




## Article

# The State of Air Pollution as a Factor Determining the Assessment of a City's Tourist Attractiveness—Based on the Opinions of Polish Respondents

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**Abstract:** Cities are multifunctional by definition, and an increasingly significant function is the tourist function. City tourism is one of the most dynamically developing forms of tourism. Tourists' decisions regarding choosing a destination are influenced by a number of factors determining the subjective assessment of the tourist attractiveness of a given city, and one of them may be the state of air pollution, as it can have a negative impact on the health of both city dwellers and tourists. This article is an attempt to determine whether potential tourists consider information about the level of a city's air quality in the assessment of its tourist attractiveness and the impact of this information on their travel decisions. The article presents the results of surveys conducted among a group of 509 respondents from Poland. On this basis, an assessment was made of the extent to which information on the condition of air quality in a given city is relevant for persons planning a tourist trip. In the conducted research, decisions regarding both business and private trips were evaluated. In addition, information on factors that could increase the respondents' interest in the condition of air quality in the city of the intended trip (e.g., trip with children, trip length) was collected. Due to the fact that tourism is a significant source of income for many cities, the research results presented in the article may be of significant importance for entities creating the urban tourist product and responsible for its management. The article also draws attention to the fact that reducing pollution in cities can contribute to increases in their tourist attractiveness.

**Keywords:** city tourism; tourist attractiveness; tourism management; air pollution; sustainable tourism

## 1. Introduction

Cities are some of the main tourist destinations from a global perspective, affecting both domestic and international incoming traffic. The main tourist motives for visiting cities are of a cultural nature, including historical, business, commercial, and leisure purposes. Tourists visiting cities spend part of their time in closed facilities, but also in the open air, when moving around the city and especially when sightseeing. Hence, the air quality may become an important factor conditioning the tourist perception of urban space.

Cities perform a number of functions, and the implementation of some of these functions may cause side effects, e.g., in the form of emissions of substances contributing to air pollution. However, it should be mentioned here that tourism may also be responsible for its creation. Air pollution can

cause many diseases and health problems, but does not always require a long period of exposure to harmful factors. This means that the negative effects of breathing in polluted air can also be felt by tourists. Due to the fact that tourist trips are rarely obligatory (with the exception of business trips), people who are aware of this may treat the condition of air quality in a given city as one of the factors determining its attractiveness. This may translate into a final decision to choose a tourist destination.

The aim of the present article is to determine whether potential tourists, when assessing the attractiveness of a city to which they intend to go for tourism purposes, consider information about the existing air quality. It is also intended to assess the impact of this information on their travel decisions. In order to achieve this objective, studies were carried out on the principles and methods of providing information on the current state of air pollution in cities belonging to the European Union. Additionally, a questionnaire survey was conducted to identify factors that could determine the increased interest in information about the condition of a city's air quality.

The subject is important due to the mass character of urban tourism and the growing number of cities facing problems with maintaining imposed air quality standards. Despite the importance of this subject, it is rarely the focus of scientific research. Thus, the study fills in the existing theoretical gap and deals with issues related to city tourism. It also draws attention to the fact that the cleanliness of air in cities may be important not only for their inhabitants, but also for potential tourists who assess their tourist attractiveness, and thus influence the economy of a given city.

## 2. Theoretical Background

### 2.1. Urban Tourism and the Tourist Attractiveness of Cities

Cities are some of the most popular tourist destinations. They are both a type of destination and a significant part of the tourist transit traffic [1]. The demand for city tourism is growing, which makes it one of the most dynamically developing forms of tourism [2–4]. In many urban destinations, tourism is one of the most important elements of shaping economic effects [2], being the basis for creating social and economic development [5], through influencing tourism entrepreneurship in cities [6,7], the labour market [8], and the standard of living of the inhabitants [9,10].

Urban tourism is of course tourism in urban areas [11] (p. 4), but in fact, it is difficult to interpret unequivocally because of the wide spectrum of motives for tourist arrivals, which are shaped by tourist behaviour and consumption in cities [12–14], [15] (p. 8). Urban tourism, otherwise often interpreted as metropolitan tourism [16], is connected with the destination of tourist traffic. This is an urban area, or more broadly a metropolitan area, with developed urban infrastructure, including transport, accommodation, catering, culture, sports and recreation, entertainment, trade, and communal and other services serving both the needs of tourists and the needs of permanent residents [17–19]. Typical objectives that direct tourists to cities include: Sightseeing, cultural, business, sports, family, social, and shopping motives.

Tourism causes strong anthropopressure on the environment. This results both from the need to reach the city tourism destination by means of transport (especially by air and water) [20–22], [23] (p. 219) and from the need to stay at the destination (garbage production, use of air-conditioners, etc.) [24] (p. 256). These activities cause, among other things, high exhaust emissions. However, this is usually a secondary problem in relation to the impact on the quality of the natural environment, shaped primarily by industrial activity, services, transport, and the everyday life of the inhabitants of large urban agglomerations that are attractive tourist destinations.

The development of urban tourism requires the city to implement an appropriate tourism policy within which the city should strive to take into account the interests of many entities, both on the part of economic entities not related to tourism and the inhabitants of the city, as well as tourists and entities servicing tourism traffic. These issues constitute one of the most important areas of strategic activities of large metropolises with a shaped tourist function, determining their competitiveness [25] and the level of tourist attractiveness [26–28]. These issues are in the area of quality management, which is a

fundamental factor determining the competitiveness of the tourist area, including the product of urban tourism. Analysing qualitative phenomena at the level of the tourist area is difficult due to the scale and diversity of the problem [29]. Despite the limitations in this respect, indirect means of assessing the quality of an urban tourism product can be used.

One of the determinants of the level of tourism competitiveness [30] used in the research of the level of tourist development of an area is the tourism attractiveness of such an area [31,32]. This is defined as the sum of subjective and objective assessments of particular elements of tourist supply within the limits set by given levels of prices and income [33]. The elements influencing the tourism attractiveness of the area include [34] (p. 132):

- Number and rank of tourist values: Natural and cultural,
- number and category of elements of tourist management, including the ability to service tourist facilities: Accommodation, catering, complementary facilities,
- the state of transport accessibility through particular branches of tourist transport: Rail, road, air, sea, and inland waterway, as well as local transport,
- the state of the natural environment and the results of measures to protect it:
  - Treated wastewater,
  - generated and managed waste,
  - devastated, degraded, and rehabilitated land,
  - emission and reduction of pollutants, including in particular those related to the state of the air.

Tourism attractiveness is a measure that allows the assessment of the quality of a tourist product of a city in a specific period of time. On the basis of individual assessments of the overall quality of the tourist offer and its individual elements, the tourist makes a collective assessment of the offer and makes purchasing decisions [35]. The assessment uses elements that are of a permanent nature. Apart from the measures describing the condition of the basic tourist offer (i.e., values, tourist management, and accessibility), from the point of view of the considerations undertaken, the issue of the condition of the natural environment in the urban tourist space, which includes the assessment of air quality, water quality, and waste management [36], occupies an important place. There is a strong relationship between tourism and the environment [37] (p. 56). That is why tourism attractiveness also concerns the assessment of tasks performed by the municipal authorities in the field of environmental protection, independently and in cooperation with entities offering services to tourists. It is also important to determine the trends in the development of indicators (e.g., pollution emissions—improvement or deterioration) [38] (pp. 236–237).

One of the detailed elements determining the attractiveness of a city tourism destination is therefore the air quality, analysed through the emission of solid and gaseous pollutants (dust and chemical compounds) [39].

