

## ORIGINAL ARTICLE

# The impact of face masks on acne-prone skin in Polish young adults during COVID-19 pandemic

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## Abstract

COVID-19 pandemic raised many problems for patients with acne-prone skin: a limited access to health care services, the necessity of developing telemedical consultations also in dermatology, and the usage of face masks. The aim of the study was to investigate the influence of respiratory protective measures (type of masks, wearing time during the day) on declared skin condition in patients already diagnosed with acne or reporting acne for the first time. The study was conducted in Poland among 1420 responders using the original authors' questionnaire, of which 1274 responders were included in the final sample. Acne exacerbations were reported as being more frequent and more severe in women than in men. Changing cosmetic products, facial skin decontamination before or after applying masks, the number of days per week that a mask was worn were related to acne exacerbation. The type of mask had no significant impact on the occurrence of acne lesions. Respondents noted that masks contribute significantly to skin condition worsening by exacerbating existing and causing new acne lesions. This phenomenon was particularly observable in women, in whom, according to the research results, new lesions appeared much more frequently. Therefore, there is a need to develop new ways of limiting acne exacerbation during COVID-19 pandemic.

## KEYWORDS

acne, COVID-19, face masks, pandemic

## 1 | INTRODUCTION

At the beginning of 2020, after several cases of pneumonia of unknown etiology had been detected in the city of Wuhan in China with an increasing number of cases following in the consecutive days, a coronavirus isolated from the respiratory tract of sick people was found to be the cause of a new infectious disease, named COVID-19.<sup>1</sup> As the disease spread worldwide, the World Health Organisation (WHO) made a recommendation, among others, to wear face masks during contact with other people when it is not confirmed whether they are uninfected.<sup>2</sup> For most of the pandemic period in Poland, it was not mandatory to wear a face mask in open spaces, however from 10th October 2020 till 15th May 2021 an obligation to cover the

mouth and nose, regardless of whether one is in an enclosed space or not was announced.<sup>3</sup> As in Poland such a habit had practically never occurred before, this was quite revolutionary for the society, as well as for the people's skin.

Studies have already confirmed that wearing face masks shows a negative impact on skin condition; it may cause itch or irritation, especially in people with atopy, previous skin lesions in covered face regions or those who wear masks for prolonged time.<sup>4</sup> In Singapore, a study conducted among health care workers during the outbreak of SARS virus in 2003–2004 in order to investigate adverse skin reactions to protective measures showed that the staff who used N95 masks for an average of 8 h a day reported numerous skin reactions including acne, while staff using only surgical or paper masks reported

no such symptoms.<sup>5</sup> Researchers in Thailand found a positive correlation between covering nose and mouth with protective gear and skin lesions occurrence, the most common of which was acne. In their study, wearing surgical masks was associated with a higher risk of skin symptoms than using material ones. Neglecting daily mask change was also a significant risk factor, which dramatically increased the possibility of adverse facial skin effects.<sup>6</sup> Since the feeling of itching leading to scratching may result in the improper mask wearing, which is associated with their reduced protective effectiveness, it is extremely important to limit the occurrence of skin reactions as possible.<sup>7</sup> The negative impact of certain skin lesions as acne on the psychosocial state is also an important problem that cannot be ignored.<sup>8</sup> Acne has been shown to be associated with social isolation, self-esteem and frequent feeling of shame.<sup>9,10</sup>

Wearing masks, by mechanical irritation of the facial skin, leads to stimulation of the sebaceous glands and creates optimal conditions for bacterial development (with raised temperature and humidity), as well as minimizes the effect of UV radiation and other external factors of bacteriostatic and bactericidal action, significantly increasing the risk of acne exacerbation and/or onset.

