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Financial hardship among rural cancer survivors: An analysis of the Medical Expenditure Panel Survey

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Abstract

Some cancer survivors report spending 20% of their annual income on medical care. Undue financial burden that patients face related to the cost of care is referred to as financial hardship, which may be more prevalent among rural cancer survivors. This study examined contrasts in financial hardship among 1419 rural and urban cancer survivors using the 2011 Medical Expenditure Panel Survey supplement – The Effects of Cancer and Its Treatment on Finances. We combined four questions, creating a measure of material financial hardship, and examined one question on financial worry. We conducted multivariable logistic regression analyses, which produced odds ratios (OR) for factors associated with financial hardship and worry, and then

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Appendix A. Supplementary data

Supplementary data to this article can be found online at <https://doi.org/10.1016/j.ypmed.2019.105881>.

generated average adjusted predicted probabilities. We focused on rural and urban differences classified by metropolitan statistical area (MSA) designation, controlling for age, education, race, marital status, health insurance, family income, and time since last cancer treatment. More rural cancer survivors reported financial hardship than urban survivors (23.9% versus 17.1%). However, our adjusted models revealed no significant impact of survivors' MSA designation on financial hardship or worry. Average adjusted predicted probabilities of financial hardship were 18.6% for urban survivors (Confidence Interval [CI]: 11.9%–27.5%) and 24.2% for rural survivors (CI: 15.0%–36.2%). For financial worry, average adjusted predicted probabilities were 19.9% for urban survivors (CI: 12.0%–31.0%) and 18.8% for rural survivors (CI: 12.1%–28.0%). Improving patient-provider communication through decision aids and/or patient navigators may be helpful to reduce financial hardship and worry regardless of rural-urban status.

Keywords

Health expenditures; Cost of illness; Rural health; Neoplasms; Health surveys; Stress; Psychological; Survivors

1. Introduction

In 2010, national expenditures on cancer in the United States (U.S.) were estimated to be \$125 billion and are expected to grow to \$158 billion by 2020 (Mariotto et al., 2011; Yabroff et al., 2011). The growing cost of cancer treatment and the stress of managing the disease has the potential to create financial and emotional stress on cancer survivors. Estimates suggest some cancer survivors spend 20% of their annual income on medical care (PDQ Adult Treatment Editorial Board, 2002), and according to the National Health Interview Survey (NHIS), >2 million cancer survivors did not receive medical services because of financial concerns between 2003 and 2006 (Weaver et al., 2010).

The undue financial burden and stress that patients face related to the cost of cancer care is referred to as *financial hardship*. Financial hardship is a significant concern as it not only influences cancer treatment outcomes, but also survivors' quality of life and financial stability during and after treatment (PDQ Adult Treatment Editorial Board, 2002). Access to care, health insurance status, poverty, previous debts, total assets, health care costs, and ability to find or maintain employment may buffer or exacerbate cancer-related financial hardship (Gilligan et al., 2018; PDQ Adult Treatment Editorial Board, 2002; Yabroff et al., 2016). Cancer survivors' household income and being the highest contributor to the household income is also associated with financial hardship (PDQ Adult Treatment Editorial Board, 2002). Cancer survivors who filed for bankruptcy have a higher mortality rate than those who did not, possibly due to survivors altering treatment or not taking medication properly to save money (PDQ Adult Treatment Editorial Board, 2002; Weaver et al., 2010).

Rural cancer patients may be at higher risk of financial hardship due to greater travel burden to health care providers, lower likelihood of being insured, and lower incomes than urban cancer patients (Charlton et al., 2015; Texas A&M Health Science Center, n.d.; Zahnd et al., 2018). The American Society of Clinical Oncology reports that only 7% of oncologists practice in rural communities despite 20% of the U.S. population residing

in rural areas (Kirkwood et al., 2018). Rural patients face longer travel times to cancer specialists and treatment centers and are more likely than urban patients to rely on care from generalists rather than specialists (Chan et al., 2009; Charlton et al., 2015; Onega et al., 2008). Additionally, an estimated 1.6 million rural households do not own a car (Charlton et al., 2015). Rural communities often lack reliable public transportation, making travel to health care facilities difficult (Charlton et al., 2015). Lack of access may also affect screening rates, further increasing the financial burden when cancer is detected at a later stage and more extensive treatment is required (Zahnd et al., 2018).

