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PRESCRIPTION TRENDS AND PATIENT KNOWLEDGE DISPARITIES BETWEEN RURAL AND URBAN POPULATIONS: A COMPARATIVE STUDY

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ABSTRACT

Rational prescription practices and adequate patient knowledge about medications are crucial for optimizing therapeutic outcomes and preventing drug-related problems. However, differences in healthcare infrastructure, physician practices, and patient literacy may influence prescription patterns and drug awareness across rural and urban settings. This comparative observational study was designed to evaluate prescribing trends and patient knowledge in rural versus urban populations. Prescriptions were analyzed for drug categories, average number of drugs per prescription, use of generic versus branded medicines, adherence to essential drug lists, and prevalence of polypharmacy. Patient knowledge was assessed using structured questionnaires covering drug name, indication, dosage, frequency, and potential side effects. The study findings revealed significant differences between rural and urban settings. Urban prescriptions showed a higher tendency toward rational prescribing with greater adherence to standard guidelines, while rural prescriptions displayed higher rates of polypharmacy and lower generic use. Patient drug knowledge was considerably better in urban populations, likely due to higher literacy levels, improved access to healthcare providers, and better patient–doctor communication. These findings underscore the need for targeted interventions to promote rational prescribing and improve patient education in rural areas.

I. INTRODUCTION

Access to and use of health information are critical to personal and public health outcomes. Better health information access and use help individuals improve knowledge, increase use of health services, reduce health care costs, adopt healthier behavioral patterns, and therefore promote health.1,2 Access refers to people's ability to seek, find, and obtain health-related information.1 Use refers to people's ability to make decisions that maintain and/or improve their health based on the health information they receive.1 Whether an individual has health information access and how the individual uses such information can influence that person's health behavior, health care utility, health outcomes, and quality of life.1 For example, higher levels of health information access and use are associated with lower levels of smoking and alcohol consumption, higher levels of exercise and health checkups, and better self-rated health status.3 Multiple barriers create challenges for rural residents to access and use reliable health information, including barriers such as geography, distance, inclement weather, and lack of financial resources and specialty health care services.4 Furthermore, there are rural-urban health disparities that disadvantage the 20% of the US population who live in rural areas.5 Compared to urban residents, rural residents have higher all-cause mortality rates,6 higher rates of premature morbidity and mortality from diseases such as cancer, heart disease, and childhood obesity,7–10 lower access and use of preventive health care services,11,12 and they are more likely to engage in unhealthy behaviors.13,14 Due to the connection between health information access/use and health outcomes, examining the

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rural-urban health information access/use differences may help reduce rural-urban health disparities. The knowledge gap hypothesis 15 may also be helpful for understanding the role of information access and use in the development of rural-urban health disparities. In its original formulation, the hypothesis posits that, compared to those with lower socioeconomic status (SES), individuals with higher SES should have more access to and use of health information and thus will be more likely to benefit from new health information.15 Over time this creates a gap in health knowledge between those with higher and lower SES15,16 that contributes to health disparities.17 Research has shown that rural residents have lower SES than urban residents,7 and thus they may have limited access to and use of health information due to the differential access posited by the knowledge gap hypothesis. Finally, research has shown that rural residents have limited access to and use of online health information compared to urban residents,18 particularly online access involving high speed Internet.19 They also have lower access to health care providers.20 Given that people identify health care professionals and Internet as their primary sources of health information, 1,21,22 these infrastructure limitations may be significant obstacles to health information access and use in rural areas. However, less is known about the differences in health information source access and use between rural and urban residents. This study contributes to the literature by investigating the access/use patterns among 25 health information sources including health professionals, lay individuals, mass media, and different types of online sources (eg, social media, medical websites, and blogs or celebrity webpages). We explored a wide range of health information sources because consumers report consulting multiple kinds of sources for information when making health decisions.23 For example, individuals tend to use health professionals for information related to diagnosis or standard treatment, but they use friends for information related to coping strategies.23 Also, many previous studies categorized online health information sources as a single source, rather than differentiating between types of online sources; however, the use patterns vary among medical websites, social media, and celebrity webpages.24 Thus, it is important to differentiate among the wide variety of online health information sources to investigate people's health information access/use patterns in greater detail..

