Proceedings of the 2nd International Conference on Modern Medicine and Global Health
DOI: 10.54254/2753-8818/15/20240420

Correlation between water pollution and the incidence of common cancers — Wuyingshan community as an example

Haoran Yang

Mercyhurst Preparatory School, 538 East Grandview Blvd. Erie, PA, 16504, USA

hyang24@students.mpslakers.com

Abstract. The reasons for the significant decrease in cancer incidence in the past decade among residents of Wuyingshan Community, Tianqiao District, Jinan City, Shandong Province, where the author lives, are certainly comprehensive and multifaceted. Due to time and energy constraints, this paper takes the perspective of the creation of a National Sanitary City in Jinan and the widespread use of tap water purification equipment by residents in the Wuyingshan Community, and uses the sample sampling method and comparative research method to indirectly prove the relationship between water pollution and the incidence of common cancers among residents in the Wuyingshan Community by investigating the effects of the quality of residents' drinking water on residents' tumors. The results of the study show that there is a positive correlation between water pollution and the incidence of common cancers, and that the creation of the National Sanitary City and its continuous management of water pollution effectively reduce the incidence of common cancers in the community, and that the residents contribute to the further purification of tap water; on the other hand, residents who do not pay attention to the quality of drinking water are prone to the occurrence of common cancers. In order to sustainably reduce the level of urban water pollution and maintain drinking water quality that meets internationally accepted health standards, this paper makes several recommendations from the dimensions of water quality legislation, production and living needs, water quality monitoring, and sewage treatment.

Keywords: Water Pollution, Common Cancers, Water Purification.

1. Research Background

The relationship between environmental pollution and cancer incidence has been mostly answered in the affirmative. The author is interested in the correlation between water pollution and the incidence of common cancers. It has been suggested that there is some causal relationship between drinking water and cancer incidence because surface water such as lakes, reservoirs, and rivers and groundwater such as underground rivers and wells, as well as treated drinking water, are contaminated with chemical carcinogens in the environment [1]. However, the author has not yet seen the relevant data from the survey. In view of the fact that the drinking water most frequently contacted by the general public is related to everyone's physical and mental health, the author tries to take drinking water as the object and take the community of Wuyingshan, Tianqiao District, Jinan City, as a sampling sample, to examine the changes in the quality of drinking water of the community and its relationship with the

DOI: 10.54254/2753-8818/15/20240420

incidence rate of common cancers, and indirectly to seek evidence of the relationship between water contamination and the incidence rate of common cancers.

Nowadays, it is a common phenomenon that more and more people are using bottled water, more and more families and organizations are installing water purifiers, and more and more high-grade hotels and catering and entertainment establishments are using water purification equipment, which was unimaginable 20 or 30 years ago. The reason for this, on the one hand, is people's higher requirements for drinking water quality, on the other hand, it is reflecting the concern of the residents on drinking water pollution and water quality components.

A large amount of sewage is flooding people's living environment. These sewages are either discharge water from the life and production, or the water from residential, institutional, commercial or industrial discharge, mixed with groundwater, surface water, storm water, etc., carrying polluted materials. According to their types, the sewage includes domestic sewage (including from the residential, office buildings, institutions or similar sewage, sanitary sewage, sewage, etc.) and industrial wastewater, commercial wastewater sewage (such as catering sewage, laundry sewage, animal feeding sewage, sewage generated by hair salons, etc.) and initial rainwater.

