

Health Disparity and Cancer Health Disparity in China

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ABSTRACT

China is one of the largest and most populated countries in the world. It has undergone rapid economic growth in recent years. However, the development is not equitable, and the distribution of wealth significantly varies among the regions in China. Geographical and socioeconomic inequalities, together with the lack of an equitable national social support system, cause the high variance of health outcomes among the regions. Furthermore, the fast growth of the economy has evoked many environmental challenges and puts much pressure on the population. The severe environmental deterioration, especially

of the atmosphere and water bodies, has affected the health of the people living in China. As a result, cancer has become a major public health issue, and an alarming increase in incidence and mortality has been reported. However, cancer incidence and mortality vary in different areas in China. Cancer and cancer treatment disparities have existed for years. This article will discuss the existing health and cancer disparities associated with the risk factors and how these disparities are managed in China.

Key words: Cancer health disparity, China, health disparity

Introduction

Disparities in health continue to persist across Mainland China. In this paper, the disparities and contributing factors are discussed to provide a reference for the medical challenges China is facing. This study could also be used as a basis to develop corresponding strategies to meet these health challenges.

Health Disparity

China is the third largest country in the world and has 34 provincial divisions with over 1.36 billion of the populations (one-third of the world's population),^[1,2] making it one of the most populated countries in

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the world.^[3] In 2012, the aging population was 194 million (14.3%), and it is estimated to increase up to 4.83 million (34.1%) by 2050, making the country one of the fastest aging populations worldwide.^[4,5] Over the past four decades, China has undergone rapid economic growth.^[6] The benefits of economic growth, however, are not distributed equally. Disparities in income and wealth between the urban and rural areas have widened substantially. Data from the World Bank in 2009^[7] showed that approximately 11.8% of the Chinese population lived below the poverty line (<\$1.25 per day)^[8] and 26% of urban and 44% of rural dwellers did not have access to basic sanitation.^[9] China's income gap between rural and urban dwellers is now one of the largest in the world.^[10,11] These geographical and socioeconomic disparities, together with the lack of an equitable national social support system, are the reason why health outcomes differ significantly between Chinese regions. Many studies have proven that socioeconomic factors mainly contribute to the health disparities and the study findings support the National Cancer Institute's description about health disparity: "Health disparity involves a health differences that are closely linked with social, economic, and environmental disadvantage and are often driven by the social conditions in which individuals live, learn, work, and play."^[12] In this part of the paper, observed health disparities in some aspects in China and the contributing factors are discussed.

Disparities in community infrastructure

Hospitals are distributed differently between urban and rural areas

In 2011, there were 954,389 health institutions in total, with 134,841 health institutions located in urban areas and 819,548 located in rural areas in China.^[13]

A lower average number of doctors and nurses are found in the rural areas

An investigation^[14] revealed that in 2005, China had 4,460,000 health professional workers including licensed doctors, nurses, and other health professionals. Among the professional workers, licensed doctors accounted for 1.5% at national level which was lower than that (2.1%) in urban area and higher than that (1.0%) in rural area; licensed nurses accounted for 1.1% which was lower than that (1.7%) in urban area and higher than that (0.5%) in rural area. According to the data collected by the Chinese Ministry of Health, in 2011, there were 1.66 nurses per 1000 population at national level, which was higher than that (0.98 nurses per 1000 population) in rural area and lower than that (3.23 nurses per 1000 population) in urban area. For the ratio of patients to nurses, the national average

ratio of patients to nurses in 2011 was 0.41, which was slightly higher than the average ratio (0.4) stipulated by the Chinese Ministry of Health in 1978.^[15] Study findings also indicated that doctor-and-nurse distribution was even worse in low-income provinces and the educational level of workforce varied between the rural and urban areas. Poorer provinces tend to have less educated workforce, and the inequality in per-head availability of well-trained health professionals is likely to be larger.^[14]

A contrast in access to safe drinking water and sanitation between urban and rural areas

Safe drinking water is available to 96% of the population in large cities, but <30% of people in poor rural areas have access to safe drinking water. Differences in access to effective sanitation are even larger; 90% of residents in large cities have adequate sanitation, whereas <10% of the population in poor rural areas have access to effective sanitation.^[16]