Despite challenges that rural survivors face in receiving cancer care, few studies have examined urban versus rural differences in cancer survivors' experiences with financial hardship following treatment (McDougall et al., 2018; Zahnd et al., 2019). These previous studies have examined urban-rural differences in financial hardship only among colorectal cancer patients or using a single survey question to capture financial hardship. Additional evidence from varying data sources is needed to better understand the relationship of rural residence and financial hardship. Therefore, our study aims to examine urban-rural differences in cancer survivor-reported financial hardship using data from the 2011 Medical Expenditure Panel Survey (MEPS), the most recent MEPS data available with an urban-rural variable.

2. Methods

2.1. Data source

MEPS is a multi-component, nationally representative, population-based survey from the Agency for Healthcare Research and Quality (AHRQ). It includes questions on demographics, health conditions, health care utilization, spending, and insurance and is administered through computer-assisted personal interviewing (*Medical Expenditure Panel Survey background*, n.d.). We used data from the 2011 MEPS survey household component. Specifically, we analyzed five questions from the supplemental Cancer Self-Administered Questionnaire (CSAQ) section titled "The Effects of Cancer and Its Treatment on Finances" to examine differences in reported financial hardship by urban versus rural residence. MEPS participants are selected from across the U.S., as a subsample of participants from the NHIS conducted the previous year. In 2011, MEPS had a response rate of 54.9%; the supplemental questionnaire on cancer-related financial hardship had a response rate of 90.0% for an overall response rate of 49.4% (*Medical Expenditure Panel Survey background*, n.d.).

2.2. Participants

Respondent-level characteristics included rurality, age, sex, highest educational degree earned, race, marital status, health insurance type, family income, and time since last cancer treatment. Family income was categorized as those in poverty or low income versus middle or high income. Definitions for poverty and income levels in MEPS were based on 2011 poverty statistics from the U.S. Census Bureau's Current Population Survey (United State Census Bureau, n.d.). Rurality was defined by the U.S. Census Bureau's Office of Management and Budget metropolitan statistical area (MSA) designation from 2011, where micropolitan and noncore areas were designated as rural and metropolitan areas as urban

(United States Census Bureau Geography, n.d.). We excluded subjects with missing MSA designation ($n = 249$). To maximize our sample size, we included non-melanoma skin cancer survivors ($n = 264$) in our final sample ($N = 1419$).

2.3. Financial hardship and worry

We examined responses to four yes/no questions in the MEPS survey supplement regarding the material financial hardship of cancer:

1. You or anyone in your family had to borrow money or go in debt;
2. You or anyone in your family filed for bankruptcy;
3. You or family made other financial sacrifices;
4. *Unable to cover cost of medical care visits.*

To create a single measure of material financial hardship, those who responded “yes” to at least one of the above questions were defined as experiencing financial hardship. We compared the sum of “yes” responses by urban and rural designation for material financial hardship as well. We also examined financial worry from yes/no responses to a fifth question,

5. Did you ever worry about paying medical bills?

2.4. Statistical analyses

We compared urban versus rural differences in the sociodemographic and treatment characteristics of respondents by chi-square tests and reported frequencies as well as percentages. We then performed multivariable logistic regression on each outcome independently, examining the effect of MSA designation accounting for all other respondent-level characteristics. More specifically, our models included terms for MSA designation, age, sex, highest educational degree earned, race, marital status, health insurance type, family income, and time since last cancer treatment. We obtained odds ratios (ORs) and produced average adjusted predicted probabilities of financial hardship and worry by all sociodemographic and treatment characteristics. The adjusted predicted probabilities for each respondent in the dataset were calculated using the respondent’s full profile, i.e., their age, their sex, and other characteristics. Then, these adjusted probabilities were averaged by MSA designation or by other sociodemographic and treatment factors. Analyses were conducted using the population weights assigned by AHRQ to account for the complex sampling design of the MEPS survey. All statistical tests were based on a significance level of $\alpha = 0.05$, all confidence intervals (CI) are 95% CIs. All analyses were performed using SAS 9.4.

