White other	0.13	0.27	1.00	−0.68	0.93
	Mixed or multiple ethnic groups	0.71	0.36	0.72	−0.34	1.76
	Black, African, Caribbean or black British	0.84	0.36	0.32	−0.23	1.90
	Other ethnic group	0.75	0.39	0.83	−0.40	1.90
Black, African, Caribbean or Black British	White British	−0.96	0.27	0.01	−1.76	−0.16
	White other	−0.71	0.30	0.27	−1.59	0.17
	Mixed or multiple ethnic groups	−0.13	0.38	1.00	−1.24	0.98
	Asian or Asian British	−0.84	0.36	0.32	−1.90	0.23
	Other ethnic group	−0.09	0.41	1.00	−1.29	1.12
Other ethnic group	White British	−0.88	0.31	0.07	−1.78	0.03
	White other	−0.62	0.33	0.93	−1.60	0.36
	Mixed or multiple ethnic groups	−0.04	0.41	1.00	−1.23	1.15
	Asian or Asian British	−0.75	0.39	0.83	−1.90	0.40
	Black, African, Caribbean or Black British	0.09	0.41	1.00	−1.12	1.29