The level of air quality, being an element in the assessment of tourist attractiveness, determines the tourist competitiveness of a city destination. Information about the air quality in a city that is a tourist destination may directly influence the decisions related to a tourist's trip to a specific city. It may therefore directly influence the decision to travel according to a specified schedule, its components, or the cancellation of the travel. These decisions may be influenced by many factors, including but not limited to:

- Obligatory departure: Private, business,
- the motive for the journey: Leisure, health, cognitive,
- accompanying persons: On their own, with their families, including children,
- departure time: During the season or outside the tourist season, especially during periods with more or less favourable air quality levels,

- way of organizing the trip: Independently or through a travel agency,
- detailed elements of the offer, e.g., the means of transport used, including local transport,
- scope of the offer, and tourist activities in the city—spending time mainly in closed facilities (e.g., cultural, sports, and tourist bases), or in places and facilities outside, in the so-called “open air”,
- health: The health status of participants, e.g., related to diseases (e.g., respiratory system, allergies) or susceptibility to malaise under poor air quality conditions.

The state of air quality and available information on this subject become factors influencing not only travel decisions and the structure of elements determining the full tourist offer consumed by the tourist, but also the overall tourist image. They are also influencing factors in the case of potential tourists, i.e., people who make comparisons of places (cities) that could be their travel destinations in the short or long term for their own needs. These issues may be subject to long-term assessment together with the observation of the activities of public authorities, including individual tourist destinations, related to the impact on the level of air quality in a certain time horizon [40]. These issues directly affect the tourist image of the city, understood as the sum of beliefs, ideas, and emotions possessed by a potential tourist about a given place that is a potential destination for a tourist trip [41,42] (pp. 128–129), [43] (p. 25), [44]. It is a set of patterns of people’s attitudes towards a tourist destination, based on various assessments, experiences, ideas, views, and expectations related to this destination [45] (p. 38). The tourist image shapes the purchasing decisions and may increase or decrease the city’s tourist competitiveness [46,47].

Taking into account that the tourist image is shaped over years [48] (p. 9), [49], the problems with air quality in the perception of tourists are of a long-term nature and directly affect the evaluation of tourist destinations and decisions about visiting cities, which has been confirmed by studies conducted in Europe [50,51] and China [52–55], as well as in other countries [56]. Therefore, reduced air quality can influence decisions related to tourist arrivals in cities and at the same time requires action by public authorities to reduce the negative impact of smog on the urban tourism economy through measures to improve air quality in the short and long term. A strategic policy and planning approach are crucial for successful implementation of sustainable tourism development [57] (p. 26). It should be emphasized that, especially in European cities, including Poland, low air quality affects the autumn and winter periods in particular, because apart from the emission of industrial and transport pollution occurring with a variable intensity throughout the year, there are also intensive emissions of pollutants related to the heating of houses and flats, as well as facilities operated by enterprises and institutions.

## 2.2. Types of Air Pollution and Their Impacts on the Health of Residents and Tourists

Cities are characterized by a variety of functions. It is impossible to list all of them. However, among the most common are: Residential, industrial, administrative, scientific, communications, trade, religious, and tourist-recreational. In addition, there are government bodies in cities, therefore cities can also be centres of power. The multitude of functions is related to the location of numerous industrial, service, commercial, and residential facilities within a city’s area and in the immediate vicinity, which is conducive to a high population density. It is estimated that cities occupy about 2% of the Earth’s surface area, but they are already inhabited by about 50% of the total population, and by 2050, this percentage will have increased to 70% [58,59]. A negative consequence of intensive human activity in the urban space is the creation of pollution, among which one of the most dangerous types for human health is air pollution. The largest shares in its generation are held by the energy industry, requiring combustion of fossil fuels, the activity of individual households, which are sources of pollution caused by coal and waste furnace combustion (including plastic raw materials), as well as transport [60]. This is not only a matter of individual transport, but also of delivery transport, which supplies numerous commercial and service outlets. Air transport also contributes to the formation of pollution in cities where airports are located. In port cities, on the other hand, harmful substances are

emitted by sea transport. Port cities are often attractive tourist destinations, and many of the ships that contribute to air pollution are passenger ships.

Air pollutants in cities are mainly dusts (PM10 and PM2.5), nitrogen oxides (NO<sub>x</sub>), sulfur oxides (SO<sub>x</sub>), and tropospheric ozone.

PM10 is recognized as one of the main pollutants that degrade air quality. It is a particle with an aerodynamic diameter less than 10 micrometres in size. It is a complex mixture of small particles and liquid droplets in the atmosphere, which may be formed of aerosols, powders, metals, combustion products, or microorganisms (such as protozoa, bacteria, viruses, fungi, and pollen) that can cause different types of diseases. [61]. When particles are inhaled, they are not always expelled by the body's immune systems, causing a variety of human health problems [62].

Fine particulate matter (PM2.5) is responsible for significant negative impacts on human health. There is no identifiable threshold below which PM2.5 would not pose a risk [63]. This has been noted for a long time, and it was reflected in, among other publications, *The European Environment-state and outlook report* [64], in which it was stated that pollution continues to cause serious health impacts, particularly in urban areas. Citing data from 2011 from 39 countries, it was estimated that about 430,000 premature deaths in the EU were attributable to PM2.5 [64]. The report contains a proposal for a forecast which, unfortunately, has not been confirmed so far. Namely, it was claimed that “projected improvements in air quality are not expected to be sufficient to prevent continuing harm to health and the environment, while health impacts resulting from climate change are expected to worsen”.

In 2013, it was estimated that transport was responsible for 13% of PM10 emissions and 15% of PM2.5 emissions, as well as for about one third of greenhouse gas production. EU policies promoting alternative drives as well as developments in vehicle technology (e.g., the use of particulate filters) have resulted in a reduction in vehicle emissions. However, due to the increasing number of vehicles in urban areas, non-fuel-related particulate emissions from brake and tyre wear have increased. It is worth noting that the increased demand for transport in tourist destinations may be due to the development of tourism [65].

Nitrogen Oxide (NO<sub>x</sub>) and Sulfur Oxide (SO<sub>x</sub>) gases in the air also cause health problems. Long-term exposure can decrease lung function, increase the risk of respiratory conditions, and contribute to the formation or exacerbation of allergies [66]. These compounds cause the formation of smog and acid rain as well as being central to the formation of fine particles (PM) and ground-level ozone (tropospheric ozone). NO<sub>x</sub> gases are formed as a result of the combustion of fuel by power plants, refineries, and motor vehicles [67].

Tropospheric ozone (O<sub>3</sub>), otherwise known as ground-level ozone, is a secondary pollutant that is formed as a result of photochemical reactions of nitrogen oxides and volatile organic compounds in the atmosphere [68]. These compounds are largely emitted by cars and other vehicles, fossil fuel power plants, oil refineries, the agriculture sector, and a number of other industries. The formation of tropospheric ozone is accelerated by the high air temperature. For this reason, the highest concentrations are usually recorded in spring and summer [69]. Tropospheric ozone affects the climate beyond increased warming, having impacts on evaporation rates, precipitation levels, cloud formation, and atmospheric circulation. Ozone is a major component of smog. It has a very negative impact on human health—it can worsen bronchitis and emphysema, trigger asthma, and permanently damage lung tissue. Tropospheric ozone exposure is responsible for an estimated one million premature deaths each year [70].

According to data from the World Health Organization (WHO), air pollution is the biggest environmental risk to health and is responsible for about one in every nine deaths annually. Ambient air pollution kills around 3 million people each year, and only 10% of people live in a city that complies with the WHO Air quality guidelines. [71]. It is worth noting that in EU countries, there are internal EU standards concerning the permissible level of air pollution—much more liberal than the WHO standards. However, the data on air pollution are still terrifying. The percentage of the European urban



population exposed to pollution levels in excess of air pollutant concentration standards between 2015 and 2017 is shown in Table 1.

**Table 1.** Percentage of the population of European cities exposed to pollution levels in excess of air quality standards in European urban areas in 2015–2017.

Type of Pollution	% Excess of EU Limit Value	% Excess of WHO Value
PM10	13–16	42–52
PM2.5	6–8	74–85
O <sub>3</sub>	7–10	95–98
NO <sub>2</sub>	7–8	7–8

Source: Own study based on [72].