3. Results

A total of 1592 survey participants were eligible to complete the CSAQ section of the MEPS survey. Our final sample included 1419 cancer survivors with 275 residing in a rural MSA (weighted 18.3%) and 1144 in an urban MSA (weighted 81.7%) (Table 1). Bivariate analyses displayed in Table 1 also show that rural and urban cancer survivors had

a similar distribution for age, sex, marital status, and time since last cancer treatment ($p > 0.05$). Characteristics that differed between rural and urban groups included education, race, income level, and health insurance (Table 1). Compared to urban cancer survivors, rural survivors were more likely to be white (rural: 95.6% vs. urban: 92.2%, $p = 0.01$) and low income (rural: 31.7% vs. urban: 23.7%, $p = 0.01$), less likely to have a college education (rural: 35.9% vs. urban: 45.1%, $p = 0.02$) and less likely to have private commercial insurance (rural: 64.9% vs. urban: 71.4%, $p = 0.01$). In bivariate analyses, more rural cancer survivors reported experiencing material financial hardship than their urban counterparts (rural: 23.9% vs. urban: 17.1%, $p = 0.02$). There was no significant difference between rural and urban survivors reporting financial worry (rural: 22.2% vs. urban: 20.1%, $p = 0.72$).

In the adjusted model for financial hardship, the association between MSA designation and financial hardship was not significant ($p = 0.10$). Table A1, available in Appendix, shows the individual effects (ORs) of MSA designation as well as of all other sociodemographic and treatment characteristics. Using the average adjusted predicted probabilities from the model, we also examined the probability of financial hardship by MSA designation (Fig. A1 in Appendix and Table 2). Rural survivors had a 24.2% adjusted probability of reporting material financial hardship compared to 18.6% for urban survivors, with both groups showing wide CIs around their predicted probabilities (rural CI: 15.0%–36.2%, urban CI: 11.9%–27.5%) (Fig. A1 in Appendix and Table 2). Age, race, and insurance were significantly associated with reported financial hardship (Table A1). Financial hardship was more likely among cancer survivors under 65 years of age compared to those over 65 (18–64: 25.8% vs. 65–85: 14.1%; $p < 0.01$). Non-white cancer survivors were more likely than their white counterparts to report financial hardship (non-white: 31.0% vs. white: 17.8%; $p = 0.02$). Uninsured survivors had a higher probability of experiencing financial hardship than survivors with private insurance (uninsured: 48.3% vs. privately insured: 15.9%; $p = 0.01$).

Similarly, in the adjusted model for financial worry, the association between MSA designation and financial worry ($p = 0.63$) was not significant. Table A2, available in Appendix, shows the individual effects (ORs) of MSA designation as well as of all other sociodemographic and treatment characteristics. Average adjusted predicted probabilities were examined by urban-rural status (Fig. A1 in Appendix and Table 3). Rural survivors had an 18.8% adjusted probability of reporting financial worry compared to 19.9% for urban survivors, with both groups showing wide CIs around their predicted probabilities (rural CI: 12.1%–28.0%, urban CI: 12.0%–31.0%) (Fig. A1 in Appendix, Table 3). Age and highest degree earned were also significantly associated with the presence of financial worry (Table A2). Cancer survivors 65 and older were less likely than cancer survivors under 65 to experience worry about paying medical bills (18–64: 26.6% vs. 65–85: 12.3%; $p < 0.01$). Those with an education of GED/diploma or less were more likely to experience financial worry than those with some college or higher education (GED/diploma: 21.4% vs. college: 15.0%; $p = 0.01$).

4. Discussion

We analyzed a nationally representative survey that examined financial hardship among rural and urban cancer survivors using MSA designation. In unadjusted analyses, a higher

proportion of rural cancer survivors reported material financial burden compared to urban survivors, but there were no differences in reported financial worry. However, the association between rural-urban status and financial hardship was no longer significant after accounting for other factors. Age, race, and insurance status remained significant factors in the full model. Adjusted analysis also showed no rural-urban differences in financial worry, but indicated that adults over age 65 and with some college or higher level of education were less likely to report worrying about paying medical bills than younger or less educated cancer survivors, respectively.