We decided to investigate the impact of face masks on acne in young adults during COVID-19 pandemic in Poland. To our knowledge, the study was one of the first in Poland to examine the effects of wearing masks on acne, not only its primary occurrence but also worsening of an already existing condition. Some studies conducted in Poland provide information on the use of masks by Poles, as well as the effects of their use on the complexion. A study that was carried out in April 2020, that is, at the beginning of the pandemic in Poland on a group of young people aged 18–27, indicated that out of 876 people surveyed, only 7.7% reported itching of the skin, and only 0.9% reported skin irritation, in connection with wearing masks.<sup>11</sup> Another study, conducted during the second wave of COVID-19 taking place in October 2020, indicates that most young people living in Poland complied with government regulations and used masks regularly. Therefore, investigating the impact of their use on skin condition could be an area of interest.<sup>12</sup> In turn, yet another study conducted in Poland in October 2020, indicated the existing problem of facial itching in relation to the use of masks during the COVID-19 pandemic and the relationship between the type of masks used, the time they were worn and the occurrence of itching.<sup>13</sup> Due to the inconclusive results found in forementioned studies, we decided to design a new one. The aim of our study was to investigate the effect of wearing masks not only on the initial occurrence of acne, but also on the worsening of an already existing condition and to identify factor.

## 2 | METHODOLOGY

The study was conducted in Poland between 15th November and 18th December 2020. Data was collected via an online survey, created using the application “Google Forms”. The survey had been constructed by the authors and contained 7 open-ended, 26 single-choice and 3 multiple-choice questions concerning demographical data (age,

sex, place of living), healthstatus (previous diagnosis of acne made by a physician, current treatment) and the questions related to the topic of study. The questions focused on demographic data (age, sex, place of residence), acne skin condition and factors that could make it worse or better during the pandemic.

A link to the survey was distributed through social media (Facebook service) in 25 public forums concerning higher education, students' activities and the city of Katowice. Each of the participants was asked to complete the survey only once. There was no time limit for accessing the form. The inclusion criteria for the study included: (1) completing the form, (2) being a young adult, (3) no current dermatological treatment, (4) living in Poland for at least 1 year. Young adults were defined as men and women between 18 and 29 years of age. Exclusion criteria included: (1) resigning from completing the survey at any stage, (2) not meeting the age criteria of a young adult, (3) current dermatological treatment, (4) not living in Poland. Skin decontamination was defined as using any additional agent (liquid, gel, wipes) showing cleansing, antimicrobial, antiviral or antifungal activity that was not a part of any dermatological treatment and was available without prescription. The level of acne exacerbation was assessed using 1–6 VAS scale, with 1 standing for mild and 6 for severe exacerbation. In order to analyze the results, Statistica 13.3 by StatSoft was used (TIBCO Software Inc, Palo Alto, CA, USA); Chi<sup>2</sup> Fisher's exact test and U Mann-Whitney test had been used in statistical analysis. The level of statistical significance was established as  $p < 0.05$ .

## 3 | RESULTS

During 34 days, 1420 surveys were collected among the Polish population in larger cities, namely Katowice, Cracow, Warsaw, Bydgoszcz and Kielce. Statistics was performed by Statistica<sup>®</sup> 13.3.0 software (TIBCO Software Inc, Palo Alto, CA, USA). Based on the response time, age, gender, 42 cases of duplicate surveys were identified. From the duplicate surveys, only ones containing the complete set of responses were included, therefore 1274 completed surveys were included in the final analysis. There were 183 male responders and 1091 females. Median age of responders was 22 years (range: 18–29). The demographic characteristics of the investigated group are presented in Table 1.

Acne flare was noticed significantly more often by women than men (79.3% vs. 50.8%;  $p$ -value  $< 0.001$   $\chi^2$  Fisher). As flare intensity depended on gender, the majority of male patients (52.7%) experienced moderate exacerbation, but almost equal number of women noticed moderate (47.8%) or severe (46.9%) flare of the disease. Frequency of acne lesions did not differ significantly between men and women ( $p = 0.54$   $\chi^2$  Fisher).

The exacerbation was found to be significantly more frequent in patients practising disinfection of face masks both before and after its use (Table 2). The practice of disinfection before as well as after its use was equally frequent in both men and women (Table 1). The majority of responders experienced acne flares when they wore face masks at least once a week. Median daily duration of wearing a mask