Disparities in health outcomes

Disparities in health outcomes in China have been proven. A cross-sectional study detailed that the infant mortality rate, maternal mortality rate, and under-five mortality rate were two to three times higher in western rural China than in eastern rural China.^[17,18] The Chinese Ministry of Health also reported that rural infant mortality rates are nearly five times higher in the poorest rural counties than in the wealthiest counties – 123 versus 26 per 1000 live births. Although the under-five mortality has significantly declined between 1996 and 2004, child mortality rates still remain much higher in rural than in urban areas, and this variation has widened.^[19] The average rates of maternal health management, hospital delivery, and under-three health management were higher in eastern rural China than those in central and western rural China.^[20] In addition, there is a three-fold difference in the number of malnourished children aged <5 years between urban and rural areas.^[20]

The Chinese Ministry of Health stated that life expectancy has improved much slower in poor provinces than in rich ones. For example, life expectancy in Beijing and Shanghai increased 4–5 years compared with 1.4 years in Gansu, one of the China's poorest provinces.^[21]

Multiple factors contribute to the observed disparities in the health outcomes, such as occupation, education, and household income.^[22] Some research indicates that household income is the most powerful predictor of mortality rates when compared with other socioeconomic indicators.^[23]

Therefore, national efforts to improve the social and economic well-being of China's rural populations are urgently needed. Efforts should focus on grassroots medical networks, which can penetrate lower-tier socioeconomic populations across central and western rural China to help them have access to essential medical services.^[6,18,24] To achieve equity in the distribution of health services, the Chinese Government has taken more proactive in the setup of health policies for developing the economy, reducing poverty, and improving access to health services, particularly in rural areas. The government also increased its budget for modernizing the public health system.^[18,24]

According to Amartya Sen, health disparity has many aspects, which can be best seen as a multidimensional concept and requires that health issues be integrated with broader issues of social justice and overall equity.^[25]

Cancer Health Disparity

Data from recently updated GLOBOCAN 2012^[26] show that two-third of new cancer cases worldwide were in China. According to the World Health Organization (WHO), cancer is the second most common cause of death after cardiovascular disease and has the most pronounced increase in cases in rural areas in China. The annual cancer mortality in China is a quarter of all cancer deaths worldwide.^[27]

After 30 years of fast and dynamic development of China's economy and opening policy reform, many environmental challenges came with the rapid economic boom and industrialization. Severe environmental deterioration, especially of the atmosphere and water bodies, has affected the health of people living in China.^[28] As a result, cancer cases are alarmingly increasing and have become a major public health issue. Currently, it has become the second leading cause of death, accounting for 21% of all deaths, and furthermore, this rate is increasing.^[6,29-32]

Despite recent advancements in oncology, the Chinese Government and relevant medical professionals still face great challenges in managing the current cancer burden. Cancer health disparities exist persistently in different populations across Mainland China.

Cancer health disparities refer to the adverse differences in cancer incidence (new cases), cancer prevalence (all existing cases), cancer death (mortality), cancer survivorship, and burden of cancer or related health conditions that exist among specific population groups.^[12] In this section of the article, cancer health disparities in incidence and mortality,

most common cancers, cancer survival, screening and access to cancer care in China are discussed.

Disparities in cancer incidence and mortality

Higher incidence rates and lower mortality rates in urban areas and lower cancer incidence and higher mortality rates in rural areas have been observed in 2009, 2010, 2011, and 2012^[33-39] [Tables 1 and 2]. However, in 2015, cancer incidence and mortality rates in rural areas were higher than those in urban areas ($213.6/10^5$ vs. $191.5/10^5$; $149/10^5$ vs. $109.5/10^5$).^[40]

Differences in most common cancers

The top five types of cancer vary every year; however, the leading cancers in both men (indicated cancer of lung and stomach) and women (indicated cancer of breast and lung) remained the same between 2009, 2010, 2011, 2012, and 2015 in China [Table 3]. Within the same years, a downward trend in the occurrence of colorectal, liver, and cervical cancer has been observed whereas an upward trend in stomach and esophagus cancer in women has been seen. In men, a downward trend in liver and colorectal cancer has been observed whereas an upward trend in esophagus cancer has been observed.^[33-40] Cancer distribution is also far different worldwide. For example, based on the WHO statistics, the top five most common cancers in males in the US in 2012 were prostate, lung, colorectal, bladder, and melanoma cancer, whereas the top five cancers in American women were breast, lung, colorectal, corpus uteri, and thyroid.^[41]

