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ORIGINAL ARTICLE

# Examining potential gaps in supportive medication use for US and foreign-born Hispanic women with breast cancer

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## Abstract

**Background** Compared to non-Hispanic Whites, Hispanic women are more likely to report pain, depression, and other mental health concerns. However, little is known about Hispanic women's use of supportive medications, and whether use differs depending on nativity (US- vs. foreign-born). This study's objectives were to examine patterns of supportive medication use and investigate potential differences by ethnicity/nativity among women with breast cancer.

**Methods** We used the Surveillance, Epidemiology, and End Results data linked with Medicare claims to identify women diagnosed with incident breast cancer between July 1, 2007, and December 31, 2011. Supportive medication use (opioid pain and non-opioid psychotropic medications) in the 90 days after diagnosis was the primary outcome. We categorized ethnicity/nativity as US-Born non-Hispanic, US-born Hispanic, foreign-born non-Hispanic, and foreign-born Hispanic. Modified Poisson models examined associations between ethnicity/nativity and medication use, adjusting for tumor, treatment, and demographic characteristics.

**Results** We included 23,091 women, of whom 88% were US-born non-Hispanics, 4% US-born Hispanics, 6% foreign-born non-Hispanics, and 2% foreign-born Hispanics. Supportive medication use varied by ethnicity/nativity. Compared to US-born non-Hispanics, foreign-born Hispanics and non-Hispanics were 5% (95% CI 0.92–0.98) and 10% (95% CI 0.85–0.96) less likely to receive supportive medications, respectively. US-born Hispanics were 5% (95% CI 1.02–1.09) more likely to receive supportive medications. Observed differences persisted when analyses were limited to stage I–III breast cancer cases.

**Conclusions** This work highlights potential disparities in the pharmacologic treatment of psychosocial needs of foreign-born breast cancer patients. Future studies should explore if differences observed here are reflective of health disparities or differential patient preferences.

**Keywords** Hispanic · Latina · Supportive care · Breast cancer · Disparities

## Background

Hispanic/Latinos are the fastest growing minority group in the USA [1]. In 2014, 17% of the population self-identified as Hispanic/Latino, and we expect this number to continue to grow [1]. Breast cancer is the most common cancer among Hispanic/Latina women in the USA [2]. Although Hispanic/Latina incidence rates are lower than non-Hispanic White

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rates, Hispanic/Latinas are often diagnosed with later stage breast cancer, which is partially driven by lower rates of mammography [2, 3]. Access to care barriers such as language, culture, and socioeconomic status undoubtedly affects racial/ethnic differences in stage of breast cancer diagnosis [2, 3].

Hispanic/Latinas have also been shown to report worse quality of life following cancer diagnosis and treatment [3]. In particular, Hispanics/Latinas with breast cancer are more likely to report distress, depression, and other mental health concerns [3, 4]. As such, this group may benefit from supportive medications such as anti-depressants, opioid pain medications, and non-benzodiazepine sleep aids following breast cancer diagnosis [4].

Despite experiencing a greater burden of psychosocial challenges, Hispanic/Latinos without cancer are less likely to receive supportive medications compared to non-Hispanic Whites [5–9]. Physician bias and resource constraints, in addition to patient-level factors such as socioeconomic status, culture, and knowledge, have been identified as barriers to appropriate supportive medication use for adults without cancer [8, 9]. However, to date, differences in supportive medication use for Hispanic/Latinos with cancer have not yet been explored. Furthermore, it is unknown if potential differences vary by nativity.

Given the paucity of work in Hispanic/Latina disparities in supportive medication use, we aimed to identify potential differences by race/nativity with the ultimate goal of improving the quality of supportive care for Hispanic/Latina breast cancer survivors. The objectives of this study were to (1) determine if Hispanic/Latino differences in supportive medication use exist for women with breast cancer and (2) evaluate if differences exist by nativity (US-born vs. foreign-born). We hypothesized that overall, Hispanic/Latina women with breast cancer would be less likely to receive supportive medications than their non-Hispanic White counterparts. In particular, we hypothesized that foreign-born Hispanics would be the least likely to receive supportive medications compared to US-born non-Hispanics. This work will support opportunities to reduce racial/ethnic differences in supportive care, which is increasingly recognized as a critical component of high-quality cancer care [10].

