

Proceeding Paper

# COVID-19 Pandemic: Sanitary–Hygienic Aspects of Household Members’ Self-Isolation †

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**Abstract:** Self-isolation is a preventive measure that started in January 2020 as a response to the spread of COVID-19, and it has no precedents in human history. During this pandemic, governments forced billions of people to self-isolate for several months, and the sanitary–hygienic assessment of self-isolation became an essential issue. We suggest a definition for sanitary–hygienic self-isolation and then develop methods for assessing how hygienic the isolation of the household members is. The Household Members’ Self-Isolation Index Point Score (HMSI) is determined based on the number of self-isolated household members, the coefficients of household members’ physical activity, the indoor area per household member, the time spent in fresh air, and the number of domestic conflicts during the household members’ self-isolation. This is inversely proportional to the calorie intake. HMSI can identify if family household members’ isolation is optimal, favorable, or unfavorable. In this paper, we determined an approach to assess the level of the functional reserves, and then we identified the leading health risk factors of the self-isolated household members. The sanitary–hygienic assessment of self-isolation can prevent cardiovascular, alimentary-dependent diseases and pathologies of the musculoskeletal system. Besides, self-isolation accompanies a decrease in physical activity and unbalanced nutrition.

**Keywords:** COVID-19; self-isolation; health risks; sanitary–hygienic regulation; mental health



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## 1. Introduction

COVID-19 is a new disaster that has come to the fore, and today, self-isolation is an essential tool wielded by public health authorities to prevent the spread of infectious diseases. Carrying out any public health measure requires an immediate risk assessment, and self-isolation is never an exception. Consequently, for self-isolation, risk factors may include nutritional deficiencies, hypodynamia, hypoxia, mental health, and an imbalance between work and rest. The Russian government has sanitary–hygienic regulations that determine all the recommended physiological and hygienic standards for (1) physical activity, (2) nutrition, (3) mental health, (4) work, and (5) rest [1].

The hygienic standards can be employed for supporting physiologically optimal conditions for staying at home, work–rest regimes, microclimate indicators, nutrition, mental wellness, and physical activity [2–4].

This study aims to establish sanitary–hygienic assessment criteria for self-isolation; to propose measures that prevent potential non-communicable diseases in the isolated population; to identify the leading risk factors affecting the health of the isolated persons; and to propose sanitary–hygienic criteria for assessing self-isolation.

## 2. Materials and Methods

Informational, analytical, and statistical research methods were applied: We analyzed hygiene-related legal documents of the Government of the Russian Federation, and COVID-19-related publications of the World Health Organization (WHO) and public health authorities of various governments.

## 3. Results and Discussion

The Russian Federation regulations and standards consider the estimated energy requirements (EER) that determine the physiological needs for energy and nutrients of various groups of the population. Estimated Energy Requirement (EER) is the average dietary energy intake that is predicted to maintain energy balance in healthy, normal-weight individuals of a defined age, gender, weight, height, and level of physical activity consistent with good health. In children and pregnant and lactating women, the EER includes the needs associated with growth or secretion of milk at rates consistent with good health. The physical activity coefficients are used in the EER equations to estimate energy requirements and are based on ranges of physical activity levels. The physical activity level (PAL) is the ratio of total energy expenditure to basal energy expenditure (TEE/BEE) [2].

According to the Russian Government's Guidelines, during the enforcement of stay-at-home orders, it is essential to consider the needs of adults and children in terms of macronutrients and micronutrients. Additionally, it is necessary to reduce calorie intake and consider stressful conditions while designing a diet plan.

Optimal nutrition can increase the immune response and can help to protect the population from the adverse effect of any environmental factors, including biological factors such as microbes and viruses.

During the enforcement of self-isolation, population nutrient intake guidelines should consider the existence of stress-forming situations and a decrease in physical activity, and it should enhance the non-specific immune response.

Mandatory self-isolation and quarantine have become essential anti-epidemic measures during the COVID-19 pandemic.

Self-isolation may lead to a drop in physical activity, which may reduce energy consumption by 300–400 kcal or more per day for adults and by 200–400 kcal or more per day for children (from 3 to 18 years old). The usual daily diet might lead to weight gain and the accumulation of visceral adipose tissue (VAT) and may cause muscle atrophy.

During the enforcement of stay-at-home orders, there may be an increase in the daily energy consumption associated with the high availability of food, free time, and hyperphagia in response to stress.