We found that rural cancer survivors had a higher probability of reporting financial hardship than urban survivors, but this was explained by sociodemographic factors. However, insurance status remained significantly associated with financial hardship after adjustment. Health care system approaches may be effective in reducing these reported financial hardships experienced by cancer survivors, regardless of geography, insurance status, or other sociodemographics. Previous studies have shown that physicians may not be conscious of the costs of cancer treatments to their patients and subsequently may not have related discussions with their patients (Jagsi et al., 2018; Resnicow et al., 2019). Broadly, one study showed that more than half of cancer patients who discussed costs with their oncologists reported lower out-of-pocket costs because they were connected to financial assistance programs or because physicians made changes in their medication regimens to reduce costs (Zafar et al., 2015a). However, just 19% of those who wanted to discuss costs with their physicians in this study did discuss costs. This provides an opportunity for physicians or other members of the health care team to proactively initiate cost-related discussions. Another study showed that patients are equally amenable to discuss the costs of their care with another member of the health care team outside of their physician (Bullock et al., 2012). Thus, patient navigators or social workers may be well-suited to assist patients with financial challenges associated with their cancer. Studies have shown that financial navigators can also be effective to help rural cancer patients address financial challenges associated with their care (Palomino et al., 2017; Vanderpool et al., 2017). Yabroff and colleagues suggest that decision aids may be a useful tool to enable physicians and other health care professionals to help their patients make informed decisions about treatment in the context of their specific health insurance status/plan (Yabroff et al., 2018). Moreover, decision aids have been shown to be effective to enable patients facing serious illnesses, including cancer, to make informed decisions regarding their care (Austin et al., 2015).

Cancer survivors under 65 years of age and those of non-white race were more likely to report financial hardship in our study, corroborating previously reported findings. Studies by Yabroff et al. and Zheng et al. found that experiencing financial hardship was more common among cancer survivors between the ages of 18 and 64 (Yabroff et al., 2016; Zheng et al., 2019). As health care costs rise, cancer survivors, even those with insurance coverage, continue to report higher out-of-pocket expenditures than those without a cancer history (Ekwueme et al., 2019; Zheng et al., 2019). Being uninsured or on high deductible insurance plans, which are available to adults aged 18–64, increases the financial burden on an individual; while insurance mitigates the risk of financial distress, it does not eliminate it (Yabroff et al., 2011; Zheng et al., 2019). Banegas et al. also found that working-age cancer survivors with public health insurance have an increased risk of financial hardship

(Banegas et al., 2016). Because people aged 18–64 are more likely to be working than those who are older and on Medicare, state and federal level policies that increase medical leave time or that require paid sick time may be an effective approach to helping reduce the financial burden of cancer (Yabroff et al., 2018). Further, more expansive Medicaid eligibility may be another effective way to reduce financial hardship among those in this age group (Yabroff et al., 2018), as studies have shown that Medicaid expansion increased insurance coverage in cancer patients (Davidoff et al., 2018; Gan et al., 2019). This may be particularly beneficial for rural cancer patients who are more likely to live in states that have not expanded Medicaid (Foutz et al., 2017). Our findings indicating higher reported financial burden among those of non-white race confirm previous studies showing that Black cancer survivors have greater financial challenges than White cancer survivors regardless of geographic location (Pisu et al., 2015; Spencer et al., 2019; Wheeler et al., 2018). Future research should further examine the relationship between race and financial hardship, and systemic interventions should be developed to address the disproportionate burden of financial hardship in non-White cancer survivors.

We also found that having a GED/diploma and being under the age of 65 was also associated with financial worry. Our findings regarding the relationship between educational attainment and reporting financial worry corroborate previous studies showing an association between education and financial impact among cancer survivors (Wheeler et al., 2018). Such findings may underscore the importance of financial literacy interventions to address financial concerns among cancer survivors (Yabroff et al., 2018; Zafar et al., 2015b). Similarly, higher rates of financial worry among those under the age of 65 mirror that of prior studies. The population under age 65 may face issues with unemployment resulting in a loss of health insurance coverage. This population is also more likely to have dependent family members; thus, financial decision making may be more complex leading to greater financial worry. In contrast, survivors age 65 and over have a higher likelihood of being retired and have Medicare coverage.

4.1. Limitations

This study is not without limitations. The small sample size may have underpowered our ability to detect significant differences between subgroups. Restricted analytic capabilities due to small sample size is a recurring issue for rural health research (Devers et al., 2013; Srinivasan et al., 2015). We utilized 2011 MEPS data; the most recent year available for CSAQ data that contains MSA designations of cancer survivors. However, results based on more recent data sources have found that financial hardship due to medical treatment is an ongoing concern, even after the implementation of the Affordable Care Act (Ekwueme et al., 2019; Zheng et al., 2019). Our data also did not report on cancer type, stage of disease, or duration of cancer treatment which may have prevented us from being able to fully examine financial hardship, as cost of cancer care varies by cancer, stage of diagnosis, and treatment type. Cases of non-melanoma skin cancer were also retained to maximize sample size, but some previous studies have excluded non-melanoma cases due to their less intensive treatment regimen (Kent et al., 2013; Yabroff et al., 2016). However, the proportion of non-melanoma cases were similar between groups: 19.7% in rural and 20.2% in urban. Although the MEPS sampling design is intended to produce nationally representative data,

the low overall response rate of 49.4% may have affected the representativeness of the data; however, the rural-urban distribution of our sample (rural: 18.3% vs. urban: 81.7%) was in line with national data. Despite these limitations, our study adds to the literature supporting financial hardship experienced by cancer survivors and growing exploration of rural-urban differences in cancer survivorship experiences.