## Methods

We used the National Cancer Institute's Surveillance, Epidemiology, and End Results (SEER) data linked with Medicare fee-for-service claims from 2007 to 2012. The SEER-Medicare linked data source includes adults diagnosed with cancer aged 65 years and older and contains information on cancer-related characteristics, patient demographics, and health care utilization reimbursed by Medicare [11]. This study was approved by the Institutional Review Board at the University of North Carolina at Chapel Hill.

We included women aged 65+ years diagnosed with incident breast cancer in SEER between July 1, 2007, and December 31, 2011. We restricted the cohort to women who were diagnosed when alive (i.e., not at autopsy or death) and those with invasive (stage I–IV) disease. All women were continuously enrolled in fee-for-service Medicare Parts A, B, and D for 6 months before and 3 months after diagnosis to capture comorbid conditions and health care services use. Our final cohort included 23,091 women.

Following prior work in supportive medication use, our primary outcome was receipt of supportive medications in the 90 days after breast cancer diagnosis [12]. We operationalized supportive care medications as prescription drug claims for opioid pain medication and non-opioid psychotropic medication (anti-depressants and non-benzodiazepine sleep aids) [12]. We examined any use of opioids, antidepressants, and sleep aids. We also created a composite outcome of use of any of these medications (see Appendix Table 1 for included drugs).

Our key explanatory variable was patient ethnicity/nativity. We created a four-category variable: US-born non-Hispanic, US-born Hispanic, foreign-born non-Hispanic, and foreign-born Hispanic. This variable was created using two variables from the SEER registry—ethnicity and country of origin. Ethnicity is determined in the SEER data with the Hispanic Identification Algorithm (NHIA), a computerized algorithm that uses a combination of variables to directly or indirectly classify cases as Hispanic for analytic purposes [13]. The NHIA algorithm has been shown to have high sensitivity and specificity of 93 and 98%, respectively [14]. Nativity was established using the country of origin variable. Although 30% had a missing value for this variable, previous studies have shown that minorities reporting missing for country of origin are more likely to be US-born [15, 16]. As such, we made the same assumption in this study. Country of origin was dichotomized as US-born vs. foreign-born. We refer to non-US-born women as "foreign-born." The reference group for this variable is the US-born, non-Hispanic women.

In our primary models, we adjusted for a woman's age at diagnosis (continuous), stage of disease presentation, hormone-receptor status, and receipt of surgery, radiation, and chemotherapy. We also included a measure of comorbidity calculated using the Klabunde modification of the Charlson comorbidity index using hospital and outpatient claims from the 6 months prior to diagnosis [17]. We also included indicators of whether or not a woman had a mental health diagnosis (International Classification of Diseases Ninth revision codes 290.0–319.99) before her breast cancer diagnosis and prior use of our medications of interest (opioids, non-benzodiazepine sleep aids, anti-depressants) in the 6 months prior to diagnosis.

In addition to the clinical factors noted above, in secondary models, we included the following socioeconomic factors: Marital status, urban/rural residence, SEER geographic region, and census tract median income quartiles as well as

whether or not a woman was enrolled in Medicaid (i.e., dual eligible) and/or received a low-income subsidy.

**Statistical analyses** We examined unadjusted differences in demographic, socioeconomic, and clinical characteristics among the four ethnicity/nativity groups using chi-square tests. Then, we estimated multivariable modified Poisson models to examine adjusted associations between our primary explanatory variable and each of the binary supportive medication outcomes [18]. We modeled the likelihood of receiving any supportive medications, antidepressants, non-benzodiazepine sleep aids, and opioids, separately. We estimated adjusted risk ratios (aRR) with 95% confidence intervals (CI) for all estimates. Statistical analyses were conducted in SAS Version 9.3 with two-sided statistical tests and a significance level of 5%.

**Sensitivity analyses** Our primary models followed the Institute of Medicine's approach to assessing racial disparities and therefore did not adjust for socioeconomic factors that may mediate relationships between race and supportive care [19–21]. However, in sensitivity analyses, we re-estimated models including these co-variates (marital status, urban/rural region, SEER geographic region, census tract income quartile, dual eligible, and low-income subsidy). Second, because disparities in supportive care have been previously documented between non-Hispanic Black and White women with breast cancer, we excluded women who identified as African-American or Black to avoid underestimating supportive care use among the non-Hispanic US-born group. In addition, as women with stage IV breast cancer may use opioids differently than women with stage I–III disease, we re-estimated our models excluding women with stage IV disease. Finally, as a sensitivity analysis, we excluded individuals who had missing values for country of origin and re-estimated our adjusted models among only those with complete data on these key measures.