Air pollution continues to rise at an alarming rate and affects economies and quality of life. Certainly, harmful substances in the air have a negative impact on city dwellers, but also on tourists visiting these cities. It can be assumed that due to the shorter time of exposure to polluted air, tourists suffer less than residents. However, in some cases, even a short period of contact with poisonous substances can cause a visible deterioration in health. Tourists usually make their own decisions concerning tourist trips that are guided by various reasons, including those related to values and tourist attractions. Prior to departure, most people conduct a reconnaissance of the attractiveness of a given city. The question is, to what extent is public information on air pollution relevant to people planning to travel?

### 2.3. Scope of Information on Air Pollution

Information on pollutants is made publicly available and accessible through various media. The assessment of air quality considers substances for which limit values for ambient air concentrations (limits/targets/long-term objectives) have been laid down in EU Directives in order to protect human health. The assessment of compliance with the criteria established to protect human health takes into account sulfur oxides (SO<sub>x</sub>), nitrogen oxides (NO<sub>x</sub>), carbon monoxide (CO), benzene (C<sub>6</sub>H<sub>6</sub>), ozone (O<sub>3</sub>), PM10 dust, and PM2.5 primary fine particulate (of 10/2.5 microns and less in diameter), and heavy metals: Lead (Pb), arsenic (As), cadmium (Cd) and nickel (Ni), and benzo(a)pyrene (B(a)P) in PM10 dust [73,74].

While Directive 2008/50/EC sets uniform information (The information level is the concentration of the substance in the air above which there is a risk to human health from brief exposure to pollutants for sensitive sections of the population, for which immediate and appropriate information is necessary. The information level is determined for ozone (O<sub>3</sub>) and PM10 [75].) and alert (Alarm level—indicates the level of the substance in the air, which, even if exceeded for a short period of time, may pose a threat to human health. The alarm level is determined for ozone (O<sub>3</sub>), PM10, sulfur dioxide (SO<sub>2</sub>), and nitrogen dioxide (NO<sub>2</sub>) [75].) levels for sulfur dioxide, nitrogen dioxide, and ozone, European Union law does not impose uniform information and alert levels for concentrations of PM10. Therefore, EU Member States are not obliged to set such levels for particulate matter (PM10, PM2.5). This is the responsibility of national or regional administrations. Member States decide on their own whether or not to report the level of air pollution. However, most European countries have introduced such limits for the health of their citizens (Table 2).

**Table 2.** Information and alert levels for PM10 concentrations in selected EU countries in 2019.

No.	Country Name	Information Thresholds	Alert Thresholds
1	AUSTRIA	50 $\mu\text{g}/\text{m}^3$	75 $\mu\text{g}/\text{m}^3$
2	BELGIUM	50 $\mu\text{g}/\text{m}^3$	70 $\mu\text{g}/\text{m}^3$
3	CZECH REPUBLIC	no data available	100 $\mu\text{g}/\text{m}^3$
4	FINLAND	50 $\mu\text{g}/\text{m}^3$	50 $\mu\text{g}/\text{m}^3$
5	FRANCE	50 $\mu\text{g}/\text{m}^3$	80 $\mu\text{g}/\text{m}^3$
6	GERMANY (Stuttgart)	no data available	50 $\mu\text{g}/\text{m}^3$
7	GREAT BRITAIN	76 $\mu\text{g}/\text{m}^3$	101 $\mu\text{g}/\text{m}^3$
8	HUNGARY	75 $\mu\text{g}/\text{m}^3$	100 $\mu\text{g}/\text{m}^3$
9	ITALY (Lombardy)	50 $\mu\text{g}/\text{m}^3$	75 $\mu\text{g}/\text{m}^3$
10	MACEDONIA	50 $\mu\text{g}/\text{m}^3$	100 $\mu\text{g}/\text{m}^3$
11	POLAND *	100 $\mu\text{g}/\text{m}^3$	150 $\mu\text{g}/\text{m}^3$
12	SLOVAKIA	100 $\mu\text{g}/\text{m}^3$	150 $\mu\text{g}/\text{m}^3$
13	SPAIN (Catalonia)	50 $\mu\text{g}/\text{m}^3$	80 $\mu\text{g}/\text{m}^3$
14	SWITZERLAND	75 $\mu\text{g}/\text{m}^3$	100 $\mu\text{g}/\text{m}^3$

\* Information and alarm levels in Poland decreased in October 2019. Previously, the information threshold was 200  $\mu\text{g}/\text{m}^3$  and the alarm threshold was 300  $\mu\text{g}/\text{m}^3$ . These were the highest accepted values in Europe. Source: Own study based on [76].

However, as Table 2 shows, these levels differ from each other significantly. The highest values apply in Poland and Slovakia. The current information threshold for PM10 in these countries is 100  $\mu\text{g}/\text{m}^3$ , and the alert threshold is 150  $\mu\text{g}/\text{m}^3$  (i.e., twice and three times the WHO guidelines, respectively). The Ministry of Health's recommendations set the alarm threshold at 80  $\mu\text{g}/\text{m}^3$ , which is similar to the EU level [77].

When the information level is exceeded, information on high air pollution should reach as many people as possible in the area. The media should be involved in the process of communicating air pollution. The alert threshold is the level at which local and regional authorities should take special ad hoc measures to reduce air pollution in a given area. It is also the case that different solutions are being applied in different countries, such as the introduction of free public transport in Poland, intensive inspections of hearths, restrictions on car traffic in city centres, extraordinary control of pollutant emissions in industrial plants, etc.

In principle, all measured data on air quality are made publicly available regardless of whether or not air quality standards are exceeded. Information about the alarm level being exceeded is transmitted to special authorities, which in turn make it available to the public in the manner customary in a given area of the country (TV, radio, local press, Internet, etc.). Global mobile applications are also widely available—they provide information on the state of air quality in every location in the world where measurements are made.

It can be concluded that interested residents and tourists can easily access information on concentrations of harmful substances in the air. However, this information will only be sought by those who are aware of the potential risks from contact with contaminants.

### 3. Materials and Methods

In the present article, the influence of air pollution on tourism in cities is investigated. In this context, the main aim of the article is to examine the influence of information about the state of air pollution on decisions concerning tourist trips to cities. In order to achieve this goal, the authors established a specific order of research.

For the purposes of the research, a research hypothesis (H) was formulated: *Information on the state of air pollution affects the assessment of the level of tourist attractiveness of cities by potential tourists, and thus affects decisions concerning tourist trips.* The following auxiliary hypotheses were also put forward (h):

**Hypothesis 1:** *The importance attached to the state of air pollution by a potential tourist in a selected tourist destination depends on the duration of the planned trip.*

**Hypothesis 2:** *The importance attached to the state of air pollution by an exemplary tourist in a selected tourist destination depends on whether the tourist trip will involve children.*

**Hypothesis 3:** *The importance attached to the state of air pollution by an exemplary tourist in a selected tourist destination depends on the motive for departure (e.g., business trip, private trip).*

For the purposes of research, the demoscopic method, i.e., a diagnostic survey based on surveys, was used, using the CAWI (Computer-Assisted Web Interviewing) technique. Surveys were sent out via e-mail and made available on the authors' Facebook profiles. Mailing took place between February and May 2019. A request to make the survey available to potential respondents was addressed to employees of universities, public administration offices, public libraries, and other workplaces in various Polish cities. The respondents were anonymous, independent, and were coming from different regions of Poland. A random sample selection was used, assuming that each of the respondents is a potential tourist. However, the requirement to have reached the age of 18 was introduced, as in Poland this is the age at which independent decisions can be made. In addition, due to the fact that the survey was conducted in Polish, the group of respondents was limited to those from Poland. Finally, 509 respondents participated in the study.

The survey prepared by the team consisted of three main parts. The first part included questions concerning the gender, age, place of residence, and health status of respondents, with only one possible answer.