5. Conclusions

A higher proportion of rural cancer survivors experienced material financial hardship compared to urban cancer survivors, but this was explained by other factors. Younger age (18–64 years vs. 65–85 years) was associated with experiencing both financial hardship and worry. Future research and improved data availability on rural populations are needed to better understand the dynamic between geography and financial hardship and worry. Additionally, improved provider-patient communication through the integration of decision tools and patient navigators may be helpful to address cancer-related financial hardship experienced by all populations regardless of geographic location. Policy-based solutions such as improved medical leave policies and Medicaid expansion may help younger cancer survivors in particular.

Supplementary Material

Refer to Web version on PubMed Central for supplementary material.

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References

- Austin CA, Mohottige D, Sudore RL, Smith AK, Hanson LC, 2015. Tools to promote shared decision making in serious illness: a systematic review. *JAMA Intern Med.* 175 (7), 1213–1221. 10.1001/jamainternmed.2015.1679. [PubMed: 25985438]
- Banegas MP, Guy GP, de Moor JS, et al. , 2016. For working-age cancer survivors, medical debt and bankruptcy create financial hardships. *Health Aff.* 35 (1), 54–61. 10.1377/hlthaff.2015.0830.
- Bullock AJ, Hofstatter EW, Yushak ML, Buss MK, 2012. Understanding Patients' attitudes toward communication about the cost of cancer care. *J Oncol Pract.* 8 (4), e50–e58. 10.1200/jop.2011.000418. [PubMed: 23180999]