## Results

Characteristics of the 23,091 women aged 65 years and older with invasive breast cancer are presented in Table 1. There were 1424 (6%) women who were considered Hispanic using the NHIA algorithm described above. Of these, 948 (66%) were US-born and 448 (34%) were foreign-born. Among the 21,667 non-Hispanics, 20,373 (94%) were US-born and 1294 (6%) were foreign-born. Regardless of nativity, compared to non-Hispanics, Hispanics were younger, more likely to reside in the West, and more likely to be dual-eligible or receiving a low-income subsidy. They also had more comorbidities and were more likely to receive chemotherapy. Overall, the largest differences were observed between foreign-born Hispanics and US-born non-Hispanics.

**Unadjusted supportive medication use** We observed statistically significant differences in use of supportive care services across the four groups: US-born non-Hispanics, foreign-born non-Hispanics, US-born Hispanics, and foreign-born Hispanics (Fig. 1). Overall, 76% of US-born non-Hispanics received any supportive medications compared to 69% of foreign-born non-Hispanics, 71% of foreign-born Hispanics, and 81% US-born Hispanics. Contradictory to our hypothesis, US-born Hispanics were the most likely group to receive any supportive medications. The most striking differences were in opioid use. Foreign-born non-Hispanics and foreign-born Hispanic rates of opioid use were 7 and 9 percentage points lower, respectively, than US-born non-Hispanics (Table 2).

**Adjusted supportive medication use** After adjusting for demographic, treatment, and tumor characteristics, we continued to observe differences in any supportive medication use by ethnicity and nativity. Compared to US-born non-Hispanic women, foreign-born Hispanic and non-Hispanic women were 5% (adjusted risk ratio [RR] 0.95, 95% confidence interval [CI] 0.92–0.98) and 10% (RR 0.90, 95% CI 0.85–0.95) less likely to receive supportive medications, respectively (Table 3). US-born Hispanic women were 5% (RR 1.05, 95% CI 1.02–1.09) more likely to receive supportive medications compared to US-born non-Hispanics (Table 3). This appears to be primarily driven by use of post-diagnosis opioids. Compared to US-born non-Hispanics, foreign-born non-Hispanics and foreign-born Hispanics were 9% (95% CI 0.87–0.95) and 14% (95% 0.80–0.93) less likely to receive opioids, respectively.

**Sensitivity analyses** Differences between the four groups persisted even after adjustment for socioeconomic characteristics (Table 3). In addition, differences persisted when models were limited to early stage (stage I–III) breast cancer. Furthermore, our results remained unchanged when women who identified as African-American or Black were removed from the US-born non-Hispanic group. Finally, our sensitivity analyses removing women with missing values for country of origin also yielded similar results to our primary analyses.

## Discussion

We observed that foreign-born women with breast cancer were significantly less likely to receive supportive medications in the 90 days following their cancer diagnosis compared to their US-born counterparts. Compared to US-born non-Hispanics, foreign-born Hispanics were the least likely to receive these supportive medications. However, US-born Hispanics were more likely than Non-Hispanics to receive supportive medications, suggesting that differences may be largely explained by nativity. To our knowledge, this is the