The second part of the survey concerned 2 types of tourist trips: Business and private, each including domestic trips (in Poland) and foreign trips (outside Poland):

1. Business trips:
  - a) In Poland,
  - b) outside Poland,
2. Private trips:
  - a) In Poland,
  - b) outside Poland.

The first three questions in each of the thematic blocks concerned information on the frequency of trips, the length of stay during the trip, and checking the state of air pollution in the city to which the respondent intends to go on a tourist trip. Each question required a single answer. The last question in each of the thematic blocks was answered only by those respondents who did not give a clear answer to the question concerning checking the state of air pollution in the city they are going to visit. This question was aimed at determining the reasons why respondents check the state of air pollution in the cities they visit. In this question, a five-step Likert scale was used, where 1 meant the least important factor and 5 meant the most important. Additionally, in the case of thematic block 2, *Private trips*, questions were introduced concerning potential participation of children during a joint tourist trip, age of children, health condition of children, and checking the state of air pollution in the city that the respondents and their children visit.

The third part of the survey consisted of questions concerning, among others:

- The impact of air quality on the subjective assessment of the city's tourist attractiveness in the opinion of respondents;
- personal protective equipment used by respondents in case of bad air condition;



- ways of informing tourists about the state of air pollution.

These included questions requiring one answer, questions allowing for the selection of multiple answers, and questions using the five-step Likert scale.

The division of the questionnaire into three main parts is presented schematically in Figure 1.

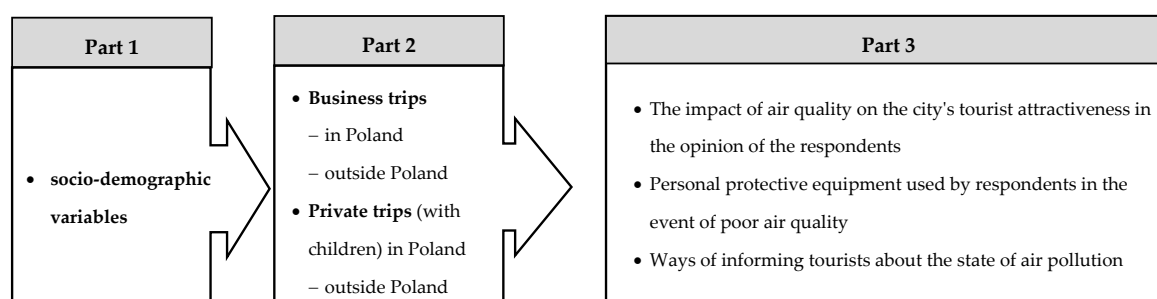


Figure 1. Structure of the questionnaire.

The results of the study are discussed in the context of the formulated research hypotheses. A chi-squared test was used to verify the veracity of the hypotheses presented in the article. In addition, the obtained survey results are presented in graphical form. The article ends with conclusions and recommendations concerning the results of the study.

#### 4. Analysis of Results in the Context of Established Research Hypotheses

The survey was conducted on a sample of 509 people, 74% of whom were women and 26% of whom were men, all aged 18 to 75 years of age. The respondents were asked about the impact of the state of air pollution in a given city on decisions concerning tourist trips. The average age of the respondents was 40.73 years, while the standard deviation was 12.87 years. The average age of the surveyed women was 41.06 years and that of the men was 39.77 years. In this case, the standard deviation was 12.09 and 14.88 years, respectively. Based on the quartile values, 50% of the respondents were aged between 31.28 and 49.67 years. This means that the respondents were mainly women, who are potentially more interested in the state of air pollution, and mainly middle-aged people who go on tourist trips without small children. Detailed age distribution parameters of the respondents, including gender, are presented in Figure 2.

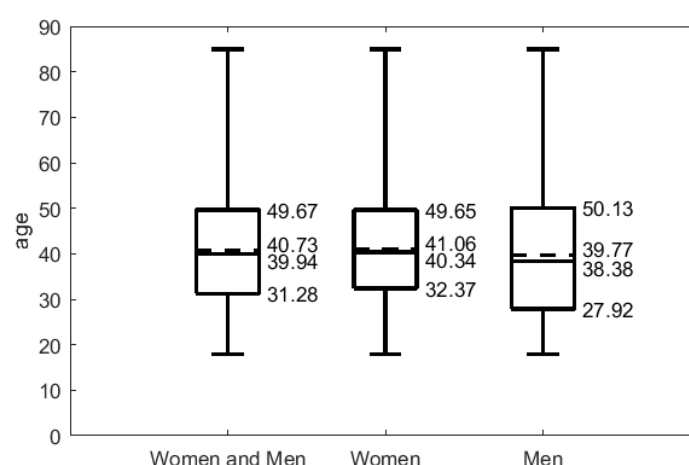
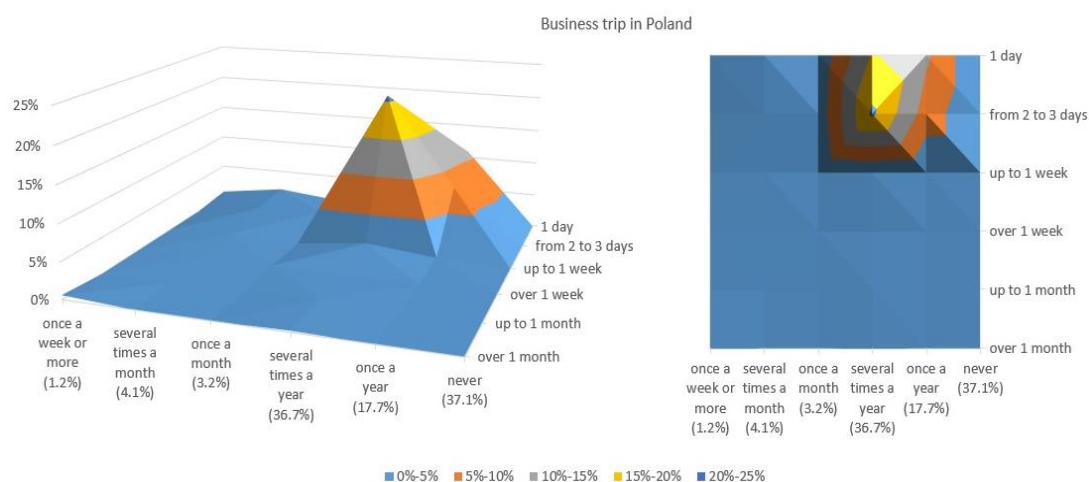


Figure 2. Average (dashed line), median, upper, and lower quartiles, maximum and minimum age of all survey participants.

Respondents were asked about the frequency of domestic (travel in Poland) and foreign trips to cities with a distinction between business and private trips. When arranging the survey, separate time periods were adopted for these trips, taking into account their typical nature.

