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# THE IMPACT OF URBAN MOTOR VEHICLE NOISE WITH AN ASSESSMENT OF THE RISK TO PUBLIC HEALTH

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**Abstract**

Motor vehicle noise is one of the most common forms of man-made environmental pollution in urban conditions. Constant exposure to increased noise levels has a negative impact on human health, contributing to the development of conditions such as chronic fatigue, insomnia, decreased performance, as well as disorders of the cardiovascular, nervous and endocrine systems. The abstract views the sources of traffic noise, the mechanisms of its impact on the body, vulnerable groups of the population, as well as sanitary and hygienic standards and approaches to reducing noise pollution in urban environments. Special attention is paid to the issues of prevention and possible measures to protect public health from the adverse effects of noise pollution.

**Keywords**: Motor vehicle noise, noise pollution, public health, urbanization, physiological effects, nervous system, cardiovascular diseases, sanitary standards, environmental safety, prevention.

## Introduction

The increasing negative impact of environmental factors of physical nature on the health of the population has been noted in a number of regional studies devoted to the integrated assessment of the environmental quality of the industrialized city of Yangiyul [1,2,3,4,5]. Among the priority ones operating in residential areas, especially in large cities, is noise, primarily associated with the increased use of all modes of transport [6,7,8,9]. With the help of research by Russian scientists, it was found that when exposed to night noise at levels from 40 to 55 dBA, harmful effects to health sharply increase, with a noise level of more than 55 dBA, the likelihood of diseases of the cardiovascular system is high, and at a level of 80 dBA, persistent inhibition develops in the cerebral cortex [10,11,12]. A feature of motor vehicle noise during its distribution is a large space capture, as well as prolonged exposure throughout the day. In this regard, an urgent scientific and practical task was to assess the risk to public health from exposure to motor vehicle noise in residential areas of the industrialized city of Yangiyul to justify the planning and implementation of noise protection measures [13,14,15].

## Materials and Methods

The risk assessment from the effects of motor vehicle noise was carried out on the basis of two approaches: 1) in accordance with the methodological recommendations of Kiselyov A.V. and Friedman K.B. ("Health risk assessment", St. Petersburg, 1997), according to an empirical model of noise exposure based on both experimental data and medical statistics [6]; 2) in accordance with the Interstate standard 233337-2014 "Methods of measuring noise in residential areas in residential and public buildings". When implementing the first approach, the assessment of the potential acoustic health risk was carried out according to three components: a) assessment of the risk of developing non-specific effects; b) calculation of the probability of complaints from the population; c) calculation of the risk of developing specific effects (hearing loss). The potential risk values were estimated in fractions of one on a 5-level scale (low risk, alarming, dangerous, extremely dangerous, extremely high). The algorithm of the second method used by us was based on solving a system of recurrent equations – mathematical models of the development of adverse effects under the influence of noise, integrating a set of domestic and foreign data on the dynamics of the development of adverse effects of health disorders, taking into account the probable time of exposure of this factor to the population (from 1 to 85 years with a discreteness or a step of variation of 5 years) with the definition of four indicators (from 0 to 1): the risk of hearing disorders; the risk of diseases of the nervous system; the risk of diseases of the cardiovascular system; the cumulative health risk caused by noise exposure. The risk assessment scale, according to the methodology, included 4 risk intervals: low, medium, high, and extreme.