In addition to examining overall differences in access and use, we also explored the role of health literacy in these differences. Health literacy has profound effects on people's ability to understand and use health information25,26 and therefore is an essential factor to consider as a possible determinant of information access and use. For example, compared to patients with adequate health literacy, those with limited health literacy learned significantly less from health education information.27 Studies have shown that rural residents have lower health literacy than urban residents; however, this may due to differences in age, gender, race/ethnicity, education, and income.28 Nevertheless, it is possible that people with limited health literacy who live in rural areas face qualitatively different challenges of accessing and using health information than people with limited health literacy living in urban environments. There may be more health information sources in urban than rural environments that are accessible and understandable among people with low health literacy (eg, billboards, transportation signage, greater density of health clinics). Consequently, limited health literacy may be less of a barrier to access to and use of health information among people living in urban environments than rural areas. The purpose of this study was to examine differences in health information access and use between rural and

urban adults in the US. We conducted a nationally representative survey in which participants reported their access to and use of 25 health information sources. We hypothesized that rural residents would have lower access to and use of some sources compared to urban residents and that rural-urban disparities in health information access and use would be greater among people with limited health literacy.

2. Methods

Procedure and Participants

The Institutional Review Board at University at Buffalo approved the data collection protocol. Participant recruitment and data collection were conducted by GfK Group (Nuremberg, Germany), a market research firm with an academic research arm. Participants were members of the GfK KnowledgePanel®. The KnowledgePanel includes 55,000 people selected by GfK using probability-based sampling methodology based on the most recent Delivery Sequence File of the United States Postal Service that provides an effective sampling infrastructure for recruitment of hard-to-reach individuals, such as young adults and those from racial minority groups. These members were invited to join KnowledgePanel through a series of mailings. GfK provides Internet-enabled devices for those who would like to join the panel but have no Internet connection, which helps in reducing selection bias among individuals who lack Internet access. When analyzed with proper analytic procedures that account for weighting (see Data Analysis section below),29 data from GfK samples can be considered representative of the non-institutionalized US population. For this study, GfK used its internal records about the panel to identify panelists who were eligible for this study. GfK then sent email invitations to a randomly selected subset of 1,066 members of the panel. Eligibility criteria were: 18 years or older, residing in metropolitan or nonmetropolitan areas in the US, and ability to communicate in English. There were 618 people (58% of invited respondents) who completed the survey between February and April 2017.

Responses for 18 participants were dropped because they met 2 or more of the following 4 a priori criteria indicating a lack of attention to survey completion: (1) completed the survey in less than 8 minutes (ie, one-quarter of the median time of 32 minutes), (2) straight-lined or marked identical responses on more than 4 grids that contained one or more items that were worded in the direction opposite to the others (suggesting lack of attention to individual questions), (3) failed both of the survey validation items (asking participants to select “somewhat agree” for one item and “somewhat disagree” for the other item), and (4) gave different answers to a repeated factual question about their health insurance types. Given these exclusions, the final analysis sample included 600 participants with 302 rural and 298 urban residents.

Measures

Rural-Urban Residence-

Rural-urban residence was defined based on participants’ location of primary residence (identified by GfK from the participant’s IP address) as identified by the Office of Management and Budget (OMB).30 Specifically, urban residence refers to urbanized areas with a population of at least 50,000, which are classified as “Core Based Statistical Areas” (CBSAs); rural residence refers to areas that are not included in CBSAs.

Access to and Use of Health Information Sources—We assessed access to information source with the question, “Can you easily and affordably get health information from the following sources? [Yes/No].” We assessed use of sources with the question, “Do you get health information from the following sources? [Yes/No].” We asked these 2 questions for each of 25 health information sources that were

adapted from the Health Information National Trends Survey31 and the Pew Research Center.32,33 Then, we grouped the 25 sources into 6 categories: (1) health professionals: primary care providers, nurses, specialist doctors, pharmacists, veterinarians, and dentists; (2) lay individuals: friends, family, religious organizations and leaders; (3) health authorities: health fairs, local health department, federal government organizations, scientists, and scientific literature; (4) online sources: search engines, social media, medical websites, and blogs or celebrity webpages; (5) mass media: newspapers, magazines, books, television, and radio; (6) companies: pharmaceutical companies, and other companies or corporations (eg, the retailer GNC (GNC Holdings Inc., Pittsburgh, PA)).

Health Literacy—We assessed health literacy using the Newest Vital Sign (NVS).34 The NVS asks 6 open-ended questions based on the information on a mock ice cream nutrition label. Participants receive 1 point for each correct answer. They receive 0 points on incorrect or missing items. The NVS total score ranges from 0 to 6. A score < 4 indicates the possibility of limited health literacy and a score ≥ 4 indicates adequate health literacy.34 This cut-off score has high sensitivity for detecting individuals with limited health literacy.34 Therefore, we dichotomized health literacy as limited (NVS score < 4) or adequate (NVS score ≥ 4).34–38