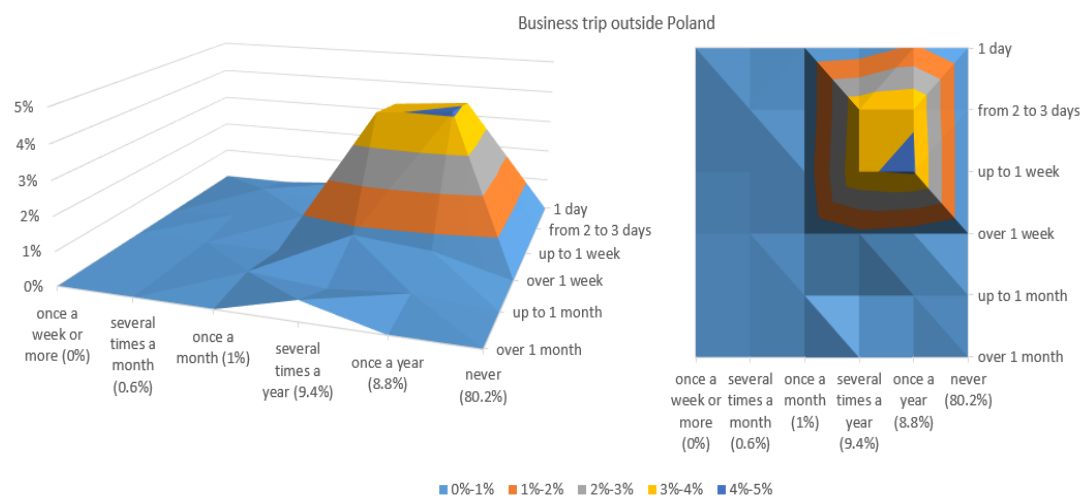
Among the respondents, 36.7% indicated that they participate in domestic business trips to cities several times a year, while 37.1% of people did not travel on business in Poland at all. These results are presented on a 3D chart and on a plane in Figure 3. The 3D chart shows the frequency of trips on one axis and the length of the trip on the other. The value axis is the percentage of people declaring that they visit cities. The 2D chart is a projection of the 3D chart. With the most frequency, as many as 21% of respondents indicated that they take a trip lasting 2–3 days several times a year; 16% of the respondents took part in a one-day trip several times a year, and 11% took part in such a trip only once.



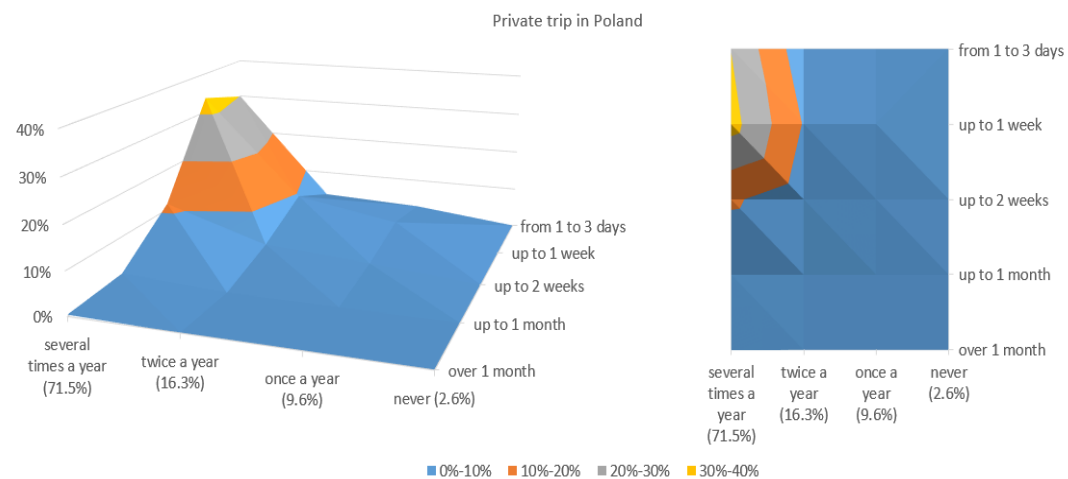
**Figure 3.** Percentage of persons declaring a business trip to cities in Poland depending on the frequency of travel during the year and the length of trips.

The frequency of foreign business trips to cities was much lower among the respondents (Figure 5). As many as 80.2% of respondents indicated that they do not take part in such trips at all, 9.4% travel several times a year, and 8.8% once a year. From the surface chart in Figure 4, it can be concluded that business trips outside Poland take place up to several times a year and last from 2 days to 1 week. After that, 4% of the respondents indicated that they participate in trips lasting 2–3 days or longer than 1 week. These results are visible at the highest level of Figure 4.

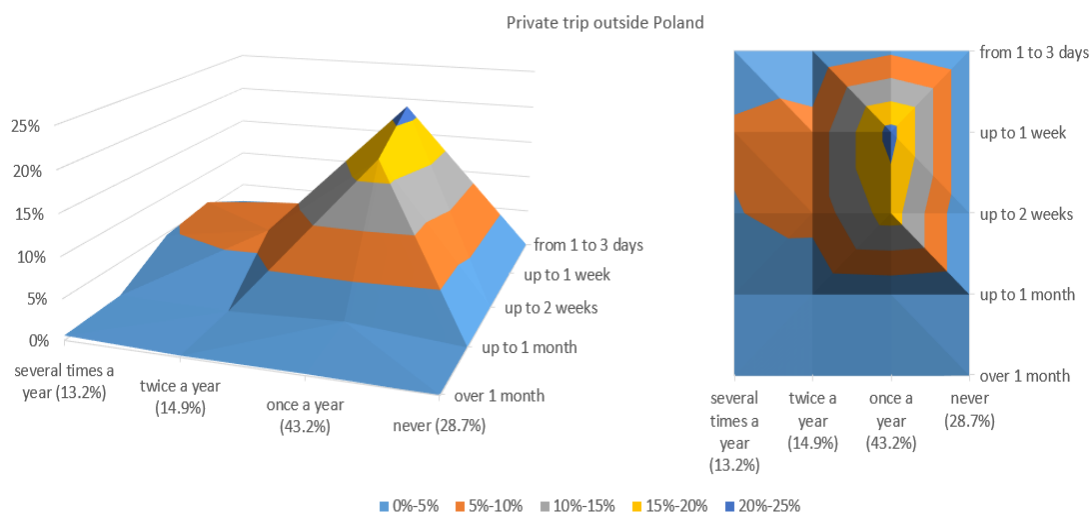
In a similar way, the frequency of private trips to cities, divided into domestic and international, is presented in 3D and 2D charts in Figures 5 and 6. The largest number of respondents (71.5%) declared that they travel privately to cities in Poland several times a year. Foreign trips were experienced by 43.2% of the respondents. Meanwhile, 2.6% of the respondents did not take part in private domestic trips, and in the case of foreign trips, this percentage was much higher and amounted to 28.7% of the respondents. 3D charts (Figures 5 and 6) show that the largest number of private travellers in Poland, i.e., 34%, take part in such trips several times a year. In the case of private trips abroad, the number of people taking part in such trips was much lower—22% of the respondents. In both cases, these were usually trips lasting up to 1 week.



**Figure 4.** Percentage of persons declaring a business trip to cities outside Poland depending on the frequency of travel during the year and the length of trips.



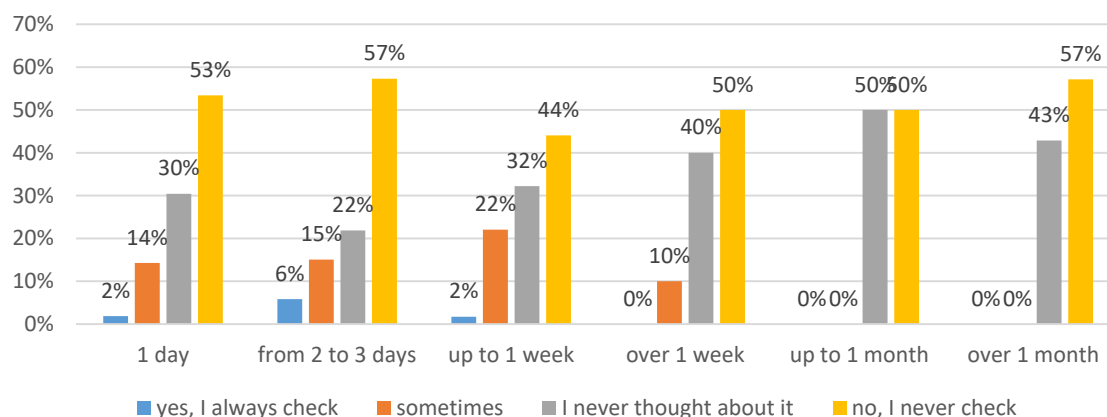
**Figure 5.** Percentage of persons declaring a private trip to cities in Poland depending on the frequency of travel during the year and the length of trips.