**Results and Discussion**

To implement the first stage of risk assessment (hazard identification), an analysis of data on the characteristics of the acoustic factor was carried out, which included an assessment of the results of 5042 measurements of noise levels carried out by the laboratory center of the Sanitary Epidemiological Welfare (SEW) and Department of Public Health (DPH) of the Yangiyul district of the Tashkent region using the SVAN947 device, a noise and vibration analyzer. Measurements of noise levels caused by the movement of motor vehicles were carried out on the territory of a residential construction site on the main highways at four monitoring points in the city of Yangiyul: 1) 114 Mustakillik Street; 2) 60 Bobura Street; 3) 52 Gulchilar Street; 4) 27 Sakkizogaini Street. The data of the street transport highways, which have from 2 to 4 lanes, are characterized by a high intensity of traffic flow. Highways are almost directly adjacent to residential areas without any noise protection measures. The studies were conducted during the day, evening and night. Motor vehicle noise was assessed in accordance with SanNorRul RUz No. 0325-16 "Permissible noise levels in workplaces". The second stage of the health risk assessment (exposure assessment) included the determination of the normalized noise parameters at a given time and the duration of its exposure. An analysis of the noise factor in monitoring currents during the daytime, evening and night showed that the highest value of the equivalent sound level was 81 dBA during the daytime at the Mustakillik monitoring point, 11. The maximum sound level was also recorded at the same monitoring point (94 dBA) (Table 1.) It was found that the arithmetic mean values of the equivalent sound level during the daytime exceed the permissible exposure limit (PEL) for residential buildings (55 dBA) at all four monitoring points (Fig. 1, see on page 3 of the cover). The results of instrumental measurements of noise levels on street highways bordering residential buildings indicate not only that the PEL is exceeded, but also a significant annual increase in the proportion of measurement results that do not meet the standards, from 19.7% in 2012 to 76.3% in 2016 with a fairly high approximation ratio (R2 = 0.89). When implementing the first methodological

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approach, the assessment of the public health risk from exposure to motor vehicle noise in the residential area adjacent to street cars showed that the highest probability at sound levels is for the development of non-specific effects (up to 0.98 units), which is estimated as an extremely high level. The probability of complaints from the population and the development of hearing loss (in fractions of a unit) is up to 0.75 (extremely dangerous risk level) and 0.17 units, respectively (the level of risk causing concern). The most unfavorable situation is located at 114 Mustakillik Street checkpoint (Table 2). It should be noted that the results of the assessment of the acoustic risk to public health, based on the values of the maximum noise level (LAMax.), overestimate the situation due to the uncertainty caused by exposure time, since such noise levels do not act continuously, but only for a short time during periods of maximum vehicle load. When using a correction for the duration of the maximum sound level during the day, equal to 1.5 hours (according to the method of Kiselyov A.V. and Friedman K.B., 1997 [5]), which is determined by the formula: $dL = 10 \cdot \lg(24/Tf)$, where Tf is the average duration of action during the day (1.5 hours). It was found that the risk of developing non–specific effects with LAmax. from 32 to 94 dBA will range from 0 to 0.98 units, the probability of complaints from the population – from 0 to 0.78 units, the risk of specific hearing loss - from 0 to 0.19 units. Summarizing the data on acoustic risk to public health allows us to conclude that the risk of developing non-specific effects increases sharply, starting with a noise level LAekv of 35-40 dBA, reaching a maximum value (1.00) at a level of about 80 dBA; the risk of hearing loss increases sharply from a level of 65-70 dBA, reaching a maximum value (1.00) at a level of about 125 dBA. The results of the assessment of the health risk from exposure to the noise factor are confirmed by the data of the SEW and DPH centers in the Tashkent region. In particular, in the city of Yangiyul, over the period 2022-2024, the number of citizens' complaints about the effects of physical factors increased 3.5 times. Verification of the validity of public complaints based on the results of laboratory measurements confirms that the level of exposure to physical factors does not meet hygienic standards in 18.0 to 32.0% of cases. According to the latest data (2024), noise (38.1%) accounted for the largest share in the structure of citizens' complaints about unfavorable living conditions, followed by microclimate parameters (16.3%) and vibration (9.0%). Other physical factors (EM field, illumination, infrasound) account for a total of 8.6% of the population's complaints. The results of the acoustic health risk assessment are consistent with the generally accepted notion that non-specific effects of noise usually occur earlier than changes in the organ of hearing. It is known that the nonspecific effect of noise is expressed in neuropsychiatric disorders in the form of neurotic and asthenic syndromes in combination with autonomic dysfunction, accompanied by irritability, general weakness, headache, dizziness, fatigue, and memory loss. In particular, in the two most disadvantaged monitoring points, for the duration of exposure in 30, 35, 40, 45, 47, 50 years risk level is estimated as average (values range from 0.08 to 0.34 units), at 55, 60, 65 years – as high (from 0.36 to 0.59 units), in 70, 75, 80, 85 – as extreme (from 0.68 to 1.00 units).