- Chan MY, Cohen H, Spiegel BMR, 2009. Fewer polyps detected by colonoscopy as the day progresses at a Veteran's Administration teaching hospital. *Clin Gastroenterol Hepatol.* 7 (11), 1217–1223. 10.1016/j.cgh.2009.07.013. [PubMed: 19631284]
- Charlton M, Schlichting J, Chioreso C, Ward M, Vikas P, 2015. Challenges of rural cancer care in the United States. *Oncol.* 29 (9), 633–640.
- Davidoff AJ, Guy GP, Hu X, et al. , 2018. Changes in health insurance coverage associated with the affordable care act among adults with and without a cancer history. *Med Care.* 56 (3), 220–227. 10.1097/MLR.0000000000000876. [PubMed: 29438192]
- Devers K, Gray B, Ramos C, Shah A, Blavin F, Waidmann T, 2013. The feasibility of using electronic health records (EHRs) and other electronic health data for research on small populations disclaimer. https://aspe.hhs.gov/system/files/pdf/107231/rpt_ehealthdata.pdf, Accessed date: 12 April 2019.
- Ekwueme DU, Zhao J, Rim SH, et al. , 2019. Annual out-of-pocket expenditures and financial hardship among cancer survivors aged 18–64 years - United States, 2011–2016. *MMWR.* 68 (22), 494–499. 10.15585/mmwr.mm6822a2. [PubMed: 31170127]
- Foutz J, Artiga S, Garfield R, 2017. The role of medicaid in rural America. The Henry J Kaiser Family Foundation <https://www.kff.org/medicaid/issue-brief/the-role-of-medicaid-in-rural-america/>, Accessed date: 4 June 2019.
- Gan T, Sinner HF, Walling SC, et al. , 2019. Impact of the affordable care act on colorectal cancer screening, incidence, and survival in Kentucky. *J. Am. Coll. Surg.* 228 (4), 342–353.e1. 10.1016/j.jamcollsurg.2018.12.035. [PubMed: 30802505]
- Gilligan AM, Alberts DS, Roe DJ, Skrepnek GH, 2018. Death or debt? national estimates of financial toxicity in persons with newly-diagnosed cancer. *Am. J. Med.* 131 (10), 1187–1199.e5. 10.1016/j.amjmed.2018.05.020. [PubMed: 29906429]
- Medical expenditure panel survey background. https://meps.ahrq.gov/mepsweb/about_meps/survey_back.jsp, Accessed date: 2 July 2018.
- Jagsi R, Ward KC, Abrahamse PH, et al. , 2018. Unmet need for clinician engagement regarding financial toxicity after diagnosis of breast cancer. *Cancer* 124 (18), 3668–3676. 10.1002/cncr.31532. [PubMed: 30033631]
- Kent EE, Forsythe LP, Yabroff KR, et al. , 2013. Are survivors who report cancer-related financial problems more likely to forgo or delay medical care? *Cancer* 119 (20), 3710–3717. 10.1002/cncr.28262. [PubMed: 23907958]
- Kirkwood MK, Hanley A, Bruinooge SS, et al. , 2018. The state of oncology practice in America, 2018: results of the ASCO practice census survey. *J Oncol Pract* 14 (7), e412–e420. 10.1200/JOP.18.00149. [PubMed: 29906211]
- Mariotto AB, Robin Yabroff K, Shao Y, Feuer EJ, Brown ML, 2011. Projections of the cost of cancer care in the United States: 2010–2020. *J Natl Cancer Inst* 103 (2), 117–128. 10.1093/jnci/djq495. [PubMed: 21228314]
- McDougall JA, Banegas MP, Wiggins CL, Chiu VK, Rajput A, Kinney AY, 2018. Rural disparities in treatment-related financial hardship and adherence to surveillance colonoscopy in diverse colorectal cancer survivors. *Cancer Epidemiol. Biomark. Prev.* 27 (11), 1275–1282. 10.1158/1055-9965.EPI-17-1083.
- Onega T, Duell EJ, Shi X, Wang D, Demidenko E, Goodman D, 2008. Geographic access to cancer care in the U.S. *Cancer* 112 (4), 909–918. 10.1002/cncr.23229. [PubMed: 18189295]
- Palomino H, Peacher D, Ko E, Woodruff SI, Watson M, 2017. Barriers and challenges of cancer patients and their experience with patient navigators in the rural US/Mexico border region. *J. Cancer Educ.* 32 (1), 112–118. 10.1007/s13187-015-0906-0. [PubMed: 26362872]
- PDQ Adult Treatment Editorial Board, 2002. Financial toxicity (financial distress) and cancer treatment (PDQ®): patient version. <http://www.ncbi.nlm.nih.gov/pubmed/28682576>, Accessed date: 10 June 2018.
- Pisu M, Kenzik KM, Oster RA, et al. , 2015. Economic hardship of minority and non-minority cancer survivors 1 year after diagnosis: another long-term effect of cancer? *Cancer* 121 (8), 1257–1264. 10.1002/cncr.29206. [PubMed: 25564986]