Studies have identified multiple factors causing the disparity in availability of health services in rural areas in China, such as medical resources, lower level of cancer treatment, a larger proportion of patients diagnosed with cancer at late stages, and a higher smoking prevalence.^[40,42,43]

Table 1: Cancer incidence in China from 2009 to 2015

Estimated cancer incidence rates (per 100,000): age-standardized incidence rates by Chinese					
Area	2009	2010	2011	2012	2015
All areas	146.87	184.58	186.34	191.89	201.1
Urban area	150.31	187.53	189.89	195.56	191.5
Rural area	139.68	181.1	182.1	187.1	213.6

Table 2: Cancer mortality rates in China from 2009 to 2015

Estimated cancer mortality rates (per 100,000): age-standardized mortality rates by Chinese					
Area	2009	2010	2011	2012	2015
All areas	85.06	113.92	112.88	112.34	126.9
Urban area	80.86	109.21	108.2	107.231	109.5
Rural area	94.4	119	117.97	118.22	149

Table 3: The top 5 cancer sites by gender in China from 2019-2015

Year	2009	2010	2011	2012	2015
Sex					
ALL sexes					
1	Lung	Lung	Lung	Lung	Lung
2	Stomach	Breast	Breast	Stomach	Stomach
3	Colorectum	Stomach	Stomach	Liver	Esophagus
4	Liver	Liver	Liver	Colorectum	Liver
5	Esophagus	Esophagus	Colorectum	Esophagus	Colorectum
Female					
1	Breast	Breast	Breast	Breast	Breast
2	Lung	Lung	Lung	Lung	Lung
3	Colorectum	Colorectum	Colorectum	Colorectum	Stomach
4	Stomach	Stomach	Stomach	Stomach	Colorectum
5	Liver	Liver	Liver	Cervix	Esophagus
Male					
1	Lung	Lung	Lung	Lung	Lung
2	Stomach	Stomach	Stomach	Stomach	Stomach
3	Liver	Liver	Liver	Liver	Esophagus
4	Colorectum	Esophagus	Esophagus	Esophagus	Liver
5	Esophagus	Colorectum	Colorectum	Colorectum	Colorectum

Lung cancer

The prevalence of tobacco smoking in China definitely contributes to increasing lung cancer incidence and mortality. It has been estimated that if current smoking patterns persist in China, approximately 100 million Chinese men currently aged between 0 and 29 years would be killed by smoking, and this number would reach 3 million a year by 2050.^[44]

Although tobacco smoking is the primary risk factor for lung cancer, air pollution has also a significant effect in the development of lung cancer. Air pollution levels in Chinese cities are among the highest in the world today and frequently exceed the health-based national and international guidelines. Data from high-quality studies conducted in some regions around the world consistently show a positive association between lung cancer and fine particulate matter exposure and other air pollutants. Numerous studies from China, especially genetic biomarker studies in exposed populations, support that the polluted air in China is genotoxic and carcinogenic to humans.^[45] Xinhua, China's official newswire service, reported that the pollutants in some areas in China include heavy metals, such as chromium, as well as other carcinogens that have long been banned in other countries.^[46]

Another source of air pollution is the household. Burning coal, biomass fuels, wood, and crops in rural areas pollute the air. Although there are rapid urban developments in China, more than 60% of the population still lives in rural areas. Most households in rural areas still use biomass fuel in simple stoves that are often unvented and produce substantial

indoor air pollution.^[47] Therefore, controlling the prevalence of tobacco smoking and eliminating air pollutants are the greatest long-term challenge for public health officials in China at the beginning of the 21st century.^[44,48]

Breast cancer

It is the most common cancer in women, followed by lung cancer. Breast cancer incidence has been increasing annually both in urban and rural areas in China. According to the findings of a study, the incidence rate of the breast cancer in urban area was 53.87/10⁵ (185,585 new cases) which was higher than that of 40.14/10⁵ (132,432 new cases) in rural areas in 2015.^[49] Some research analyzed the reason why breast cancer incidence in China has kept increasing for years and found that lifestyles, especially in urban areas, are becoming more Westernized, such as change in dietary and increased alcohol consumption, reduced physical activity, obesity (especially among the young), childbearing at a later age, and low fertility. One or more of these factors are responsible for the increasing incidence of breast cancer. Early detection and effective treatment are the most realistic approach to reducing mortality.^[50]