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No. 1 Table Equivalent and maximum sound levels in residential areas affected by urban highways.

| Monitoring point | Meaning | Equivalent sound level, time dBA | | | Maximum sound level, time, dBA | | |
|---|---|---|---|---|---|---|---|
| | | daytime | evening | night | daytime | evening | night |
| Mustakillik St. | Min/мах | 45-62 | 42-51 | 33-68 | 40-80 | 45-60 | 28-80 |
| Gulchilar St. | Min/мах | 50-70 | 40-50 | 40-50 | 60-75 | 50-60 | 50-60 |
| Bobura St. | Min/мах | 53-68 | 43-50 | 42-50 | 70-80 | 50-60 | 50-60 |
| Sakkizogaini St. | Min/мах | 32-68 | 32-65 | 30-68 | 50-80 | 38-75 | 40-70 |

The maximum risk of nervous system diseases caused by traffic noise is 0.04 units. (for 85 years of exposure) and is considered low. The maximum risk of hearing diseases caused by traffic noise is 0.03 units (for 85 years of exposure) and is considered low. Although both guidelines do not specify the acceptable risk level, from a hygienic point of view, according to the authors of the article, the upper value of the low-risk interval, which is defined as 0.05 units for both methodological techniques, can be considered an acceptable risk value. Summarizing the results of the application of two different techniques, it can be concluded that the risk of health disorders of the urban population at existing noise levels from cars and mobile transport is worrisome.

## Conclusion

The potential acoustic risk to public health caused by exposure to motor vehicle noise at recorded sound levels up to 78 dBA is characterized by a high probability of developing non-specific effects (up to 0.96 units) and is estimated as extremely high; the risks are up to 0.74 units, respectively. (extremely dangerous risk level) and 0.16 units. (dangerous level of risk). Thus, for the city of Yangiyul, the need to improve the noise regime on the street highways connecting the administrative districts of the city and being an urban continuation of the main highways of the Russian and regional levels is beyond doubt. In this regard, the creation of high-speed highways designed to connect remote areas of the city is promising for Voronezh. Moreover, when designing a citywide high-speed highway system, reducing the harmful effects of highways on residential areas and recreational areas should be achieved by placing them in sanitary protection zones, on disturbed and inconvenient lands, in areas of low-rise buildings (with the installation of noise barriers), and in railway right-of-way.

No. 2 Table Assessment of the potential risk to public health from exposure to motor vehicle noise

| Territory | Indicator of the noise level in the territories | Noise level, dBA | The probability of an effect in fractions of a unit | | |
|---|---|---|---|---|---|
| | | | Development of non-specific effects | Pre-presentation of public complaints | Development of specific effects |
| Sakkokiy St. | Min | 40 | 0,01 | 0,02 | 0,04 |
| X. Alimjaga St. | Max | 79 | 0,88 | 0,70 | 0,20 |
| Bunyodkor St. | Min | 42 | 0,25 | 0,04 | 0,10 |
| Katta Kani St. | Max | 75 | 0,90 | 0,50 | 0,20 |
| Dustlik St. | Min | 45 | 0,30 | 0,03 | 0,04 |
| Ikhtifor St. | Max | 68 | 0,60 | 0,20 | 0,05 |
| Shifokorlar St. | Min | 30 | 0,04 | 0,04 | 0,10 |
| Khirmontepa St. | Max | 75 | 0,80 | 0,50 | 0,20 |

Such an event as the introduction of functionally justified restrictions on the movement of motor vehicles in residential areas during the implementation of a high-speed highway construction project, especially within inter-highway territories, and the organization of so-called residential zones in them, within which the movement of cars at a speed of no more than 10 km/h is carried out, will also reduce the noise load in residential neighborhoods. The influence of green spaces on the spread of traffic noise, although insignificant and seasonal, nevertheless also needs to be taken into account. Moreover, the enhancement of the noise-proof qualities of green spaces in places where this is possible must be achieved through special multi-row plantings. When new buildings are being built along highways, it is promising to use special types of residential buildings that act as noise shields. Another feature of noise–proof houses is an increase in the soundproofing capacity of enclosing structures, primarily window and door blocks, to the required value. This type of house is called noise-proof. Residential buildings of the gallery type are used as noise–proof buildings, with all residential premises located in the opposite direction from the transport highway. Such houses are oriented with the main facade to the street highway, which is a source of noise. In addition, the project provides for the installation of glazed loggias to protect living rooms from noise. Naturally, the implementation of such large-scale tasks requires not only competent solutions from a sanitary and hygienic point of view, but also huge organizational and technical efforts, as well as considerable financial support. There is also a need for an adequate legislative framework that would stimulate the reduction of the harmful effects of physical factors on the population, including motor vehicle noise, and promote the priorities of urban improvement from the perspective of ensuring a comfortable, hygienically safe urban environment.