Measures to minimize the negative effect of the stay-at-home orders (self-isolation) should include a decrease in the energy value of dietary carbohydrates and ensuring the maximum level of physical activity.

Optimal nutrition determines the protection of an isolated person from the effects of adverse factors. For maintaining a healthy weight, it is necessary to maintain a full, adequate diet with a decrease in calorie content of 200–400 kcal compared to the usual one, which on average is:

- 1500 kcal for children aged 3 to 7 years (considering the level of physical activity);
- 1600–2000 kcal for children aged 7 to 18 (considering the level of physical activity);
- 1600–1800 kcal for healthy women over 18 years old;
- 1800–2100 kcal for healthy men over 18 years old.

Recommended percentage distribution of energy consumption of meals: breakfast—25%, second breakfast—5%, lunch—35%, afternoon tea—10%, dinner—25% [5].

A healthy diet is essential for self-isolated distance learning students, and they should take into consideration the following recommendations:

(1) Considering 2–6 meals a day that should include meat, milk, butter, vegetable oil, rye, and wheat bread; (2) Including fish, eggs, cheese, cottage cheese, and dairy products at least once every 2–3 days; (3) Considering a sample menu that contains a rational

distribution of energy in every meal: breakfast—20%, lunch—30–35%, afternoon tea—15%, dinner—25%, and second dinner—5–10% [6].

While organizing education for children during the enforcement of self-isolation, it is necessary to consider (1) regular breaks between lessons; (2) ventilating the study spot and getting fresh air regularly on a balcony or loggia; (3) carrying out physical exercises, performing gymnastics, and using simulators to organize independent fitness classes at home [7].

The sanitary–hygienic criteria for self-isolation:

1. Time spent in fresh air, including dog walking, visiting grocery stores, pharmacies, or spending time on balconies;
2. The size of the isolation area per person;
3. Interactive condition of work regimen using computer technology;
4. Psycho-emotional stress, long-term stay in a limited space, and stress;
5. The location of the self-isolated person (apartment, country house, or hotel) can determine the possibility of getting fresh air and limiting hypoxia;
6. The physical activity of each isolated person, such as the use of sports equipment and gymnastics;
7. Rest regimen.

Based on the sanitary–hygienic criteria of self-isolation, we developed the Household Members' Self-Isolation Index Point Score (HMSI) to assess the risks of self-isolation. Based on the sanitary–hygienic aspects of self-isolation of the household members, we developed a hygienic self-isolation index point score. This index is beneficial for establishing a comprehensive hygienic assessment for self-isolation and determining the isolation compliance level using all the recommended physiological–hygienic standards.

HMSI determines that the optimal self-isolation mode is directly proportional to the number of self-isolated household members ( $n$ ), the coefficients of household members' physical activity ( $D$ ), the indoor area (air cubic capacity) per household member ( $S$ ), the time spent in fresh air ( $T$ ), and the number of domestic conflicts during the household members' self-isolation ( $C$ ). This is inversely proportional to the calorie intake ( $K$ ).

$$\text{Household Members' Self - Isolation Index Point Score (HMSI)} = n + C + \left( \frac{D + S + T}{K} \right)$$

- The number of self-isolated household members ( $n$ )
- Physical activity of an isolated household member ( $D$ ): The actual physical activity (the number of calories spent on each physical exercise) exercise time. (Recommendations of the World Health Organization) [8].
- Space of isolation (cubic meter of air) per isolated household member ( $S$ ): The actual space (cubic capacity) of self-isolation area: In a 20 m<sup>2</sup> total area per household member:  $K = 30 \text{ m}^3/\text{hour}$ . If the total area is not less than 20 m<sup>2</sup> per person:  $K = \text{not less than } 30 \text{ m}^3/\text{hour}$  [9].
- Time spent on outdoor activities ( $T$ ): Time spent getting fresh air (hours).
- The number of domestic conflicts during the self-isolation ( $C$ )
- Calorie or energy intake ( $K$ ) The caloric value of food (indicated on the product labels); physiological energy requirements for adults from 2100 to 4200 kcal/day for males and from 1800 to 3050 kcal/day for females [2,10].

HMSI confirms that the more time an isolated person spends on physical fresh-air activities or in a ventilated room and the more closely he/she eats according to his/her energy expenditure, the lower the risk of developing hypodynamia, hypoxia, and obesity.

It appears possible to assess self-isolation in points: the optimal hygienic index of self-isolation is equal to 3, a favorable index is greater than 3, and an unfavorable index is less than 3 (Table 1).