Data Analysis

We performed Chi-square and t-tests using unweighted data to compare sociodemographics and health literacy between rural and urban participants. The rural and urban subsamples were weighted using the geodemographic benchmarks from the Current Population Survey (CPS)39 information released in March 2017. Analyses applying survey weights reduce the likelihood of Type I errors by accounting for the survey's complex design and sampling scheme.29 This weighting approach yields estimates that are representative of the US rural and urban populations. We used unadjusted and adjusted logistic regression models with weighted data to test associations between rurality and access to and use of each of the 25 health information sources separately. Outcomes were each source, each category of sources, and all sources aggregated together. Covariates were race/ethnicity, income, and education because, as expected based on prior research7 and our descriptive results, rural and urban residents significantly differed on these 3 demographic variables. Where source use was the outcome, we added access to the models because use of information is contingent upon access to such information. Unadjusted models provide valuable information about the aggregate experiences of actual people living in rural and urban areas; in contrast, adjusted estimates tell us more about people's hypothetical behavior if they had similar racial/ethnic and SES characteristics.40 To better understand the source access and use patterns, we performed Hierarchical Linear Modeling (HLM) because HLM provides more accurate estimates compared to linear regression models when analyzing nested data.41 We classified the 25 sources into 6 categories; therefore, sources were nested within each category. Finally, we used logistic regressions to test whether or not rurality interacted with health literacy to predict access to and use of the individual health information sources. We also performed the relative excess risk due to interaction (RERI) to test the departure from additivity of effects.42–44 We conducted regression analyses using Stata (StataCorp LLC, College Station, TX) and HLM using SAS (SAS Institute Inc., Cary, NC). We set the significance level at α=0.05.

3. RESULTS

Sociodemographics and Health Literacy Differences between Rural and Urban Residents

Differences in sociodemographics and health literacy between the unweighted rural and urban samples are shown in Table 1. Rural participants were less racially and ethnically diverse than urban participants (P < .001). Compared to urban participants, more rural participants self-identified as non-Hispanic white, and fewer were non-Hispanic black, Hispanic, or non-Hispanic other. Rural participants had lower income (P < .001) and education (P < .001) than urban participants. We found no differences in health literacy (P = .538) or age (P = .725) between rural and urban participants. About 83.7% of the rural participants and 81.8% of the urban participants had adequate health literacy (NVS score ≥4).

Access to Health Information Sources

Apart from descriptive statistics and comparisons in Table 1 reported above, all other analyses were conducted with weighted data. Among rural residents, the 3 most accessible health information sources were search engines (90%), family (89%), and friends (87%); the 3 least accessible sources were veterinarians (24%), health fairs (39%), and scientists (41%). Among urban residents, the 3 most accessible sources were family (94%), search engines (92%), and medical websites (91%); the 3 least accessible sources were veterinarians (27%), health fairs (43%), and companies or corporations other than pharmaceutical companies (44%). Figure 1 contains weighted frequency of access to each source of health information among rural and urban residents. In Table 2, we present the unadjusted and adjusted HLM findings of 6 categories (capitalized), as well as the logistic regression findings of each individual health information source. In the unadjusted HLM models, compared to urban residents, rural residents had significantly lower access to health information from the following source categories: health professionals (OR=0.70, 95% CI: 0.55–0.88, P = .003), online sources (OR=0.67, 95% CI: 0.45–1.00, P = .047), and mass media (OR=0.63, 95% CI: 0.41–0.97, P = .034). In the adjusted model, there were no statistical rural-urban differences among any of the source categories. In the unadjusted models for each individual source, compared to urban residents, rural residents had significantly lower access to health information from primary care providers (OR=0.56, 95% CI: 0.34–0.90, P = .016), specialist doctors (OR=0.58, 95% CI: 0.41–0.82, P = .002), dentists (OR=0.68, 95% CI: 0.48–0.95, P = .026), religious organizations and leaders (OR=0.72, 95% CI: 0.52–1.00, P = .049), federal government organizations (OR=0.63, 95% CI: 0.44–0.90, P = .011), scientists (OR=0.70, 95% CI: 0.50–0.96, P = . 028), blogs or celebrity webpages (OR=0.67, 95% CI: 0.47–0.96, P = .030), magazines (OR=0.65, 95% CI: 0.45–0.92, P = .016), and radio (OR=0.67, 95% CI: 0.47–0.95, P = . 025). In the adjusted models, only the difference in access to health information from specialist doctors remained significant (AOR=0.62, 95% CI: 0.43–0.90, P = .011).