**TABLE 1** Demographic and pattern of wearing face covering characteristics in the investigated population

	Men	Women	<i>p</i> -value
<i>Number of responders</i>	183	1091	
<i>Median age of responders</i>	21	22	0.017
<i>Noticed flare</i>	93 (50.8%)	865 (79.3%)	<0.001
<i>Intensity of the flare</i>			
• Mild	12 (12.9%)	46 (5.3%)	0.005
• Moderate	49 (52.7%)	413 (47.8%)	
• Severe	32 (34.4%)	406 (46.9%)	
<i>Type of acne</i>			
• Comedonal and papular	14 (29.2%)	165 (36.6%)	0.54
• Pustular	19 (39.6%)	171 (37.9%)	
• Cystic	15 (31.3%)	115 (25.5%)	
<i>Disinfection of a face mask</i>			
• Before usage	10 (5.5%)	71 (6.5%)	0.74
• After usage	33 (18%)	208 (19.1%)	0.84
<i>Face covering daily wearing rate (hours)</i>			
Median	4.5 h	4.5 h	<0.001 <sup>a</sup>
• ≤1 h	17 (9.3%)	72 (6.6%)	<0.001
• 2–3 h	64 (35.0%)	272 (24.9%)	
• 4–5 h	63 (34.4%)	372 (34.1%)	
• 6–8 h	29 (15.9%)	224 (20.5%)	
• ≥9 h	10 (5.5%)	151 (13.8%)	
<i>Face covering type</i>			<0.001
• Synthetic-fiber garment	10 (5.5%)	11 (1.0%)	<0.001
• Natural-fiber garment	5 (2.7%)	14 (1.3%)	
• Synthetic-fiber mask	10 (5.5%)	92 (8.4%)	
• Natural-fiber mask	45 (24.6%)	334 (30.6%)	
• FFP2/FFP3	19 (10.4%)	123 (11.3%)	
• Surgical mask	90 (49.2%)	487 (44.6%)	
• Visor	1 (0.6%)	27 (2.5%)	
• Other	3 (1.6%)	3 (0.3%)	
<i>New cosmetics</i>	40 (21.9%)	517 (47.4%)	

Note:  $\chi^2$  Fisher.

<sup>a</sup>U Mann–Whitney.

was 4.5 h in both genders, but significantly ( $p < 0.001$ ) greater number of women wore it longer than 4–5 h when compared to men. Exacerbation of acne remained dependent on the duration of face mask wearing ( $p = 0.002$ ) (Table 2).

A diversity in choice of face covering was gender-dependent ( $p < 0.001$ ), however surgical mask was the most frequently chosen face protection in both men (49.2%) and women (44.6%). Type of face covering had no significant influence on the frequency of acne flare ( $p = 0.61$ ).

A change in daily skin routine, concerning products, was reported by 47.4% of women and it was significantly more frequent than in men (21.9%;  $p$ -value <0.001  $\chi^2$  Fisher). The change of cosmetics was not associated with more frequent flare of acne ( $p = 0.948$   $\chi^2$  Fisher).

## 4 | DISCUSSION

Our study shows a significant positive correlation between the use of upper respiratory protective measures and the declared occurrence of

acneic skin lesions. The question about the genesis of this phenomenon immediately arises. Therefore, we analyze possible causes of this situation, and hypotheses concerning bacteriological and physiological grounds will follow.

### 4.1 | Characteristics of respiratory protective equipment use

Frequency and time of wearing face coverings remain an important factor, affecting the acne flare. The results show that more than a half of surveyed individuals reported that they wore masks on an everyday basis, with more than 80% of respondents using them on weekdays. No significant gender differences were observed for the number of days per week on which masks were worn, the same with hourly distribution of the frequency of wearing masks during the day. However, it can be noted that the majority of responders fall into two time ranges, that is, 2–3 h or 4–5 h during the day. In general, women tend to wear masks for more than 5 h a day, while in male part of the

	Flare	Without flare	<i>p</i> -value
<i>Face mask disinfection</i>			
• Before its use	71 (87.7%)	10 (12.3%)	0.007
• After its use	206 (85.5%)	35 (14.5%)	<0.001
<i>Wearing duration (per week)</i>			
			<0.001
• Less than 1×/week	5 (41.7%)	7 (58.3%)	
• 1–2×/week	33 (51.6%)	31 (48.4%)	
• 3–4×/week	121 (78.1%)	34 (21.9%)	
• 4–5×/week	54 (75.4%)	83 (24.6%)	
• Everyday	545 (77.2%)	161 (22.8%)	
<i>Wearing duration (daily)</i>			
			0.002
• ≤1 h	55 (61.8%)	34 (38.2%)	
• 2–3 h	238 (70.8%)	98 (19.2%)	
• 4–5 h	339 (77.9%)	96 (22.1%)	
• 6–8 h	195 (77.1%)	58 (22.9%)	
• ≥9 h	131 (81.4%)	30 (18.6%)	
<i>Face covering type</i>			
			0.61
• Garment	28 (70%)	12 (30%)	
• Fiber mask	365 (75.9%)	116 (24.1%)	
• FFP2/FFP3	106 (74.7%)	36 (25.3%)	
• Surgical mask	430 (74.5%)	147 (25.5%)	
• Visor and others	29 (85.3%)	5 (14.7%)	
<i>Modification of applied cosmetics</i>			
			0.948
• Change	418 (75.1%)	139 (25.0%)	
• No change	540 (75.3%)	177 (24.7%)	