**References:**

1. Зуев А. В. и др. Оценка влияния транспортного шума на акустическую среду жилых помещений //ББК: 51.1 (2) 2я43 Профилактическая медицина как научно-практическая основа сохранения и укрепления здоровья населения. Сборник научных трудов. – 2018. – С. 37.
2. Леванчук А. В., Копытенкова О. И., Афанасьева Т. А. Гигиеническое обоснование методов снижения акустической нагрузки в жилых помещениях //Здоровье населения и среда обитания. – 2020. – №. 10 (331). – С. 46-51.
3. Бортновский В. Н., Рубан Н. М., Пашкевич В. Е. Гигиеническое обоснование шумозащитных мероприятий в условиях г. Гомеля. – 2019.
4. Алексеев В. Б., Клейн С. В., Кошурников Д. Н. Транспортный шум как фактор риска здоровью населения и установления ограничений использования земельных участков городских и сельских поселений //Здоровье населения и среда обитания. – 2022. – Т. 30. – №. 10. – С. 25-32.
5. Новикова С. А., Мартынов Д. Н. Влияние зеленых насаждений на снижение уровня шума от автотранспортных потоков в Иркутске //Вестник Московского университета. Серия 5. География. – 2022. – №. 4. – С. 16-25.
6. Красовский В. О. и др. О гигиенической значимости спектрального содержания шума автомобилей //Современные проблемы науки и образования. – 2017. – №. 2. – С. 46-46.



Web of Medicine: Journal of Medicine, Practice and Nursing
webofjournals.com/index.php/5

7. Давыдов Н. В., Федосеенко А. А. Программный комплекс для дифференциальной оценки риска здоровью населения от воздействия шума железнодорожного и автомобильного транспорта //Известия Петербургского университета путей сообщения. – 2024. – Т. 21. – №. 2. – С. 470-479.
8. Петрянина Л. Н., Викторова О. Л., Матиева Ю. А. Урбанистические тенденции городской среды. Методические указания для самостоятельной работы. – 2015.
9. Копытенкова О. И., Афанасьева Т. А. Эффективность снижения шума от железнодорожного транспорта акустическими экранами //Гигиена и санитария. – 2023. – Т. 102. – №. 8. – С. 764-767.
10. Васильев В. А., Ксенофонтова В. К. Шум автомобильного транспорта //Noise Theory and Practice. – 2020. – Т. 6. – №. 1 (19). – С. 66-76.
11. Дрябжинский О. Е. Негативное воздействие автотранспорта. Проблема шумового загрязнения //Современные тенденции развития науки и технологий. – 2015. – №. 8-4. – С. 91-94.
12. Фесак Д. И. и др. Программный комплекс для дифференциальной оценки риска здоровью населения от воздействия шума железнодорожного и автомобильного транспорта //Proceedings of Petersburg Transport University. – 2024. – С. 2.
13. Леванчук А. В., Рябец В. В. Особенности оценки комфортности среды городских поселений с учетом виброакустического воздействия в зоне влияния транспортных железнодорожных узлов //Вестник евразийской науки. – 2021. – Т. 13. – №. 6. – С. 53.
14. Чеботарёв А. Г., Курьеров Н. Н. Гигиеническая оценка шума и вибрации, воздействующих на работников горных предприятий //Горная промышленность. – 2020. – №. 1. – С. 148-153.
15. Холопов Ю. А., Хмельницкий Ю. Н., Мусаткина Б. В. Анализ эффективности шумозащитных мероприятий на железнодорожном транспорте //Защита от повышенного шума и вибрации. – 2019. – С. 710-717.