**Table 1** Cohort characteristics by ethnicity and nativity

| | Non-Hispanics | | | | Hispanics | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | US-born | | Foreign-born | | US-born | | Foreign-born | | *P* value |
| | 20,373 | % | 1294 | % | 948 | % | 476 | % | |
| Age at diagnosis | | | | | | | | | < 0.0001 |
| 65–69 years | 5137 | 25% | 271 | 21% | 279 | 29% | 144 | 30% | |
| 70–74 years | 5007 | 25% | 333 | 26% | 248 | 26% | 128 | 27% | |
| 75–79 years | 4179 | 21% | 271 | 21% | 191 | 20% | 92 | 19% | |
| 80–85 years | 3258 | 16% | 241 | 19% | 148 | 16% | 67 | 14% | |
| 85+ years | 2792 | 14% | 178 | 14% | 82 | 9% | 45 | 9% | |
| Married | 7799 | 38% | 545 | 42% | 331 | 35% | 146 | 31% | < 0.0001 |
| Race | | | | | | | | | |
| White | 17,656 | 87% | 752 | 58% | 664 | 70% | 265 | 56% | |
| Black | 1970 | 10% | 37 | 3% | 14 | 1% | 13 | 3% | |
| Asian/Other | 747 | 4% | 505 | 39% | 270 | 28% | 200 | 42% | |
| Rural | 568 | 3% | – | < 1% | – | < 1% | – | < 1% | < 0.0001 |
| SEER Geographic Region | | | | | | | | | < 0.0001 |
| West | 7556 | 37% | 937 | 72% | 754 | 80% | 341 | 72% | |
| Midwest | 2934 | 14% | 54 | 4% | 26 | 3% | – | < 1% | |
| South | 5940 | 29% | 53 | 4% | 44 | 5% | – | < 5% | |
| Northeast | 3943 | 19% | 250 | 19% | 124 | 13% | 116 | 24% | |
| Income Quartile | | | | | | | | | < 0.0001 |
| 1 | 5153 | 25% | 225 | 17% | 249 | 26% | 107 | 22% | |
| 2 | 5076 | 25% | 254 | 20% | 251 | 26% | 147 | 31% | |
| 3 | 4991 | 24% | 357 | 28% | 249 | 26% | 130 | 27% | |
| 4 | 5020 | 25% | 454 | 35% | 192 | 20% | 91 | 19% | |
| Dual eligible/LIS | 3668 | 18% | 600 | 46% | 421 | 44% | 289 | 61% | < 0.0001 |
| Number of Comorbidities | | | | | | | | | < 0.0001 |
| 0 | 10,833 | 53% | 602 | 47% | 431 | 45% | 211 | 44% | |
| 1 | 5078 | 25% | 378 | 29% | 257 | 27% | 121 | 25% | |
| 2+ | 4462 | 22% | 314 | 24% | 260 | 27% | 144 | 30% | |
| Stage | | | | | | | | | < 0.0001 |
| I | 10,813 | 53% | 606 | 47% | 426 | 45% | 218 | 46% | |
| II | 6528 | 32% | 440 | 34% | 343 | 36% | 156 | 33% | |
| III | 1997 | 10% | 153 | 12% | 117 | 12% | 62 | 13% | |
| IV | 1035 | 5% | 95 | 7% | 62 | 7% | 40 | 8% | |
| Estrogen Receptor Positive | 16,539 | 81% | 1039 | 80% | 740 | 78% | 370 | 78% | 0.0166 |
| Surgery | | | | | | | | | 0.0002 |
| No surgery | 1494 | 7% | 122 | 9% | 77 | 8% | 49 | 10% | |
| Breast conserving surgery | 11,229 | 55% | 659 | 51% | 479 | 51% | 241 | 51% | |
| Mastectomy | 7650 | 38% | 513 | 40% | 392 | 41% | 186 | 39% | |
| Had radiation | 11,239 | 55% | 692 | 53% | 495 | 52% | 273 | 57% | 0.1402 |
| Had chemotherapy | 4491 | 22% | 311 | 24% | 291 | 31% | 152 | 32% | < 0.0001 |
| Had endocrine therapy | 13,544 | 66% | 852 | 66% | 661 | 70% | 332 | 70% | 0.0809 |

Cells with $N < 11$ were suppressed. One hundred forty-five women had missing values for income, but due to cells < 11, these were excluded from Table 1

first study that has used SEER-Medicare data to examine differences in supportive medication use by both race/ethnicity and nativity.

We observed marked differences in the use of supportive medications despite observing strikingly similar rates of primary cancer-directed treatment receipt (surgery, radiation, and

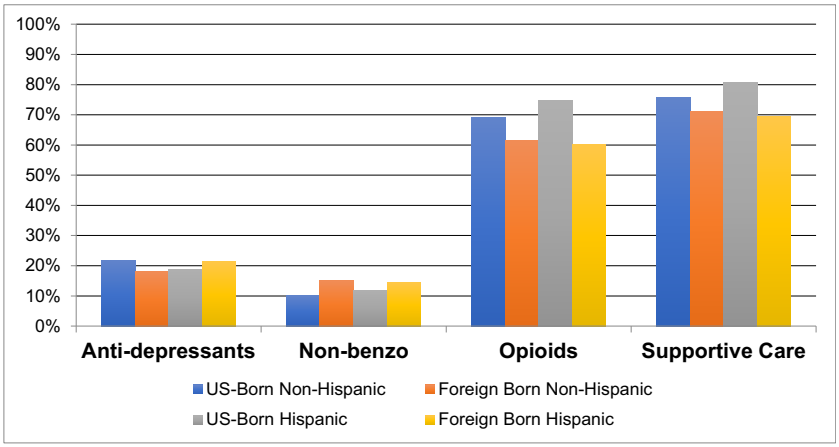


**Fig. 1** Supportive medication use by ethnicity and nativity. This figure shows unadjusted rates of use by ethnicity and nativity. "Supportive Care" includes any of the other three medication types (anti-depressants, non-benzodiazepine sleep aids or anxiolytics, and opioids listed in Supplemental Table 1)