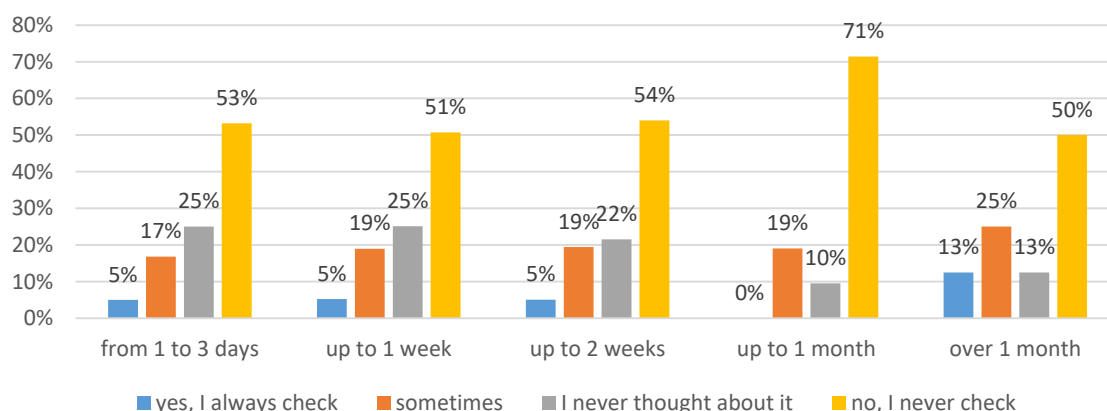
**Figure 6.** Percentage of persons declaring a private trip to cities outside Poland depending on the frequency of travel during the year and the length of trips.

Figures 7–9 present the results of the answers to the questions concerning the verification of air pollution in the destination city by the respondents. This was analysed in terms of:

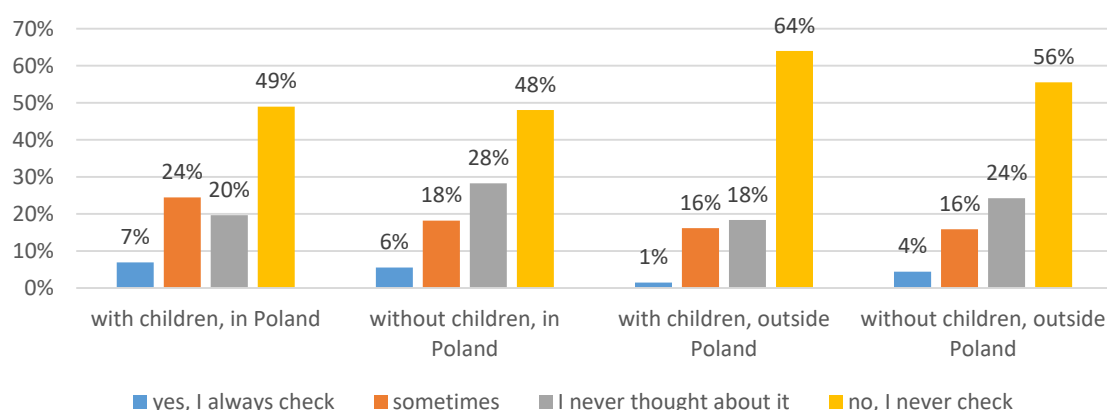
- The length of the trip (distinguishing between business and private),
- travel with children (domestic and foreign),
- the motive for the journey (including private or business, domestic or foreign).



**Figure 7.** Distribution of answers to the question concerning checking the state of air pollution in the destination city depending on the duration of the planned business trip.



**Figure 8.** Distribution of answers to the question about checking the state of air pollution in the destination city depending on the duration of the planned private trip.



**Figure 9.** Distribution of answers to the question concerning checking the state of air pollution in the destination city depending on whether children participate in the tourist trip.

In the case of this question, the respondents had four types of answers at their disposal:

- A. Yes, I always check,
- B. I check sometimes,
- C. I never thought about it,
- D. No, I never check.

The study shows that the respondents—in all analysed cases—rarely check the state of air pollution in the city they are going to.

For business trips lasting between 2 weeks and 1 month, 50% of respondents indicated that they never consciously check the state of air pollution in the city they are traveling to, and 50% said they never even thought about it (Figure 7). For shorter business trips lasting 1 day or 2–3 days, more than 50% of respondents never check the state of air pollution. However, there were affirmative answers of 2% and 6%, respectively, when respondents declared that they always looked for such information. The state of air pollution in the destination city was checked “sometimes” by 14% of people who travelled on business for 1 day and by 15% who travelled for 2–3 days. In private trips (Figure 8), regardless of the length of the trip, 50% or more people never checked the state of air pollution. However, in the case of trips for a longer period of time—lasting more than 1 month—as many as 13% of people always looked for such information.

Table 3: To check whether there is a relationship between the duration of the trip and the importance attached to the state of air pollution by a potential tourist, a chi-squared test was carried out. The following statistical hypotheses were tested:

**Table 3.** Chi-squared test result.

Type of Travel	Type of Response	Data Size (N)	Degrees of Freedom (Df)	Test Statistic (H)	Significance Level
Business travel in Poland and abroad	Six travel periods and four responses to air pollution checks	445	15	15.398	>0.05
Private travel in Poland and abroad	Five travel periods and four responses to air pollution checks	908	12	7.634	>0.05

Null hypothesis H0a: There is no relationship between the duration of the planned trip and the importance attached to the state of air pollution by a potential tourist in a selected tourist destination.

Alternative hypothesis H1a: There is a relationship between the duration of the planned trip and the importance attached to the state of air pollution by a potential tourist in a selected tourist destination.

The obtained results are presented in Table 3. In both the cases of business and private travel, a significance level above 0.05 was obtained. Considering the test results, we conclude that there is no reason to reject the null hypothesis H0a. Therefore, it should be recognized that there is no significant relationship between the duration of the planned trip and the importance attached to the state of air pollution by a potential tourist. This conclusion applies to both business and private travel in Poland and abroad.

For the purpose of the survey, a group of people who had children and travelled with them was selected from among all the respondents. Their answers to the question about checking the state of air pollution in the tourist destination city show that the representatives of this group also rarely check the condition of air quality (Figure 9). However, the results differed depending on the location of the destination. For domestic trips, 69% of travellers do not consciously check or have never even thought to check the air quality. This percentage was much higher in the case of foreign trips, and amounted to as much as 82% of people. For those without children, the results were slightly different—76% of those traveling in Poland and 70% of those traveling abroad did not check or never thought about checking the state of air pollution at their destination.

Among those who always checked the state of air pollution before traveling to cities, the highest number of people went on domestic trips with children (7%). In the case of people traveling in Poland without children, this percentage was only slightly lower and amounted to 6%.

Using the chi-squared test, the relationship between the results of checking air pollution among people who have children and travel with them and those who do not have children was verified. The test compared the independence of the responses on checking air pollution before traveling abroad and in Poland for people who have children and those who do not have them. The following hypotheses were examined in this test:

Null hypothesis H0b: There is no relationship between the responses of people with children and those who have no children and the importance attached to the state of air pollution by a potential tourist in a selected tourist destination.

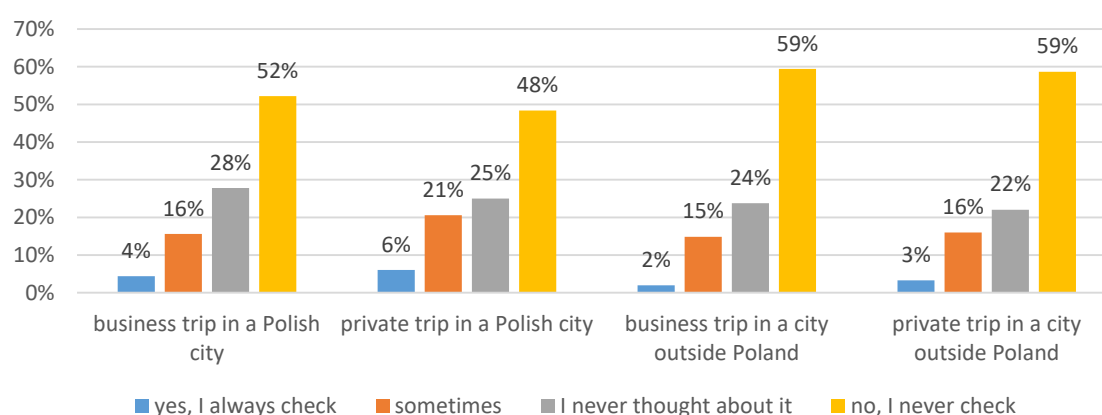
Alternative hypothesis H1b: There is a relationship between the responses of people with children and those who have no children the importance attached to the state of air pollution by a potential tourist in a selected tourist destination.