- Resnicow K, Patel MR, Mcleod MC, Katz SJ, Jaggs R, 2019. Physician attitudes about cost consciousness for breast cancer treatment: differences by cancer sub-specialty. *Breast Cancer Res. Treat.* 173 (1), 31–36. 10.1007/s10549-018-4976-7. [PubMed: 30259283]
- Spencer JC, Rotter JS, Eberth JM, et al. , 2019. Employment changes following breast cancer diagnosis: the effects of race and place. *J Natl Cancer Inst.* 10.1093/jnci/djz197. 10.
- Srinivasan S, Moser RP, Willis G, et al. , 2015. Small is essential: importance of subpopulation research in cancer control. *Am. J. Public Health* 105 (Suppl 3(S3)), S371–S373. 10.2105/AJPH.2014.302267. [PubMed: 25905825]
- Texas A&M Health Science Center, 2015. Rural Healthy People 2020. *Am. J. Public Health* Vol. 1. <https://srhrc.tamhsc.edu/docs/rhp2020-volume-1.pdf>, Accessed date: 1 October 2019.
- United State Census Bureau Current population survey (CPS). <https://www.census.gov/programs-surveys/cps.html>, Accessed date: 2 July 2018.
- United States Census Bureau Geography 2010 geographic terms and concepts - core based statistical areas and related statistical areas. https://www.census.gov/geo/reference/gtc/gtc_cbsa.html, Accessed date: 3 April 2019.
- Vanderpool RC, Nichols H, Hoffler EF, Swanberg JE, 2017. Cancer and employment issues: perspectives from cancer patient navigators. *J. Cancer Educ.* 32 (3), 460–466. 10.1007/s13187-015-0956-3. [PubMed: 26627904]
- Weaver KE, Rowland JH, Bellizzi KM, Aziz NM, 2010. Forgoing medical care because of cost: assessing disparities in health care access among cancer survivors living in the United States. *Cancer* 116 (14), 3493–3504. 10.1002/cncr.25209. [PubMed: 20549763]
- Wheeler SB, Spencer JC, Pinheiro LC, Carey LA, Olshan AF, Reeder-Hayes KE, 2018. Financial impact of breast cancer in black versus white women. *J. Clin. Oncol.* 36 (17), 1695–1701. 10.1200/JCO.2017.77.6310. [PubMed: 29668368]
- Yabroff KR, Lund J, Kepka D, Mariotto A, 2011. Economic burden of cancer in the United States: estimates, projections, and future research. *Cancer Epidemiol. Biomark. Prev.* 20 (10), 2006–2014. 10.1158/1055-9965.EPI-11-0650.
- Yabroff KR, Dowling EC, Guy GP, et al. , 2016. Financial hardship associated with cancer in the United States: findings from a population-based sample of adult cancer survivors. *J. Clin. Oncol.* 34 (3), 259–267. 10.1200/JCO.2015.62.0468. [PubMed: 26644532]
- Yabroff KR, Zhao J, Zheng Z, Rai A, Han X, 2018. Medical financial hardship among cancer survivors in the United States: what do we know? What do we need to know? *Cancer Epidemiol. Biomark. Prev.* 27 (12), 1389–1397. 10.1158/1055-9965.EPI-18-0617.
- Zafar SY, Chino F, Ubel PA, et al. , 2015a. The utility of cost discussions between patients with cancer and oncologists. *Am. J. Manag. Care* 21 (9), 607–615. <http://www.ncbi.nlm.nih.gov/pubmed/26618364>. [PubMed: 26618364]
- Zafar SY, Ubel PA, Tulsy JA, Pollak KI, 2015b. Cost-related health literacy: a key component of high-quality cancer care. *J Oncol Pract.* 11 (3), 171–173. 10.1200/jop.2015.004408. [PubMed: 25829522]
- Zahnd WE, Fogleman AJ, Jenkins WD, 2018. Rural-urban disparities in stage of diagnosis among cancers with preventive opportunities. *Am J Prev Med* 54 (5), 688–698. 10.1016/J.AMEPRE.2018.01.021. [PubMed: 29550163]
- Zahnd WE, Davis MM, Rotter JS, et al. , 2019. Rural-urban differences in financial burden among cancer survivors: an analysis of a nationally representative survey. *Support Care Cancer* 27, 1–8. 10.1007/s00520-019-04742-z. [PubMed: 30006742]
- Zheng Z, Jemal A, Han X, et al. , 2019. Medical financial hardship among cancer survivors in the United States. *Cancer* 125 (10), 1737–1747. 10.1002/cncr.31913. [PubMed: 30663039]

Table 1: Rural versus urban characteristics and financial hardship of cancer survivor sample, MEPS 2011.

| | Rural | | Urban | | X ² -p-value |
|-----------------------------------|----------------|------------|----------------|------------|-------------------------|
| | Unweighted no. | Weighted % | Unweighted no. | Weighted % | |
| Total | 275 | 100.0 | 1144 | 100.0 | |
| Financial hardship | | | | | |
| Yes | 71 | 23.9 | 225 | 17.1 | 0.02* |
| No | 204 | 76.1 | 919 | 82.9 | |
| Financial worry | | | | | 0.72 |
| Yes | 54 | 22.2 | 253 | 21.0 | |
| No | 211 | 77.8 | 840 | 79.0 | |
| Age | | | | | 0.35 |
| 18–64 | 115 | 43.0 | 551 | 47.2 | |
| 65–85 | 160 | 57.0 | 593 | 52.8 | |
| Sex | | | | | 0.44 |
| Male | 110 | 41.4 | 461 | 43.9 | |
| Female | 165 | 58.6 | 683 | 56.1 | |
| Highest educational degree earned | | | | | 0.02* |
| GED/diploma or less | 202 | 64.1 | 702 | 54.9 | |
| Some college or more | 73 | 35.9 | 439 | 45.1 | |
| Income level | | | | | 0.01* |
| In poverty or low income | 131 | 31.7 | 373 | 23.7 | |
| Middle or high income | 144 | 68.3 | 771 | 76.3 | |
| Race | | | | | 0.01* |
| White | 242 | 95.6 | 972 | 92.2 | |
| Non-white | 33 | 4.4 | 172 | 7.8 | |
| Marital status | | | | | 0.30 |
| Married | 161 | 62.9 | 630 | 58.5 | |
| Not married | 114 | 37.1 | 514 | 41.5 | |