chemotherapy) across the four ethnicity/nativity groups. In fact, once age, tumor stage, and hormone-receptor status were adjusted for, there were no statistically significant differences in primary treatment rates by race/nativity. Given that primary treatments were received at similar rates, we would generally expect similar rates of symptoms and thus need for supportive medications. Although we were unable to measure symptom burden directly, our findings of different levels of supportive medication use for similarly treated patients after controlling for age, co-morbidity, and mental health history raise concerns that some patient groups are being over-prescribed or under-prescribed supportive medications.

A possible explanation for this finding is that, in breast cancer, primary treatment selection is guided by well-established guidelines and standards. Appropriate supportive care, on the other hand, is more nuanced and highly dependent on the needs of individual patients. Assessing and responding to patients' supportive care needs may be even more complex when language barriers and/or cultural factors, which may be most pronounced for foreign-born patients, are at play [22, 23]. For example, the results of prior work suggest that providers are less likely to recognize symptoms among their racial/ethnic minority patients compared to their white patients [24]. Further, cultural/attitudinal factors may impact patients' willingness to report symptoms/supportive care needs to providers [24]. In the context of prior work, our study highlights the need for research on non-native patients' communication with providers about symptoms and supportive care needs, as a potentially modifiable factor for interventions to close gaps. For example, a future qualitative study could interview non-native cancer patients to elucidate the patient-perceived barriers to effective patient-physician communication surrounding supportive care needs. Nativity in this context may be a surrogate for language or other cultural facets that may serve as barriers to a patient's ability to navigate the healthcare system [22, 25]. Understanding these issues from the patient perspective would allow us to identify ways to address these potential barriers and provide more equitable care.

Another factor potentially underlying observed differences is the setting of care. Specifically, foreign-born patients may have inadequate access to supportive care providers by virtue of where they are treated. A future study could consider examining if supportive medication use patterns among non-native cancer patients differ by geographic region. Board-certified palliative care and psychiatric specialists, for example, are few in number and tend to be concentrated in large academic medical centers [26]. Foreign-born patients, like other minorities, are known to receive care in practices/systems that are lower performing, where supportive/

**Table 2** Unadjusted use of supportive medications after diagnosis by ethnicity and nativity

| | Non-Hispanics | | | | Hispanics | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | US-born | | Foreign-born | | US-born | | Foreign-born | | *P* value |
| | 20,373 | % | 1294 | % | 948 | % | 476 | % | |
| Anti-depressants | 4455 | 22% | 233 | 18% | 178 | 19% | 102 | 21% | 0.0017 |
| Non-benzo | 2084 | 10% | 195 | 15% | 113 | 12% | 69 | 14% | < 0.0001 |
| Opioids | 14,097 | 69% | 797 | 62% | 709 | 75% | 287 | 60% | < 0.0001 |
| Any supportive medications | 15,447 | 76% | 919 | 71% | 764 | 81% | 330 | 69% | < 0.0001 |

Any supportive medications include anti-depressants, non-benzodiazepine sleep aids or anxiolytics, and opioids listed in Supplemental Table 1

**Table 3** Adjusted risk ratios of supportive medication use

| | US-born Hispanics | | Foreign-born non-Hispanics | | Foreign-born Hispanics | |
|---|---|---|---|---|---|---|
| | RR (95% CI) | *P* value | RR (95% CI) | *P* value | RR (95% CI) | *P* value |
| IOM definition | | | | | | |
| Any supportive medications | 1.05 (1.02–1.09) | < 0.01 | 0.95 (0.92–0.98) | < 0.01 | 0.90 (0.85–0.95) | < 0.001 |
| Anti-depressants | 0.91 (0.84–0.99) | < 0.05 | 0.90 (0.84–0.97) | 0.02 | 0.99 (0.87–1.12) | 0.97 |
| Non-benzo | 1.03 (0.91–1.18) | 0.59 | 1.13 (1.02–1.26) | 0.01 | 1.02 (0.86–1.23) | 0.82 |
| Opioids | 1.06 (1.02–1.10) | < 0.01 | 0.91 (0.87–0.95) | < 0.001 | 0.86 (0.80–0.92) | < 0.001 |
| Includes socioeconomic factors | | | | | | |
| Any supportive medications | 1.05 (1.02–1.09) | < 0.01 | 0.95 (0.92–0.98) | < 0.01 | 0.90 (0.85–0.96) | < 0.001 |
| Anti-depressants | 0.93 (0.85–1.01) | 0.09 | 0.93 (0.86–1.00) | 0.04 | 1.01 (0.89–1.15) | 0.87 |
| Non-benzo | 1.00 (0.88–1.15) | 0.97 | 1.06 (0.95–1.19) | 0.28 | 1.00 (0.83–1.21) | 0.99 |
| Opioids | 1.06 (1.02–1.10) | < 0.01 | 0.91 (0.87–0.95) | < 0.001 | 0.86 (0.80–0.93) | < 0.001 |