If analyzed carefully, it is never easy to drink a glass of clean water. The main pollutants in sewage include pathogenic pollutants, oxygen-consuming pollutants, plant nutrients, and toxic pollutants, radioactive pollutants, and so on. Pathogens are mainly viruses, bacteria, parasites; oxygen-depleting pollutants are mainly carbohydrates, proteins, oils and fats, lignin and other organic substances which may further deteriorate the water quality; plant nutrients are mainly nitrogen, phosphorus, etc. which can stimulate the growth of algae and aquatic grasses, interfere with the purification of the water quality, so that the BOD5 elevated substances; toxic pollutants refer to the heavy metals and difficult to decompose organic pollutants and other organic pollutants that can cause a temporary or persistent pathological state or even life-threatening substances, toxic contaminants are heavy metals and difficult to decompose organic pollutants. Toxic pollutants refer to heavy metals and hard-to-decompose organic pollutants that can cause temporary or long-lasting pathological conditions or even life-threatening substances. Heavy metals include mercury, cadmium, chromium, lead, vanadium, cobalt, barium, etc., of which mercury, cadmium, lead is more hazardous, and arsenic, selenium and beryllium are also more toxic. Heavy metals are generally not easy to disappear in nature, they can be enriched through the food chain, such substances in addition to the direct effect on the human body to cause disease, some metals may also promote the development of chronic diseases. Radioactive pollutants mainly come from cooling water discharged from nuclear power plants, radioactive waste dumped into the ocean, fallout from nuclear explosions that land in the water column, and nuclear fuel leaked from accidents on nuclear-powered ships. Mining, refining and use of radioactive substances can also cause radioactive contamination if not handled properly. Radioactive contaminants in water bodies can attach to the surfaces of living organisms or enter them and accumulate, and can also cause internal irradiation of people through the food chain [2, 3].

Precisely because of the extremely complex composition of urban sewage, sewage treatment is often an unbearable burden for government departments. The usual practice is that sewage treatment plants operate by physical and biological treatment and then discharge the water into rivers, lakes, seas and other bodies of water. Physical treatment mainly includes filtration, degreasing and sedimentation, biological treatment mainly refers to the activated sludge method and biofilter method, but these conventional methods are difficult to remove all the harmful factors in the sewage. Therefore, it is not surprising that people are naturally concerned about the quality of drinking water.

2. Research object and methods

In order to clarify the relationship between water pollution and the incidence of cancer, taking into account that the drinking water quality of different populations is different, and that the drinking water quality can reflect the degree of water pollution to a certain extent, this paper adopts the sample sampling and comparative research methods.

DOI: 10.54254/2753-8818/15/20240420

The sample sampling method is based on the data from the Wuyingshan Community in Tianqiao District of Jinan City and Jinan Beicheng Hospital, which is located in the community, as the samples for investigation. The comparative research method is to examine the relationship between the management of water pollution and the occurrence of common cancers by comparing the changes in the number of cancer patients in the community before and after the establishment of Jinan as a National Sanitary City, and the relationship between the degree of drinking water cleanliness and the occurrence of common cancers by comparing the different incidence rates of cancers in the community before and after the use of drinking water purification equipment. Finally, the relationship between the cleanliness of drinking water and the occurrence of common cancers is examined by comparing the different types of drinking water for urban and rural cancer patients in Wuyinshan Community. Three investigations are as follows:

2.1. The incidence of common cancers in Wuyingshan Community before and after water resource pollution control

The Department of Chronic Disease Management of Jinan Beicheng Hospital, Wuyingshan Community Health Center, Tianqiao District, Jinan City, Shandong Province, is responsible for the management of services for 20,000 permanent residents in the community (Note: 5,000 households, although some residents moved in and out of the community or were born and died between 2004 and July 2023, the total number of residents was basically constant, and for the sake of statistics, the denominator of the percentage of the population is 20,000). The department staff help to count the number of cancer patients admitted during the 20-year period from 2004 to July 2023.

Considering that Jinan was established as a national health city in 2014, and that it had been committed to the creation of a sanitary city before that, and had done a lot of work to combat the pollution of the environment, especially drinking water resources, the author takes the number of incidences of common cancers and its incidence rate as the elements, and carries out the statistics in two time periods with the boundary of the creation of a sanitary city, which are shown in Table 1:

Table 1. Changes in the incidence of common cancers in Wuyingshan Community before and after the creation of the National Sanitary City.