| | Rural | | Urban | | X ² -value |
|----------------------------------|----------------|------------|----------------|------------|-----------------------|
| | Unweighted no. | Weighted % | Unweighted no. | Weighted % | |
| Health insurance | | | | | 0.01* |
| Private | 158 | 64.9 | 741 | 71.4 | |
| Public | 106 | 32.9 | 339 | 24.1 | |
| Uninsured | ** | ** | 64 | 4.5 | |
| Time since last cancer treatment | | | | | 0.49 |
| 4 years or less | 96 | 34.6 | 380 | 34.9 | |
| 5 years or more | 135 | 49.9 | 553 | 46.5 | |

* Significant difference at $\alpha = 0.05$.

** Cell size insufficient (<30) to produce reliable estimate.

Table 2:

Average adjusted predicted probabilities of material financial hardship among cancer survivors from multivariable logistic regression model, MEPS 2011.

| | Average adjusted predicted probability | 95% CI |
|-----------------------------------|--|-------------------|
| MSA designation | | |
| Urban | 18.6% | 11.9–27.5% |
| Rural | 24.2% | 15.0–36.2% |
| Health insurance | | |
| Private | 15.9% | 10.1–24.2% |
| Public | 22.8% | 14.5–33.8% |
| Uninsured | 48.3% | 31.1–65.8% |
| Age | | |
| 18–64 | 25.8% | 17.0–36.8% |
| 65–85 | 14.1% | 8.5–22.4% |
| Sex | | |
| Male | 15.1% | 9.1–23.7% |
| Female | 22.6% | 14.7–32.8% |
| Highest educational degree earned | | |
| GED/diploma or less | 20.9% | 13.3–31.0% |
| Some college or higher | 17.5% | 11.1–26.4% |
| Income level | | |
| In poverty or low income | 25.5% | 16.3–37.3% |
| Middle or high income | 16.7% | 10.6–25.1% |
| Race | | |
| White | 17.8% | 11.3–26.8% |
| Non-white | 31.0% | 20.2–44.1% |
| Marital status | | |
| Married | 16.7% | 10.6–25.2% |
| Not married | 23.4% | 14.9–34.3% |
| Time since last cancer treatment | | |
| 4 years or less | 19.1% | 12.0–28.7% |
| 5 years or more | 20.0% | 12.8–29.6% |

Findings in **bold** are statistically significant at $p < 0.05$ based on multivariable logistic regression results.

Table 3:

Average adjusted predicted probabilities of financial worry among cancer survivors from multivariable logistic regression model, MEPS 2011.

| | Average adjusted predicted probability | 95% CI |
|-----------------------------------|--|-------------------|
| MSA designation | | |
| Urban | 19.9% | 12.0–31.0% |
| Rural | 18.8% | 12.1–28.0% |
| Health insurance | | |
| Private | 17.1% | 11.1–25.5% |
| Public | 20.1% | 12.4–30.6% |
| Uninsured | 37.8% | 22.1–56.5% |
| Income level | | |
| In poverty or low income | 20.8% | 12.8–31.7% |
| Middle or high income | 18.2% | 11.7–27.0% |
| Age | | |
| 18–64 | 26.6% | 17.3–38.3% |
| 65–85 | 12.3% | 7.3–20.0% |
| Sex | | |
| Male | 14.7% | 8.9–23.3% |
| Female | 21.9% | 14.1–32.1% |
| Highest educational degree earned | | |
| GED/diploma or less | 21.4% | 13.6–31.8% |
| Some college or higher | 15.0% | 9.4–23.1% |
| Race | | |
| White | 18.3% | 11.7–27.2% |
| Non-white | 24.1% | 14.5–37.1% |
| Marital status | | |
| Married | 16.4% | 10.4–24.8% |
| Not married | 22.5% | 14.2–33.5% |
| Time since last cancer treatment | | |
| 4 years or less | 18.2% | 11.4–27.7% |
| 5 years or more | 19.7% | 12.5–29.2% |

Findings in **bold** are statistically significant at $p < 0.05$ based on multivariable logistic regression results.