The test results are shown in Table 4. In this case, the null hypothesis H0b was rejected; the significance level is less than 0.05. This means that there is a relationship between checking air pollution and having children.

**Table 4.** Chi-squared test result.

Type of Travel	Type of Response	Data Size (N)	Degrees of Freedom (Df)	Test Statistic (H)	Significance Level
Travel in Poland and abroad with and without children	Four types of travel and four responses to air pollution checks	859	9	21.023	$\leq 0.05$

Another cross-section of data obtained as a result of the survey concerned the relationship between the state of air pollution being checked by the respondents and the motive for travel (private or business); the results are presented in Figure 10.



**Figure 10.** Distribution of answers to the question about checking the state of air pollution in the destination city depending on the motive for the trip.

Only 6% of people always check the air quality when traveling privately to cities in Poland, 4% when traveling on business in Poland, 3% when traveling privately to cities outside Poland, and 2% when traveling on business outside Poland. When traveling on business to cities in Poland, as many as 80% of people do not check the state of air pollution at their destination. The same is true for business trips abroad, where the percentage was 83%. For private travel, 73% of travellers in Poland and 81% of travellers outside Poland never consciously check or even think about checking the air condition at their destination.



To check the independence of the respondents' travel type (business or private travel in Poland and abroad) from checking the state of air pollution, another Person's chi-squared test was performed. The hypotheses are as follows:

Null hypothesis H0c: There is no relationship between the type of trip (business or private travel in Poland and abroad) and the importance attached to the state of air pollution by a potential tourist in a selected tourist destination.

Alternative hypothesis H1c: There is a relationship between the type of trip (business or private travel in Poland and abroad) the importance attached to the state of air pollution by a potential tourist in a selected tourist destination.

The test results presented in Table 5 indicate that the null hypothesis H0c should be rejected; the significance level is less than 0.05. Thus, there is a relationship between the type of travel of respondents (business or private trip to Poland or abroad) and checking the state of air pollution at the travel destination.

Table 5. Chi-squared test result.

Type of Travel	Type of Response	Data Size (N)	Degrees of Freedom (Df)	Test Statistic (H)	Significance Level
Business or private travel in Poland and abroad	Four types of travel and four responses to air pollution checks	1279	9	17.3895	$\leq 0.05$

The respondents who did not give a clear answer to the question "do you check the state of air pollution in the city you are going to", i.e., marked the answers:

- A. I check sometimes,
- B. I never thought about it,

were additionally asked whether factors such as:

- Region of the destination,
- time spent in the city,
- children's participation in the trip,

may induce them to check the state of air pollution at the destination of a private or business trip (Figure 11).

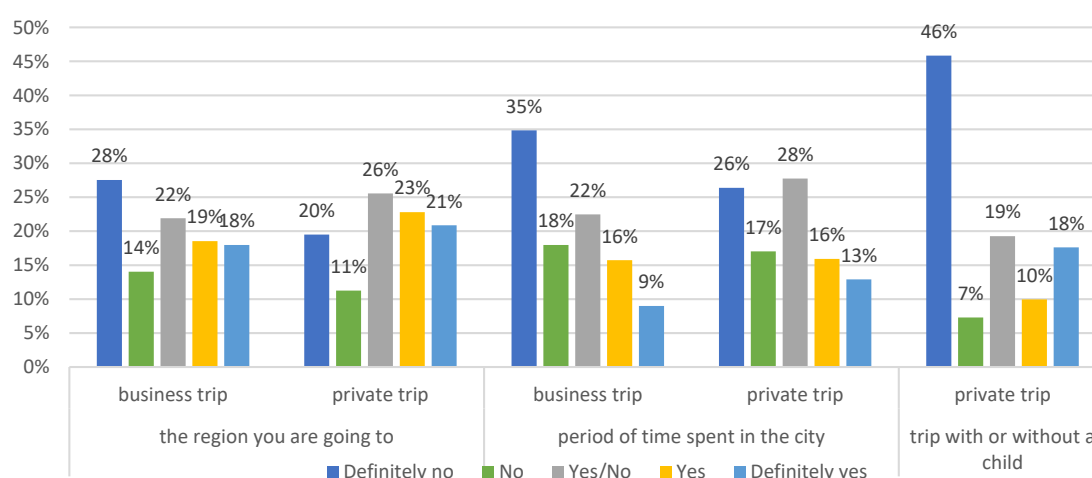


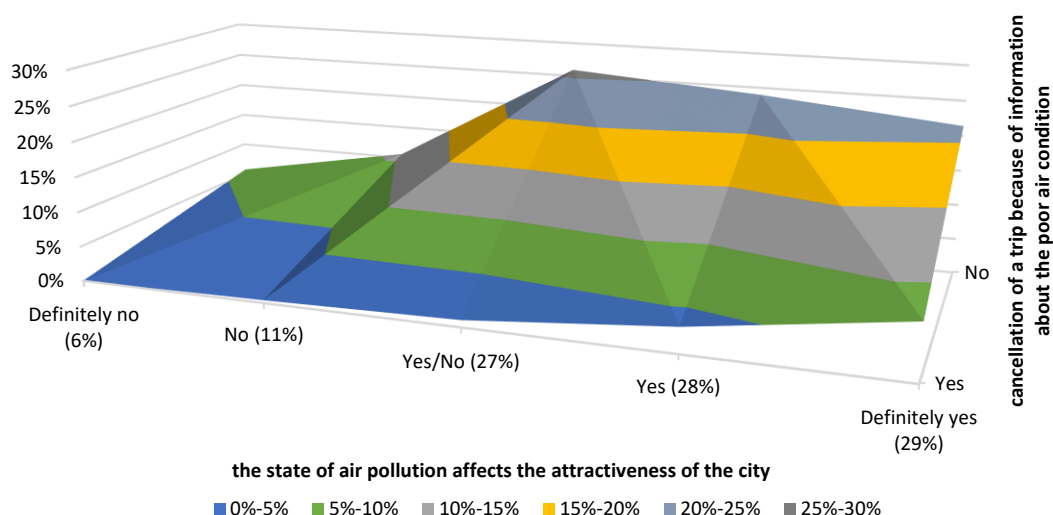
Figure 11. Distribution of answers to the question about whether the region, journey length, or participation of children in a trip has an impact on checking the air pollution status of the visited city.

In response to this question, 44% of respondents said that in the case of private trips, their decision as to whether or not to check the state of air pollution in the city they are visiting was dependent on the region in which it is located. In the group of business travellers, 37% of respondents indicated such a dependence.

Moreover, 29% of respondents traveling privately and 25% of respondents traveling on business indicated that their decision to check the air quality depended on the length of their trip.

As many as 53% of private travellers believe that traveling with children will not make them check the state of air pollution at the destination.

All the respondents were also asked whether the state of air pollution in a given city affects their subjective assessment of the level of tourist attractiveness of the city. The majority of respondents (57%) answered positively. A question was also asked about whether the poor condition of the air in a given city could make them cancel their travel plans. Figure 12 shows the distribution of data on the impact of air pollution on the assessment of the tourist attractiveness of a city, and answers to the question about whether the respondent would cancel travel due to the bad air condition in a given city. Among those claiming to have such a dependency, 8% would sometimes cancel travel due to air quality. However, the vast majority, as many as 88%, has never made such a decision.