Time Period / Cancer Patients	2004-2013		2014-July 2023			Total patients in 20 years	
	Number	Incidence%	Number	Incidence%	Decrease %	Total	Incidence%
Liver cancer	19	0.095	12	0.06	36.8	31	0.155
Stomach cancer	16	0.08	11	0.055	31.3	27	0.135
Colon Cancer	21	0.105	12	0.06	42.9	33	0.165
Leukemia	7	0.035	4	0.02	42.8	11	0.055
Pancreatic cancer	6	0.03	3	0.015	50	9	0.045
Total	69	0.345	52	0.26	24.6	121	0.605

As can be seen from Table 1, the total incidence rate of common cancers before Jinan became a National Sanitary City was 0.345%, the total incidence rate of common cancers in the latter ten years was 0.26%, and the latter ten years declined by an average of 24.6% compared with the first ten years, and the total incidence rate of common cancers during the 20 years was 0.605%.

DOI: 10.54254/2753-8818/15/20240420

It is understood that, in order to improve the quality of the water environment, Jinan City has strengthened six comprehensive measures such as "focusing on the water quality of the cross-section, strengthening law enforcement and inspection, accelerating the upgrading of wastewater treatment facilities, perfecting the mechanism of coordinated sewage control by relevant departments, strengthening the cleaning and rectification of outfalls and improving the early-warning and monitoring capacity" [4]. Undoubtedly, these comprehensive measures have contributed to the improvement of the quality of drinking water for residents and the health of the residents, reducing the occurrence of tumors and other diseases.

2.2. The use of water purification equipment in Wuyinshan Community before and after the creation of National Sanitation City

In addition to the investment of the government departments to in improving the quality of drinking water, with the improvement of living standards, after 2014, residents' families have also installed their own household water purifiers. Based on the data provided by the Neighborhood Committee of Community, the author produced Table 2:

Table 2. Comparison of household water purifiers installed by residents in the Community before and after the National Sanitary City.

Total Households	2004-2013		2014-July 2023		
	Households	%	Households	%	Increase %
5000	308	6.2	3267	65.3	961

As can be seen from Table 2, before Jinan became a National Sanitary City, only 6.2% of the families in the community installed water purifiers, while a total of 65.3% of the families invested in water purification equipment in the ten years since then, with a growth rate of 961%; it is understood that, in addition to domestic water purifiers, a water purifier manufacturer has also invested in the community in accordance with the ratio of one per hundred people to install 200 large-scale communal water purifiers. Because the price is slightly cheaper than that of domestic water purifiers, residents who do not use domestic water purifiers choose to use communal water purifiers.

2.3. Investigation on the type of drinking water for cancer patients in Jinan Beicheng Hospital

By accessing the original medical records of cancer patients admitted to the Chronic Disease Management Department of Jinan Beicheng Hospital from 2014 to July 2023, the author created Table 3 based on the data recorded therein about the types of drinking water:

Table 3. Survey table of the main types of drinking water for cancer patients in the Community.

Water type / Cancer patients	Total numbers	Daily Tap water		Daily Purified water		Daily Surface water		Others	
		Numbers	%	Numbers	%	Numbers	%	Numbers	%
Liver cancer	12	8	66.7	1	8.3	2	16.7	1	8.3
Stomach cancer	11	8	72.7	1	9.1	2	18.2	1	9.1
Colon cancer	12	9	75	0	0	3	25	0	0
Leukemia	4	3	75	0	0	1	25	0	0
Pancreatic cancer	3	2	66.7	0	0	1	33.3	0	0

DOI: 10.54254/2753-8818/15/20240420

From Table 3, it can be seen that the majority of the above-mentioned cancer patients drink tap water that has only undergone general sewage treatment on a daily basis, with surface water being the second most popular, and purified water being the least popular. By inverse reasoning, it can be assumed that drinking mainly purified water can prevent and reduce the occurrence of the above-mentioned cancers to a greater extent. Because of the complexity of urban wastewater, sewage treatment is often a difficult task for government departments. The usual practice is that sewage treatment plants discharge sewage into rivers, streams, lakes, seas and other bodies of water after physical and biological treatment, with physical treatment mainly including filtration, oil removal and sedimentation, and biological treatment mainly referring to the activated sludge method and biofilter method, but these conventional methods are not as effective as the conventional methods.