Stomach cancer

Digestive system cancer, such as that of the liver, stomach, and esophagus, is not prevalent in developed countries, but it has a significantly higher occurrence in China and other Asian countries.^[51] According to a study analyzing the incidence and mortality of stomach cancer in China in 2010, newly diagnosed stomach cancer cases were 51,897 and the crude incidence was 30.77/10⁵, among which male cases accounted for 42.77/10⁵ and female for 18.18/10⁵; the ASRIC was 23.71/10⁵ among which ASRIC was 20.72/10⁵ in urban areas and 27.37/10⁵ in rural areas. Stomach cancer mortality was 21.89/10⁵ (29.72/10⁵ for male, 13.68/10⁵ for female); ASRMC was 16.64/10⁵ (14.09/10⁵ in urban areas and 19.82/10⁵ in rural areas).^[52] Over the last half century, the incidence of stomach cancer has fallen markedly in developed countries, whereas it remains common in China, Japan, Eastern Europe, and Central and South America.^[53] Eating scalding hot food and drinking beverages posed the highest risk for developing gastric cancer.^[54] Consuming salted, smoked, and chemically preserved food, such as salted meat, pickled vegetables, and processed vegetable juice, has also been associated with elevated risk for gastric cancer.^[54,55] Some studies also reported that low socioeconomic status was a significant risk factor for gastric cancer.^[56] Families living in crowded areas were also observed to be at greater risk for gastric cancer, which may be because of an infectious etiology enhanced by a crowded environment.^[57] *Helicobacter pylori*, which the WHO considers as a gastric carcinogen, has been found thriving in

considers as a gastric carcinogen, has been found thriving in crowded areas. Other factors for transmission for *H. pylori* include family size, bedroom sharing, low socioeconomic status, low educational level, poor sanitation, and infrequent hand washing before meals.^[55] Cigarette smoking was also associated with a statistically significant increased risk of stomach cancer.^[58]

These risk factors of gastric cancer could be lowered through improving socioeconomic circumstances, better refrigeration, reducing consumption of unhealthy food, improving food preparation practices, and increasing consumption of more fruits and vegetables.^[55]

Liver cancer

According to the GLOBOCAN 2012, the incidence and mortality rates of liver cancer in developing countries are higher than in developed countries.^[26] In China, the incidence rate of liver cancer accounted for 10.54% in 2011, making liver cancer the third most common cancer in China. Higher incidence rate in males (13.79%) than in females (6.26%) and lower rate in urban areas (9.11%) than in rural areas (12.20%) were observed. Liver cancer mortality accounted for 15.26% of all cancer deaths, with higher rate in rural areas than in urban areas, making liver cancer the second most common cause of cancer death in 2011. More males died from liver cancer (17.77%) than females (10.85%).^[59]

Genetic factors play a role in the higher occurrence and mortality of liver cancer in men than in women,^[60] as well as the higher amount of alcohol consumed by men.^[61] Aflatoxin exposure, unhealthy eating habits, polluted water, and blood transfusion are also risk factors of liver cancer, and people in rural areas are easily exposed to these risk factors.^[62] Hepatitis B virus (HBV) infection leads to primary hepatic cancer as confirmed by the WHO. It is estimated that 60%–80% of hepatic cancer in China was caused by chronic HBV infection, and the Chinese population has the highest incidence of chronic HBV infection in the world.^[63] The higher mortality rate of liver cancer in rural areas mainly contributes to the limited medical resources and poor quality of medical services.^[59]