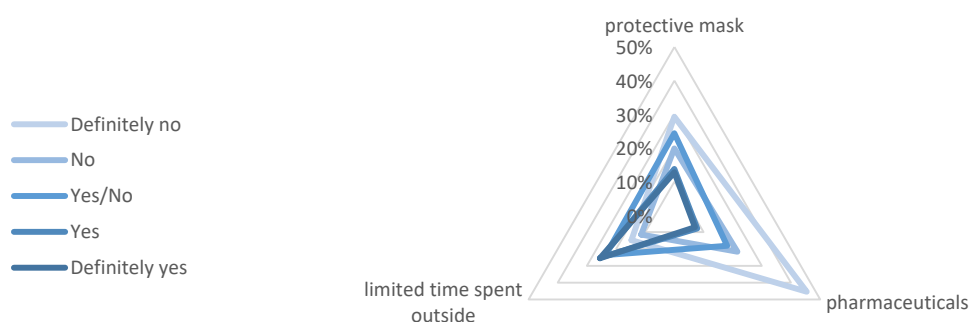


**Figure 12.** Comparison between the impact of air pollution on the attractiveness of the city and cancelling travel plans due to the degree of air pollution.

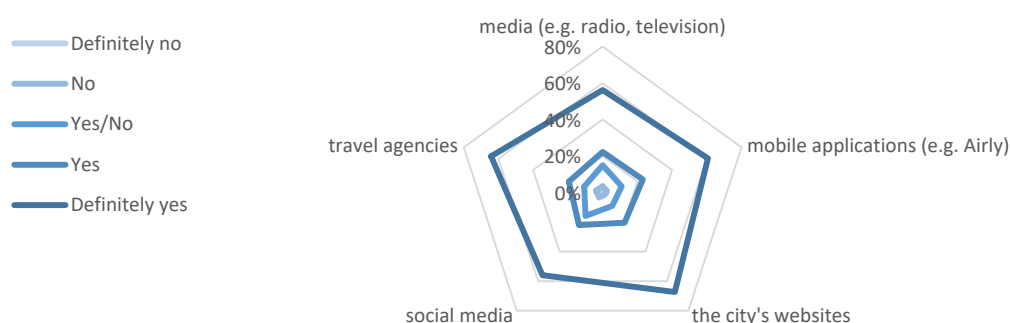
In order to reduce the negative impact of air pollution on health, various protective measures can be applied. Their use, however, is associated with a high awareness of the negative effects that can occur in the organisms of people who come into contact with poisonous substances in the air. Respondents' answers to a question concerning their willingness to use various protective measures are presented in Figure 13. Separate responses show that 14% of respondents would allow the use of a protective mask, and 7% would be willing to use pharmaceuticals, while the largest number of people—26%—would reduce the time spent outdoors as a method of protection against pollution.

However, the respondents' answers were dominated by those indicating a lack of willingness to use any personal protection against pollution. As many as 45% of people would definitely refuse to use pharmaceuticals, 29% would definitely not wear a protective mask, and 15% would definitely not limit the time spent outdoors.

The respondents were also asked how they would like to be informed about the state of air pollution in the city they are going to. Figure 14 presents a graph of respondents' answers to the question about their preferred form of being informed about the state of air pollution in the city.



**Figure 13.** The willingness to use appropriate personal protective equipment in a city with poor air quality (Question: If you went to a city with a bad air condition, would you use safety precautions?).



**Figure 14.** Preferred forms of informing tourists about the state of air pollution in a city (Question: How should tourists be informed about the state of air pollution?).

According to the results obtained, information on the state of air pollution should be provided (“Yes” and “Definitely yes” answers) mainly on the city’s websites (88%), as well as distributed through mobile applications (84%), travel agencies (84%), media (78%), and social media (78%).

On the basis of the results obtained, conclusions are drawn and recommendations are presented concerning the management of the tourist attractiveness of a city with particular emphasis on the state of air quality.

## 5. Conclusions and Recommendations Concerning the Management of a City’s Tourist Attractiveness

More than half of the respondents said that air quality is a decisive factor in the subjective assessment of the level of tourist attractiveness of a given city destination. Tourist attractiveness determines the competitiveness of a place, and therefore can directly influence the decisions related to a tourist trip to a specific city. The results of the study confirmed the main hypothesis of the article.

The conducted study showed a contradiction between the behaviours and beliefs of the respondents. According to the results of the analysis, checking the air quality of the cities that they visit for tourism (although it is considered a determinant of the attractiveness of destinations) was not popular among respondents. However, it has been noted that there are some regularities confirming the auxiliary hypotheses put forward in the article. Using the chi-squared test, the relationship between the purpose of the trip (both abroad and within Poland) and the importance attached to the state of air quality was confirmed (h3 confirmed). Histogram analyses showed that when traveling for private purposes, respondents were more inclined to check the air quality than when traveling for business purposes. This dependence is probably due to the fact that business trip destinations are usually imposed by the employer. In the case of private trips, potential tourists choose their own tourist destination based on their preferences.

Chi-squared tests showed a relationship between checking air pollution and having children (h2 confirmed). Based on the percentage values shown in Figure 9, it was concluded that among those

checking the air quality, more people were traveling with children. This is probably due to the concern for children's health and awareness of the fact that pollution is particularly dangerous for the youngest.

The chi-squared test showed no relationship between the importance attached to the state of air pollution by a potential tourist and the duration of the planned trip. Thus, H1 could not be confirmed.

It should be noted, however, that the percentage of people seeking information on air pollution in selected cities that are tourist destinations is very small. This is despite the widespread availability of this information. Respondents said they wanted to be informed about pollution and pointed to different tools and forms of information that would be most effective for them. It should be noted, however, that the information system exists and all the tools indicated by the respondents are publicly available. The fact that the respondents do not use them does not result from difficulties in finding them, but rather from low awareness that this information is even important during tourist trips. The fact that the respondents are not fully aware of the harmful effects that polluted air may have on their health is also confirmed by the answers to the question about whether they would apply self-protection measures in case of contact with polluted air. The general reluctance to such solutions indicates that the threats are underestimated. It can therefore be concluded that there is a need for further action in the field of education. The state of air quality and available information are already becoming factors influencing travel decisions for potential tourists, i.e., people who make comparisons of places (cities) for their own needs, which could be their destination in the short or long term. Thus, they determine the overall tourist image of the city. Another point is that when visiting websites about tourist attractions in a given city, very rarely it is possible to find information about the level of air pollution. Many cities that are attractive for tourists due to their history, monuments, etc. for obvious reasons do not inform about threats related to the condition of air quality in the city. The results of the survey conducted by the authors of the present article led them to further research the causes of the low interest from potential tourists in checking the state of air pollution in the city they are planning to visit.

Parallel to educational activities aimed at raising awareness of the impact of pollution on health, actions aimed at improving air quality in cities are also necessary. Actions undertaken in cities aimed at limiting emissions will be able to influence the development of cities, including urban tourism, increase the level of competitiveness of cities, including the level of tourist attractiveness, conduct an active promotional policy of cities on the tourist market, and, in particular, shape a positive tourist image. This is a great opportunity for cities which, until now, have not been so popular among tourists and have not emphasized in their promotional activities the care for cleanliness of the air.

On this basis, it should be pointed out that a decisive role in the management of the tourist offer in terms of shaping the tourist attractiveness of the city should be played by local government units in cooperation with tourist organizations, including economic self-government, regional, and local tourist organizations, and, above all, tourist enterprises. They should be involved in providing information on the air quality condition of urban areas through websites and in direct contact with potential and actual tourists. The information provided on air quality, which is part of the overall tourist attraction, directly influences the purchasing decisions of potential tourists concerning their arrival at a specific urban destination.

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