Note:  $\chi^2$  Fisher.

**TABLE 2** Habits concerning face mask wearing

sample there were more of those wearing masks for less than 2 h in a day. There may be several reasons for this. One of them is the number of men who work physically, that is, the percentage of men among construction workers is much higher than the number of women,<sup>14</sup> it was not controlled in the sample, however. In such conditions, people often do not wear masks, claiming that it is uncomfortable and that it does not allow them to work efficiently. Also, in Poland, according to the Council of Ministers' decree of 26 February 2021, new rules on mouth and nose covering have been in force since 27 February 2021, according to which people performing professional activities such as construction work in public buildings are exempted from the mandatory wearing of face masks.<sup>15</sup> Secondly, in some studies it was shown that women appear to be more aware of COVID-19 pandemics and that the consequences of contracting the virus can often be tragic.<sup>16</sup> Therefore, women may have more tendencies toward using face covers than men and to use this measure in order to protect themselves from coronavirus infection.

## 4.2 | Materials used in the respiratory protective equipment production

Reusable masks made of cloth were primarily intended for people who are not in the medical profession.<sup>17</sup> According to our study, 521 people used this form of respiratory protection, of which 393 observed an exacerbation of skin lesions. Wearing a cloth face

mask leads to an increase in facial skin temperature and increased sweating in this area, which resulted in creating a favorable microenvironment for microbial growth. In addition, as the production of scarves and masks has not been regulated, there is no certainty that all of the producers use skin-safe materials. The clothing industry uses textile dyes that can cause allergic contact dermatitis, as well as benzothiazole and its derivatives, that is, chemicals that contaminate materials. The color of the mask is also important—dark colors can lead to heat retention and increase the temperature inside the mask, resulting in increased sweating and the natural skin microenvironment disturbance. Mechanical acne resulting from the friction of the fabric against the skin that occurs when masks are used can also be a cause of exacerbations. Masks made of fabrics with fewer threads will contribute more to increased friction against the skin, that is, irritation.<sup>18</sup> Face shields made from natural fibers such as cotton or linen are seen as safer for the skin. These materials are more permeable to air, so less heat and moisture is retained inside the mask and the skin stays drier than with synthetic plastic face shields. Such face covers were used by 398 people surveyed—296 of whom reported acne flare-ups (74%). For those using synthetic plastic face covers, as many as 97 of 123 individuals reported acne exacerbation (79%). N95/FFP2 masks that were used mainly by medical personnel, are made of polypropylene fabric.<sup>5</sup> Metal nose bridges, that are very common elements of those, may contain nickel and cause contact dermatitis<sup>18</sup>; the preservatives (e.g., formaldehyde) contained in surgical and N95/FFP2 masks, may also lead to it.<sup>19</sup> As early as 2006, a study by Foo et al.

found that as many as 109 out of 307 (35.5%) subjects wearing N95/FFP2 type of mask developed skin lesions in the form of inflammation, redness and, most importantly, acne. It was hypothesized that the rash and dermatitis could be linked to a contact reaction resulting from the pressure exerted by the parts of the mask directly adjacent to the face. Interestingly, the same study found that surgical mask wearers did not report skin lesions.<sup>5</sup> In contrast to this findings, among our respondents wearing FFP2 or FFP3 masks, as many as 106 out of 142 (74.648%) reported acne exacerbation, and among those wearing surgical masks, 430 out of 577 (74.523%) experienced skin lesion exacerbation.