US-born non-Hispanics are the reference group. Models adjust for patient-level covariates, pre-diagnosis mental health diagnosis and pre-diagnosis medication use (anti-depressants, non-benzodiazepine sleep aids or anxiolytics, and opioids listed in Supplemental Table 1)

palliative care resources may be less available [27–29]. Research on strategies to improve diverse patients' access to high-quality supportive care, for example through programs that train providers who are not PC specialists to effectively asses and manage symptoms, emotional support needs, may help to close existing gaps in care delivery.

Another explanation to consider is that supportive care may be seen as a secondary concern among foreign-born patients, and potentially delayed or forgone to due competing concerns, such as employment status and immigration [30]. For example, studies have shown that Hispanic/Latina breast cancer survivors are more likely to report difficulties returning to work following breast cancer treatments [31, 32]. Non-natives may also be more likely to delay care seeking because of fear of deportation [33, 34]. Exploring the extent to which care delays exist among non-native cancer patients would be an important next step to understanding this issue.

**Limitations** This study has several limitations. First, we only included women aged 65 years and older, with fee-for-service, and Part D Medicare. As such, we do not know if our results generalize to younger women, those in Medicare Advantage plans or women without Part D coverage. Furthermore, our inclusion of fee-for-service Medicare enrollees likely represents a population with greater access to and engagement in healthcare than individuals in the general population. As Hispanic/Latinas with breast cancer are often younger, future studies should consider replicating this work in younger populations. In addition, we were limited to services that were captured in Medicare claims. It is possible that women received care or medications from other sources that are not captured in claims. Similarly, we were only able to measure if a medication was prescribed and filled, but prescribed and abandoned. That is, a patient may have had a prescription written, but chose not to fill it. These instances will not generate a Medicare claim. In addition, it is possible that medication was diverted and unused in some patients. For example, a patient may have filled the prescription but did not actually take the medication. We were also unable to account for patient preferences and experiences, which may be related to their supportive medication use. In particular, cultural norms and beliefs could influence whether or not women take some of these medications. This may be particularly true for medications that may be viewed as stigmatizing (e.g., anti-depressants or opioids). As such, we were able to report differences by race/nativity but cannot conclude if disparities exist. Finally, our primary explanatory variable relied on a country of origin variable, which had a great deal of missingness. Relying on previous work in this area, we made evidence-based assumptions that individuals with missing country of origin were more likely to be US-born. Furthermore, we conducted sensitivity analyses excluding individuals with missing country of origin and our results were similar. However, future studies with higher quality country of origin data should repeat these analyses.

**Strengths** This large, population-based study identified existing gaps in supportive medication use by race/ethnicity and nativity among an understudied group of breast cancer patients. Findings from this work contribute to both the supportive care and health disparities literature, as, to our knowledge, no previous studies have examined differences in supportive medication use by race/ethnicity and nativity among breast cancers survivors. As such, this study documents previously unknown gaps among a vulnerable patient population and suggests opportunities for future research to better understand underlying drivers of observed differences.

## Conclusions

This work sheds light on potential disparities in supportive medication use by ethnicity and nativity among women with breast cancer. Understanding the multi-level factors underlying the differences documented in this study represents a critical next step in this line of inquiry. For example, future studies should assess whether the differences observed in our study are reflective of true disparities or if they may result from differential patient preferences for supportive care services. Other areas for further investigation include patient-provider communication about supportive care needs, patients' access to supportive care, and patient's self-reported need for supportive care during the cancer care continuum. Additional research along these lines will help to inform strategies to ensure that needs of diverse patients are met.

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## Compliance with ethical standards

All procedures performed in studies involving human participants were in accordance with the ethical standards of the institutional and/or national research committee and with the 1964 Helsinki declaration and its later amendments or comparable ethical standards.