3. Discussion

From the changes in the incidence of cancers in the community before and after the control of water pollution in Jinan, the use of water purification equipment by the community residents to improve the quality of their own water, and the investigation of the drinking water of cancer patients in the Jinan Beicheng Hospital, at least the following three conclusions can be drawn: Firstly, there is a positive correlation between the degree of clean drinking water and the incidence of common cancers, and it is generally believed that the cleaner the drinking water, the lower the incidence of common cancers. This at least indicates that water pollution is one of the important reasons for the high incidence of common cancers among residents of Wuyinshan Community; Secondly, the personal health of residents cannot be completely dependent on the government, and they should enhance the quality of drinking water on their own when the financial conditions are available; Thirdly, the three major cancers most likely to be caused by insufficiently clean drinking water are colon, liver, and stomach cancers, respectively. It has been shown that contamination of water sources by algal toxins produced by blue-green algae in ponds may be related to liver cancer [5]; excessive nitrates in water and soil, and imbalance in the ratio of trace elements can be directly or indirectly related to stomach cancer through the dietary route [6].

Due to the small sample size of this paper, coupled with the complexity of cancer pathogenesis, in addition to the correlation between drinking water quality and cancer, people's mental and psychological state and emotional changes as well as nutritional conditions are all related to the occurrence of cancer, the data in this study did not exclude other influencing factors, so the conclusions of this paper are only relative, and more research needs to be done in the future to deepen the understanding of the relationship between water pollution and the incidence of cancer. For example, the relationship between water pollution and esophageal cancer, some data show that the gastric fluid of residents in areas with high incidence of esophageal cancer contains nitrosamines, and the content of nitrosamines in their drinking water and food is significantly higher than that in areas with low incidence of esophageal cancer [7]. For example, there is evidence that the high content of inorganic arsenic in the drinking water is one of the reasons for the incidence of lung cancer [8].

4. Implications for practice

Can the above findings lead to the conclusion that "the purer the drinking water, the healthier it is"? Some scholars argue through quantitative research that this is not the case, "drinking water with total dissolved solids, hardness, alkaline pH will reduce the risk of death from cancer", for this reason, drinking water should be retained in the health of the components, such as metasilicic acid and calcium carbonate. American scientists Burton analyzed the drinking water of 100 large cities in the United States, found that if the drinking water has a moderate content of TDS, is hard water, alkaline (pH>7.0), and contains metasilicic acid, then the number of cancer deaths will be reduced by 10 to 25%. Another scientist, Saul, also found a relationship between metasilicic acid and cancer, that is, the higher the content of metasilicic acid, the fewer people suffering from cancer [9]. In addition to the common cancers mentioned above, there are scholars who have pointed out the correlation between

DOI: 10.54254/2753-8818/15/20240420

water pollution and skin cancer. This scholar believes that arsenic, a pollutant in drinking water, is a carcinogen that causes skin cancer and skin lesions [10].

Based on the above understanding, people should start from the water quality legislation, production and living needs, sewage treatment and other dimensions, comprehensive measures to continue to reduce the degree of urban water pollution and maintain drinking water quality in line with internationally accepted health standards.

To strengthen the monitoring of drinking water quality, research and legislation, according to the economic and social development, people should improve the quality of drinking water and protect it according to the law.

It is necessary to advocate the reduction of material consumption and waste, encourage the use of recycled water, and advocate a low-carbon, thrifty lifestyle; it is necessary to reduce and prevent the over-concentration of people, and vigorously build new rural areas, so that part of the concentrated urban population can go to live in sparsely populated areas. These lifestyles help to reduce domestic sewage and lower the level of water pollution.