Use of Health Information Sources

As seen in Figure 2, the weighted analyses show that among rural residents, the 3 most used sources were primary care providers (87%), family (77%), and nurses (77%); the 3 least used sources were veterinarians (5%), blogs or celebrity webpages (8%), and companies or corporations other than pharmaceutical companies (11%). Among urban residents, the 3 most used sources were primary care providers (91%), family (77%), and medical websites (77%); the 3 least used sources were veterinarians (4%), companies or corporations other than pharmaceutical companies (7%), and religious organizations and leaders (9%). As shown in Table 2, the unadjusted and adjusted HLM models indicated no rural-urban

differences in using these 6 source categories. In the unadjusted models for each individual source, compared to urban residents, rural residents had significantly lower use of health information from search engines (OR=0.66, 95% CI: 0.45–0.97, P = .036), books (OR=1.52, 95% CI: 1.05–2.18, P = .025), and other companies or corporations (OR=1.90, 95% CI: 1.04–3.48, P = .038). In the adjusted models, compared to urban residents, rural residents had higher use of nurses (AOR=1.68, 95% CI: 1.06–2.64, P = .026), health fairs (AOR=1.91, 95% CI: 1.03–3.53, P = .039), and books (AOR=1.66, 95% CI: 1.13–2.45, P = .011). Demographic Predictors for Health Information Use—In the adjusted models in which each category of source was regressed on rural-urban residence, higher income was associated with more use of the health authorities category, and higher education was associated with more use of health professionals, mass media, and health authorities categories. Race/ethnicity was associated with use of the following categories: online sources, mass media, lay individuals, and health authorities. For the use of online sources, mass media, and lay individuals, non-Hispanics others, blacks, and Hispanics had higher rates than whites. For the use of health authorities, compared to whites, Hispanics and nonHispanic others had higher rates but blacks had a lower rate of using these sources.

4. DISCUSSION

This study examined the differences between US rural and urban residents' access to and use of health information from 25 sources and the degree to which health literacy exacerbated these differences. Our study contributes to the current literature by investigating the ruralurban differences in health information access and use across a wide range of sources, including from specific types of online health information sources (eg, medical websites and social media) and more traditional sources (eg, physicians, health fairs). We found that compared to urban residents, rural residents had lower access to several health information sources: primary care providers, specialist doctors, dentists, religious organizations and leaders, federal government organizations, scientists, blogs or celebrity webpages, magazines, and radio. They also had lower use of search engines for health information compared to urban residents. After adjusting for race/ethnicity, income, and education, rural residents still had lower access to health information from specialist doctors than urban residents. Such a difference may stem from the shortages in specialist health care providers in rural areas in the US.20 Access to specialists may also be constrained by lower health care coverage and lack of access to transportation among rural residents compared to urban residents.20,45 Patients in rural areas travel 2 to 3 times farther to visit specialists than those living in urban areas.46 Thus, rural residents may have reduced opportunities to ask for or be provided with health information from specialists. Holding race/ethnicity, income, and education constant rendered the differences in access non-significant except for specialist doctors. Our results indicate that race/ethnicity, income, and education are likely explanations for why ruralurban differences are observed. Individuals with lower incomes, those with less education, and those of minority race/ethnicity have less access to health information from a variety of sources.47,48 These socioeconomic factors characterize many rural areas.49 Thus, rural residents experience disparities in health information access that may ultimately be contributing to health disparities. We found that rural residents with limited health literacy had lower access to mass media and scientific literature compared to rural residents with adequate health literacy, but there was no such relationship for urban residents. Compared to urban areas, rural areas have lower levels of media coverage of health information because

mass media in rural areas may not have as many resources as urban areas have to conduct in-depth health reporting or purchase wire stories.49,50 Such shortages of health information coverage in rural areas might cause extra challenges for rural residents who have limited health literacy to seek easy-to-understand health information. We also found that rural residents with limited health literacy had a higher likelihood of using companies or corporations other than pharmaceutical companies for health information, but there was no such relationship for urban residents. Studies show that some health information from for-profit corporations/companies can be misleading because the messages were created for advertising purposes.51,52 Urban residents historically have a negative impression of health information from corporations such as tobacco and fast food markets because these corporations have been criticized for creating misleading health information to encourage unhealthy behaviors to maximize profitability.53 In addition, people with limited health literacy can have relatively more difficulty evaluating and differentiating accurate health information sources from inaccurate ones.54 Thus, negative impressions and difficulty evaluating information should be explored in future research as possible explanations for higher rates of using companies or corporations as a source for health information among rural residents with limited health literacy.

5. CONCLUSION

The comparative study highlights distinct disparities in prescription practices and patient drug knowledge between rural and urban settings. While urban populations benefited from relatively rational prescribing patterns and greater drug-related awareness, rural patients were more vulnerable to polypharmacy, branded prescriptions, and inadequate understanding of their treatment regimens. Addressing these gaps requires strengthening of rural healthcare systems, encouraging prescribers to adhere to essential drug lists, and implementing patient-centered education programs. Interventions such as community pharmacist involvement, structured counseling, and rural healthcare training initiatives can play a vital role in bridging the rural–urban divide in drug utilization and patient knowledge. Ultimately, improving prescription practices and empowering patients with knowledge will enhance therapeutic outcomes and reduce medication-related risks across populations.

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