**Conflicts of interest** The authors declare that they have no conflicts of interest or financial disclosures.

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## References

1. Colby S, Ortman JM (2014) Projections of the size and composition of the U.S. population: 2014 to 2060. U.S Census Bureau, Washington, DC
2. Society AC (2015) Cancer facts and figures for Hispanics/Latinos 2015–2017. https://www.cancer.org/content/dam/cancer-org/research/cancer-facts-and-statistics/cancer-facts-and-figures-for-hispanics-and-latinos/cancer-facts-and-figures-for-hispanics-and-latinos-2015-2017.pdf
3. Yanez B, McGinty HL, Buitrago D, Ramirez AG, Penedo FJ (2016) Cancer outcomes in Hispanics/Latinos in the United States: an integrative review and conceptual model of determinants of health. J Lat Psychol 4(2):114–129. https://doi.org/10.1037/lat0000055
4. Luckett T, Goldstein D, Butow PN, Gebski V, Aldridge LJ, McGrane J, Ng W, King MT (2011) Psychological morbidity and quality of life of ethnic minority patients with cancer: a systematic review and meta-analysis. Lancet Oncol 12(13):1240–1248. https://doi.org/10.1016/s1470-2045(11)70212-1
5. Akincigil A, Olfson M, Siegel M, Zurlo KA, Walkup JT, Crystal S (2012) Racial and ethnic disparities in depression care in community-dwelling elderly in the United States. Am J Public Health 102(2):319–328. https://doi.org/10.2105/ajph.2011.300349
6. Alegria M, Canino G, Rios R, Vera M, Calderon J, Rusch D, Ortega AN (2002) Inequalities in use of specialty mental health services among Latinos, African Americans, and non-Latino whites. Psychiatr Serv (Washington, DC) 53(12):1547–1555. https://doi.org/10.1176/appi.ps.53.12.1547
7. Alegria M, Chatterji P, Wells K, Cao Z, Chen CN, Takeuchi D, Jackson J, Meng XL (2008) Disparity in depression treatment among racial and ethnic minority populations in the United States. Psychiatr Serv (Washington, DC) 59(11):1264–1272. https://doi.org/10.1176/appi.ps.59.11.1264
8. Shao Z, Richie WD, Bailey RK (2016) Racial and ethnic disparity in major depressive disorder. J Racial Ethn Health Disparities 3(4):692–705. https://doi.org/10.1007/s40615-015-0188-6
9. Lagomasino IT, Stockdale SE, Miranda J (2011) Racial-ethnic composition of provider practices and disparities in treatment of depression and anxiety, 2003-2007. Psychiatr Serv (Washington, DC) 62(9):1019–1025. https://doi.org/10.1176/appi.ps.62.9.1019
10. Ferrell BR, Temel JS, Temin S, Alesi ER, Balboni TA, Basch EM, Firn JI, Paice JA, Peppercorn JM, Phillips T, Stovall EL, Zimmermann C, Smith TJ (2017) Integration of palliative care into standard oncology care: American Society of Clinical Oncology clinical practice guideline update. J Clin Oncol 35(1):96–112. https://doi.org/10.1200/jco.2016.70.1474
11. Warren JL, Klabunde CN, Schrag D, Bach PB, Riley GF (2002) Overview of the SEER-Medicare data: content, research applications, and generalizability to the United States elderly population. Med Care 40(8 Suppl):iv-3-18. https://doi.org/10.1097/01.mlr.0000020942.47004.03
12. Check DK, Samuel CA, Rosenstein DL, Dusetzina SB (2016) Investigation of racial disparities in early supportive medication use and end-of-life care among Medicare beneficiaries with stage IV breast Cancer. J Clin Oncol 34(19):2265–2270. https://doi.org/10.1200/jco.2015.64.8162
13. Group NRaEW (2011) NAACCR Guideline for Enhancing Hispanic/Latino Identification: Revised NAACCR Hispanic/Latino Identification Algorithm [NHIA v2.2.1]. North American Association of Central Cancer Registries, Springfield
14. Boscoe FP, Schymura MJ, Zhang X, Kramer RA (2013) Heuristic algorithms for assigning Hispanic ethnicity. PLoS One 8(2):e55689. https://doi.org/10.1371/journal.pone.0055689
15. Gomez SL, Glaser SL, Kelsey JL, Lee MM (2004) Bias in completeness of birthplace data for Asian groups in a population-based cancer registry (United States). Cancer Causes Control: CCC 15(3):243–253. https://doi.org/10.1023/b:caco.0000024244.91775.64
16. Gomez SL, Glaser SL (2005) Quality of cancer registry birthplace data for Hispanics living in the United States. Cancer Causes Control: CCC 16(6):713–723. https://doi.org/10.1007/s10552-005-0694-7