Esophageal cancer

Esophageal cancer was the fifth most common cancer and the fourth leading cause of cancer death in China in 2009, 2010, and 2012.^[33,34,36,37,38-40] The esophageal cancer incidence rate in China in 2010 was estimated at 21.88/10⁵, accounting for 9.30% of overall new cancer cases. The incidence rate in men (30.38/10⁵) was remarkably higher than in women (12.96/10⁵). Urban areas had a lower

incidence rate (16.55/10⁵) than rural areas (27.29/10⁵).^[64] In particular, certain rural areas in Henan, Hebei, and Shanxi have the highest incidence rates of esophageal cancer in the world (>100/10⁵ population). For example, the incidence rate in Cixian was 18 times higher than that of Beijing or Shanghai.^[56] The mortality rate of esophageal cancer was 15.85/10⁵, accounting for 10.65% of overall cancer deaths, and the mortality in men (22.12/10⁵) was much higher than in women (9.29/10⁵) in 2010. Urban areas had lower mortality (12.19/10⁵) than rural areas (19.58/10⁵), which is consistent with the findings of WHO.^[65] In a prospective follow-up study in Linxian, a representative high-incidence rural area in China, squamous dysplasia is strongly associated with acquiring esophageal cancer.^[66] Alcohol consumption and cigarette smoking are considered the risk factors. A study investigating the risk factors of esophageal cancer reported that a high percentage of the participants were drinking alcohol.^[67] The study led by Liang *et al.* also found that the fraction of esophageal cancer attributed to alcohol drinking was estimated at 15.2% in males and 1.3% in females. The percentage of esophageal cancer contributed to cigarette smoking was 17.9% in men and 1.9% in women.^[68,69] Nutritional deficiency is another factor closely associated with increased risk for developing esophageal cancer, especially in high-risk areas.^[56] Studies in Linxian found that malnutrition, as well as selenium, zinc, folate, riboflavin, and Vitamins A, C, E, and B12 deficiency, is considered to be related to increased risk factor of esophageal cancer.^[70] According to a population-based case–control study, lifestyle is also related to acquiring esophageal cancer. More than 60% of total cases could be attributable to lifestyle-based risk factors.^[71] Fast eating speed and eating/drinking hot foods/liquids strongly increased the risk of esophageal cancer.^[68] Numerous studies targeting certain genes have reported an association of genetic polymorphisms with esophageal cancer risk in the Chinese population. Particular genotypes appear to act synergistically with alcohol consumption.^[56]

Epidemiologic evidence indicates that digestive system cancers are preventable through reducing risk factors. The public should be educated that improving diet, nutritional status, and eating habits, reducing alcohol consumption and cigarette smoking, and adopting healthy lifestyle in general help lower the risk of developing esophageal cancer.^[56,72]

Disparity in cancer survival

The 5-year relative cancer survival in China was generally low compared with that in developed countries and even lower in rural China. Zeng *et al.* studied cancer survival from 2003 to 2005 and found that the combined age-standardized 5-year survival for all cancers was 30.9% in China. Another study showed an increased percentage of 36.9% in 2015.^[40,43]

Rural China had a much lower relative 5-year survival rate compared with urban China. This may be because of limited medical resources, low quality of cancer treatment, and a higher number of patients diagnosed during the late stage of cancers. Cancer survival can be considered an important indicator for comparison of improvement in cancer control,^[73-75] and it is positively associated with gross domestic product and the amount of investment in health technology, such as computed tomography (CT) scans.^[74] Survival increased substantially within the past 10 years, indicating substantial improvements in cancer care and screening programs, particularly mammography screening for breast cancer and prostate-specific antigen testing for prostate cancer.^[43] The wide range of differences in survival between urban and rural areas is attributable to differences in access to diagnostic and treatment services^[76] and has been associated with national levels of economic development, as measured by total national expenditure on health.^[77]

Disparities in cancer screening

Before 2009, no national screening programs were available for detecting cancers in China.^[78] The country is yet to develop a National Screening Program or Guidelines.^[79] Cancer screening programs are not available to the entire population and are especially deficient in rural areas. Some types of cancer screening are only available in urban areas or only subgroups with high predisposing rates are screened. Some individual corporations also sponsor the cancer screening of their employees.^[80]

In 2009, to reduce regional disparities in cervical cancer burden, China's government launched the National Cervical Cancer Screening Program in Rural Areas Program. It was the first time that the Chinese Government had proposed to gradually widen access to cervical cancer screening services in rural areas. This was a step toward nationwide provision of cervical cancer screening.^[81] Cervical cancer screening services are available in all provinces of China, but coverage is highly variable across regions. Women in urban areas are more likely to report a history of Pap test than those in rural areas regardless of geographic region.^[79] In 2011, the National Lung Screening Trial reported that the low-dose spiral CT-screened arm can reduce lung cancer mortality. Now, lung cancer screening is always conducted among high-risk populations. The main criteria for a high-risk population in lung cancer screening programs are age and smoking status; consequently, many other risk factors are not considered.^[82]