### 4.3 | Skin exacerbation concerns mainly papulopustular lesions

Obtained results indicate that the aggravation and/or formation of new acneic lesions concern mainly papulopustular lesions. This leads to an interpretation that there is a relationship between the wearing of personal protective equipment and the occurrence of these particular lesions. It is very important not to underestimate such changes, because they affect not only the condition of the patient's skin, but also their psychological condition. Patients struggling with acne often complain of reduced life quality, social alienation and depression, and these problems are directly proportional to the severity of acne.<sup>20</sup> Increased sebum secretion and skin microbiome disturbance lead to the formation of papulopustular lesions.<sup>21</sup> The results of the study indicate that wearing masks that contribute to mechanical irritation of the facial skin, which has an effect on stimulating the sebaceous glands, significantly increases the risk of exacerbation and occurrence of new papulopustular lesions. The creation of optimal conditions for bacterial growth while wearing face protection, that is, increased temperature and humidity, is also of importance. While wearing masks, the effect of UV radiation, which can have a bactericidal effect, is minimized.

### 4.4 | Acne flare-ups versus reduced airflow and favorable conditions for bacterial growth

In recent years, studies have been published concerning the factors affecting the development of acne, which indicated higher incidence rate in people living in high temperature and humidity regions compared to cooler ones.<sup>22,23</sup> While wearing a mask, one exhales air, which is then condensed on the mask and skin surface. During prolonged, intensive work, thermoregulation, that is, sweating, is inevitable. Sweat can affect the keratinocytes in the epidermis, including those in the sebaceous glands that drain into the hair follicles, which can lead them to close. The disturbance of facial skin hydration,<sup>24</sup> as a result of wearing a mask, can lead to pore closure.<sup>23</sup> The skin temperature also rises during mask wearing, along with the rate of sebum secretion, which increases by 10% with each 1°C temperature rise.<sup>25</sup> This combination makes the skin under face mask moisture and warm,

and the skin barrier disrupted, which creates conditions for bacterial growth and results in acne exacerbation.<sup>5,23</sup> Facial skin dehydration and excessive sebum production are factors that promote the proliferation of *Cutibacterium acnes* and *Demodex folliculorum*, leading to the inflammatory reaction triggering and skin lesions formation.<sup>24</sup>

According to the collected data, exacerbation of acneic lesions occurred in as many as 93 out of 183 men (50.82%) and in 865 out of 1091 women (79.285%), using personal protective equipment covering the face (Table 1). Considering time the mask was worn, the exacerbation of skin lesions was reported by 55 out of 89 (61.798%) responders, wearing it less than 1 hour per day, however these numbers increased significantly with each hour of face covering (Table 2). At more than 9 h per day, exacerbation was already reported by 131 out of 161 subjects (81.366%).

Similar effects occurred considering mask wearing frequency during the week. The greater the frequency of wearing face masks was, the more frequent acne exacerbations were reported.

The type of protective equipment used to cover respondents' faces seemingly is not of importance, as responders reported. There was no correlation between the type of respiratory protection used and the exacerbation.

### 4.5 | Use of visors—Cause or effect of lesions exacerbation?

In addition to all kinds of masks, visors are used as personal protective equipment. These are face shields usually made of polycarbonate, propionate or acetate.<sup>26</sup> Two versions of visors are available—held on the forehead, covering the whole face, and held on the nose and cheeks—covering the nose and mouth. This gives protection not only against inhalation of unwanted particles, but also against liquids entering the eyes. The unquestionable advantages of this form of protection against infection include easy disinfection, the fact that the material from which the visor is made is impermeable to particles and, in the case of full-face visors, protection of the organ of vision. In addition, the face is not completely isolated from the environment—there is ventilation between the face and the external environment, which results in reduced absorption of the heat that is produced by the face.<sup>27</sup> Among medical staff, visors are mostly used in combination with masks, which increases the chance of avoiding infection.<sup>28</sup> Wearing only a visor does not protect against it, due to the fact that smaller particles, including viruses, that are airborne for long periods of time, can successfully pass underneath it.<sup>29</sup> Among the responders, visor was indicated as one of face shields used, but only 28 people used it as the most common protection against coronavirus. All of 28 had acne lesions prior to the pandemic, and as many as 26 out of 28 people reported aggravation of skin lesions, with more than half describing its severity as high. The reason for this may be that the visor, although permeable to air, is attached constantly to one part of the face—the forehead or the cheeks. This area remains constantly pressed. This can lead to localized reduction in microcirculation,<sup>30</sup> mechanical damage<sup>19</sup> and closure of the outlet of the follicular and