17. Klabunde CN, Potosky AL, Legler JM, Warren JL (2000) Development of a comorbidity index using physician claims data. J Clin Epidemiol 53(12):1258–1267
18. Zou G (2004) A modified Poisson regression approach to prospective studies with binary data. Am J Epidemiol 159(7):702–706
19. Le Cook B, McGuire TG, Lock K, Zaslavsky AM (2010) Comparing methods of racial and ethnic disparities measurement across different settings of mental health care. Health Serv Res 45(3):825–847. https://doi.org/10.1111/j.1475-6773.2010.01100.x
20. Le Cook B, McGuire TG, Zuvekas SH (2009) Measuring trends in racial/ ethnic health care disparities. Med Care Res Rev 66(1):23–48. https://doi.org/10.1177/1077558708323607
21. McGuire TG, Alegria M, Cook BL, Wells KB, Zaslavsky AM (2006) Implementing the Institute of Medicine definition of disparities: an application to mental health care. Health Serv Res 41(5):1979–2005. https://doi.org/10.1111/j.1475-6773.2006.00583.x
22. DuBard CA, Gizlice Z (2008) Language spoken and differences in health status, access to care, and receipt of preventive services among US Hispanics. Am J Public Health 98(11):2021–2028. https://doi.org/10.2105/ajph.2007.119008
23. Atdjian S, Vega WA (2005) Disparities in mental health treatment in U.S. racial and ethnic minority groups: implications for psychiatrists. Psychiatr Serv (Washington, DC) 56(12):1600–1602. https://doi.org/10.1176/appi.ps.56.12.1600
24. Anderson KO, Green CR, Payne R (2009) Racial and ethnic disparities in pain: causes and consequences of unequal care. J Pain 10(12):1187–1204. https://doi.org/10.1016/j.jpain.2009.10.002
25. Rodriguez MA, Bustamante AV, Ang A (2009) Perceived quality of care, receipt of preventive care, and usual source of health care among undocumented and other Latinos. J Gen Intern Med 24(Suppl 3):508–513. https://doi.org/10.1007/s11606-009-1098-2
26. Schenker Y, Arnold R (2017) Toward palliative care for all patients with advanced cancer. JAMA Oncol 3(11):1459–1460. https://doi.org/10.1001/jamaoncol.2017.1059
27. Samuel CA, Landrum MB, McNeil BJ, Bozeman SR, Williams CD, Keating NL (2014) Racial disparities in cancer care in the veterans affairs health care system and the role of site of care. Am J Public Health 104(Suppl 4):S562–S571. https://doi.org/10.2105/ajph.2014.302079
28. Jha AK, Orav EJ, Li Z, Epstein AM (2007) Concentration and quality of hospitals that care for elderly black patients. Arch Intern Med 167(11):1177–1182. https://doi.org/10.1001/archinte.167.11.1177
29. Keating NL, Kouri E, He Y, Weeks JC, Winer EP (2009) Racial differences in definitive breast cancer therapy in older women: are they explained by the hospitals where patients undergo surgery? Med Care 47(7):765–773. https://doi.org/10.1097/MLR.0b013e31819e1fe7
30. Okie S (2007) Immigrants and health care—at the intersection of two broken systems. N Engl J Med 357(6):525–529. https://doi.org/10.1056/NEJMp078113
31. Blinder VS, Patil S, Thind A, Diamant A, Hudis CA, Basch E, Maly RC (2012) Return to work in low-income Latina and non-Latina white breast cancer survivors: a 3-year longitudinal study. Cancer 118(6):1664–1674. https://doi.org/10.1002/cncr.26478
32. Blinder V, Patil S, Eberle C, Griggs J, Maly RC (2013) Early predictors of not returning to work in low-income breast cancer survivors: a 5-year longitudinal study. Breast Cancer Res Treat 140(2):407–416. https://doi.org/10.1007/s10549-013-2625-8
33. Tavernise S (2013) The health toll of immigration. The New York times, 05/18/2013,
34. Hoffman J (2017) Sick and afraid, some immigrants forgo medical care. The New York Times, 06/26/2017