**Table 1.** Assessing self-isolation in points.

Favorable Isolation	Optimal Isolation	Unfavorable Isolation
HMSI > 3	HMSI = 3	HMSI < 3

The sanitary–hygienic assessment of self-isolation will help prevent diseases of the cardiovascular system and the musculoskeletal system. It can also help limit the risk of many other non-communicable diseases and domestic conflicts.

The spread of COVID-19 and the enforcement of public health measures led to unintended unfavorable effects such as high levels of stress, anxiety, and depression [11].

The massive fear of coronavirus (coronaphobia) has led to many psychiatric manifestations in different strata of society. Besides, pandemics represent a real risk to the household members, and to reduce the risk of contracting infectious diseases they should practice self-isolation and social distancing [12,13].

The enforcement of self-isolation can result in mental disorders because of an increase in domestic conflicts [14].

The prevalence of new infectious diseases and their consequences can increase anxiety, depression, and stress. A straightforward example of this phenomenon is that during the COVID-19 epidemic in central China, even the healthy self-isolated population experienced mental health issues [15,16].

It seems that those with preexisting mental health issues are more susceptible to stressors associated with COVID-19 compared to those without preexisting mental health issues [17].

Thus, maintaining mental and physical health is an essential factor in minimizing the risks affecting isolated household members [18].

#### 4. Conclusions

1. The sanitary–hygienic assessment of self-isolation will ensure the prevention of cardiovascular and alimentary-dependent diseases and pathologies of the musculoskeletal system.
2. We propose measures that aim to prevent non-communicable diseases in the isolated population.
3. We identify the leading risk factors affecting the health of the isolated household members [19].
4. We propose sanitary–hygienic criteria for assessing household members' self-isolation based on the sanitary–hygienic standards of the Russian Federation.
5. We develop the Household Members' Self-Isolation Index Point Score (HMSI). HMSI determines that the optimal self-isolation mode is directly proportional to the number of self-isolated household members, the coefficients of a household members' physical activity, the indoor area (air cubic capacity) per household member, the time spent in fresh air, and the number of domestic conflicts during the household members' self-isolation, which is inversely proportional to the calorie intake.
6. HMSI determines if household members' self-isolation is optimal, favorable, or unfavorable [20].

#### 5. Recommendations

##### 5.1. Nutrition

1. During the period of self-isolation, one should pay special attention to one's diet.
2. Give preference to products with a short shelf life, then use frozen food for cooking.
3. Making a meal plan that helps to avoid overeating.
4. Choose a variety of foods when forming a menu for the day, giving preference to grains, because they are rich in complex carbohydrates and fiber, which have a beneficial effect on the feeling of fullness and thus prevent overeating.

5. Follow food safety rules, tracking the expiration dates of products, keeping the kitchen work surfaces clean, and washing hands before and after cooking.
6. Give preference to fruits and vegetables as sources of fructose and sucrose and keep in mind that adding sugar to food and drinks is not recommended.
7. Reduce salt intake in the diet.
8. Drink at least 2 L of water per day during self-isolation [21–26].

### 5.2. Physical Activity

During self-isolation, it is important to maintain adequate physical activity, which has a beneficial effect on physical and mental health.

1. Spend more time standing and less time sitting or lying.
2. Include active breaks in your daily routine in the form of warm-ups or household chores.
3. Try to move around the apartment (walking during a phone call or marching in place).
4. Consider alternate physical activities with muscle relaxation.
5. Use online resources proposing physical exercises, considering the state of your health and limitations [27,28].

### 5.3. Work–Life Balance

Due to the implementation of distance education and work during self-isolation, it is essential to design a comfortable working environment.

1. The workplace should be organized with enough space for a personal computer and enough space for writing.
2. The design of the furniture for remote work and education should support a proper working posture.
3. The workplace should be lighted artificially using a lighting device in the upper position.
4. The workplace should be ventilated, cleaned every day, and far from any possible sources of extraneous noise.
5. The workplace should be next to the window to increase the natural illumination on the work surface [29,30].

### 5.4. Mental Health

The isolated population may experience mental health issues such as fear, anxiety, and confusion.

1. Refer to official information sources to assess the situation and to understand the risks and precautions.
2. Get at least 8 h of sleep a day, eat well, and stay physically active.
3. Have an interest in the news, but do not spend all your free time on it.
4. Maintain communication via the Internet with relatives and friends.
5. Quit tobacco smoking and alcoholic beverage consumption [31].

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