To strengthen the supervision of sewage discharge and daily water quality monitoring, environmental protection and other competent departments should strengthen joint law enforcement, make full use of information technology means of twenty-four-hour supervision of key production enterprises, the main sewage discharge units; procuratorial departments should strengthen the public interest litigation of sewage discharge. China's drinking water quality standard index has been issued in 1959 by "Drinking Water Health Regulations" (GB5749-2006) of 17 items increased to the current "Drinking Water Quality Standards" (GB5749-2006) of 106 items. Although the standards have been synchronized with the world, testing technology is still insufficient, and there is a need to increase testing capacity and improve testing equipment, as well as to plan for technicians and regional disparities [11].

The digital management of sewage should be strengthened to turn waste into treasure. Compared with developed countries, China's sewage treatment is still in the primary stage, and in the actual treatment process, the problem of treating the symptoms but not the root cause often occurs [12]. People should make full use of modern means of sewage treatment, the implementation of classification of sewage treatment, digital governance, realizing legal compliance, compliance with the law, strict law enforcement and investigations of violations. For example, Shanghai Songjiang Sewage Treatment Plant, which was put into operation in 1985, disposed the dewatered sludge at its early stage by the use of outgoing landfill disposal, but with the sludge volume getting bigger and bigger and landfill land getting more and more tense, the plant introduced the CTB intelligent control of sludge aerobic fermentation process in 2009, its product is used for flower substrate, garden greening, etc. The waste turned into treasure [13].

5. Conclusion

One of the main indicators of community conditions is the health status of the residents, and to evaluate whether the residents are healthy or not, it is necessary to look at both the rate of illness, hospitalization, and recovery, as well as to examine the incidence of major diseases such as cancer, and the survival rate. There is a certain correlation between water pollution and the formation of cancer, but the specific mechanism remains to be further explored. In the next few years, China needs to further strengthen the role of the government in the prevention and treatment of cancer, organically combine the framework of the health service system with the prevention and treatment of cancer, and reduce water pollution, in order to achieve the ultimate goal of reducing the occurrence of cancer.

References

[1] http://www.wxdct.cn/c_html_news/shuiyuaizhengxixixiangguan-749.html. Fan Yu. Drinking water sources and cancer.2016-12-9. accessed August 27, 2023.

[2] Fijalkowski K, Rorat A, Grobelak A, Kacprzak MJ. The presence of contaminations in sewage sludge - The current situation. J Environ Manage. 2017 Dec 1;203(Pt 3):1126-1136.

DOI: 10.54254/2753-8818/15/20240420

[3] Yangchuan Lu, Chengming Zhang. Analysis and prospect of discharge status of pollutants from urban sewage in China [J]. Sichuan Environment,2022,41(3):273-278.
[4] Jinan City to strengthen six measures all out to improve the quality of the water environment. 2021-11-29. accessed August 26, 2023. http://jnepb.jinan.gov.cn/art/2021/11/29/art_10464_4774757.html.
[5] Jiyao Wang, ed. Internal Medicine. People's Health Press April 2008 edition.514.
[6] Jiyao Wang, ed. Internal Medicine. People's Health Press April 2008 edition.431.
[7] Jiyao Wang, ed. Internal Medicine. People's Health Press April 2008 edition.411.
[8] Water Review. 90% of cancers in China, caused by water pollution.2022(6). Accessed August 26, 2023.
[9] Relationship between drinking water purity and cancer.2013-09-26. Accessed August 26, 2023.https://blog.sina.com.cn/s/blog_609091860101ei1s.htm.
[10] Qiuqiu Zhang. Evaluation of non-carcinogenic and carcinogenic health risks of drinking water contaminants in China-Arsenic and nitrosamines as examples [D]. Beijing. University of Chinese Academy of Sciences. 2017.
[11] Rui Mao, Jia Chen. Testing methods for drinking water quality of domestic drinking water[J]. Science and Technology New Era, 2021(3).
[12] Xiaobing Niu. The importance of urban wastewater treatment in environmental protection engineering and the investigation of improvement measures[J]. Science and Technology New Era, 2021(3).
[13] Fei Yan. Case introduction of Shanghai Songjiang sludge aerobic fermentation project [J]. Science and Technology New Era, 2020(5).