At present, China is yet to develop a national large-scale screening program or guidelines for breast cancer screening; however, breast cancer screening started in some large cities

in the 70th last century, but the methods of screening varied in regions.^[83] Previous studies investigating the prevalence of participating in breast cancer screening without considering the screening method among Chinese women have pointed out that a relatively low percentage of Chinese women (21.7%) in urban regions have reported that they never had received breast cancer mammographic screening. In rural regions, this percentage was even lower (16.5%).^[84] Lower participation in screening is particularly prevalent in rural China, where cancer is a taboo subject – particularly breast and cervical cancer, which are associated with female sexual organs. Chinese women avoid participating in screening, and even those who have been screened are reluctant to speak openly about it.^[85] In addition, cancer centers in China focus mainly on treatment rather than prevention and early detection.^[86] A study done by Wu *et al.* reported that 75% of 400 women surveyed had never had a mammogram, with the most common reasons being low priority, feeling healthy, and lack of awareness about the benefits of screening for breast cancer.^[87]

Disparities in access to cancer care

In addition to a general lack of human and other resources in cancer care, China's vast population, large geographical span, and diverse cultures and socioeconomic groups create wide disparities in cancer care within the country. However, remarkable progress has been made toward upgrading the health-care system.^[6] Today, China has more than 200 cancer hospitals, with more than 30 tertiary-level hospitals for cancer that provide the highest level of care.^[1] In addition to these cancer hospitals, many general hospitals have Oncology Departments. The number of beds for cancer care are unevenly distributed across the country, with twice as many beds available in urban areas as in rural areas.^[88,89] Besides different access to infrastructure of cancer care, the lack of oncologists in cancer care settings in rural areas still remains a challenge. Each year, many physicians graduate, but only a small number specialize in oncology.^[89] Most oncologists have a sound knowledge in cancer treatments, but qualified staff for modern cancer treatment are not evenly distributed around the nation, and it is difficult to attract and retain qualified oncologists in rural areas.^[9]

Strategies for Improving Cancer Care

The Chinese Government has embarked on health-care reform suited to the country's unique history and culture. The optimistic side for potential success of the health reform appears to be that the problems, contradictions, and complexities of the health inequality are well understood and China's rapidly growing economic capacity should

be able to afford the major reforms which aim to ensure better access to the Chinese population to essential health care. Government thus has started to accelerate its public investment in public health system including disease prevention and health promotion and establish health-insurance schemes including a medical financial assistance scheme for poor people.^[90] In 2009, the central government announced a reform plan, which focuses on making health care more affordable and universally available by 2020.^[29] To be consistent with the WHO global targets in reduction of premature mortality from noncommunicable diseases as well as cancer to 25% by 2025,^[91] China has set up a series of very cost-effective interventions provided in the Global Action Plan to reduce tobacco and harmful alcohol use, improve unhealthy diets, increase physical activity, enhance safe drinking water, and provide access to effective sanitation. Furthermore, screening programs for breast, uterine, and cervical cancers have been established for detecting early-stage cancer, applying prompt and optimum treatment, and reaching improved survival.^[92]

Conclusion

Health disparity, including cancer health disparity, has continued to persist in Mainland China; however, the Chinese government has implemented programs to develop the economy in central and western areas by making beneficial policies; health-care systems have been striving, and the health-care sector has helped the government to narrow the gap in health disparities between rural and urban China. As oncology nurses, we need to recognize the causes of the existing health disparities in China. Nurses, whether working in large hospitals or in rural clinics, are supposed to advocate for and educate the public, particularly those living in rural areas. The public should be educated about health promotion, cancer risks, and the importance of screening and early diagnosis/treatment. Behavioral interventions should be enhanced, such as tobacco control and healthy lifestyle promotion. Information is power, and through education, nurses can empower the public to improve their health. A Chinese proverb says, "Give a man a fish and you feed him for a day. Teach him how to fish and you feed him for a lifetime." Health education is an integral responsibility of nurses. Policymakers in China should hear our voices so that comprehensive training and development should be provided to the rural primary care workforce to enhance the quality of care provided to rural residents.

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Conflicts of interest

There are no conflicts of interest.

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