sebaceous system,<sup>31</sup> which can result in exacerbation of acne lesions. There is gentle movement of the strip on which the plexus is held and simultaneous irritation of the skin, which may result in secondary bacterial infection<sup>32</sup> or allergic contact dermatitis.<sup>31</sup> As a result of friction, blackheads break out, which can lead to mechanical acne.<sup>33</sup> Although the face does not remain completely covered as when using a mask, there is no doubt that the temperature of the face is raised and the speed of sebum secretion increases.<sup>25</sup> The inside of the visor during its use can also become humid due to the steam created by air exhalation, which combined with the higher temperature creates an ideal environment for the growth of unwanted bacterial microflora<sup>23</sup> and pore widening,<sup>34</sup> resulting in skin lesions.

Masks cover half of the face tightly, visors do not. When using them, it is possible to touch any part of the face, which may be desirable in case of itching or fogging up of the inside when the desire to rub off the steam occurs. Undisinfected hands transmit not only SARS-CoV-2 but also any other bacteria that may be responsible for acne.<sup>35</sup>

Disposable masks should be changed after each use,<sup>6</sup> reusable masks should be washed and scalded, and visors should be disinfected. This not only reduces the risk of infection with SARS-CoV-2, but also with bacteria that can multiply on dirty surfaces.

There may be many causes of acne when using visors, but it is important to note that compared to masks, airflow is allowed so that there are fewer unfavorable conditions for bacterial growth. Wearing masks very often has a negative effect on complexion<sup>6</sup> and leads to an increased number of skin lesions, so it is possible that during the study respondents used a visor as a substitute to see if the facial skin would improve. During our study, a high incidence of exacerbations in visor wearers was noted, but due to the small number of respondents wearing them, no reliable conclusions can be drawn. This situation requires further analysis on a larger group of respondents. A scenario where the use of visors is not a cause, but an effect of exacerbations of acne lesions, should also be considered.

#### 4.6 | Changes in skin care routine during pandemic as a possible cause of skin exacerbations

For many years, certain cosmetics have been considered to be a risk factor for acne formation. Particular substances may be comedogenic, including lanolin, oleic acid and isopropyl myristate. Based on a study conducted in India, it was noted that facial cosmetics can cause acne formation or aggravate existing acne.<sup>36</sup> In our study, a question was asked regarding the effect of changing cosmetics on acne exacerbation. 396 women, representing 76.6% of the total, who decided to use different cosmetics during pandemic than before noticed an exacerbation of acne lesions. This may be due to the fact that new products designed for facial care, cleansing and protection contained substances mentioned above. However, a scenario where respondents observed acne exacerbation and decided to change their skincare routine afterwards, is also possible.

It is important for people who are prone to skin lesions to obtain information on skin care regimens before using new products. It has been documented that with the use of recommended products and an appropriate regimen, the skin does not become irritated and lesions are not exacerbated.<sup>37</sup> This also reduces the number of ill-considered changes in skincare routine, which may contribute to a decrease in the number of acne exacerbations.<sup>38</sup>

## 5 | CONCLUSIONS

The results of the study may confirm the hypothesis and that wearing masks may be associated with an increased risk of skin lesions, which are significantly more frequent and more severe in women than in men. Due to the universal obligation to wear masks in Poland,<sup>39</sup> this phenomenon has probably already led to a significant burden on dermatological care. Lesions are significantly more frequent and more severe in women than in men.<sup>40</sup> When analyzing the type of acne exacerbations, a predominance of papulopustular lesions was observed, which is most likely directly related to the studied factors.<sup>21,41</sup> Another conclusion is that more frequent wearing of respiratory protection measurements (as number of days per week) significantly translates into acne exacerbation, however the time of hours per day masks were worn had no effect on skin deterioration in women. This allows us to put forward a hypothesis, yet to be tested further, that accumulating activities through which one is obliged to use masks in a few days per week is likely to reduce the worsening of acne lesions. Our study also investigated the effect of decontaminating the face before and after wearing masks, as well as changing skincare routine. It cannot be determined from this study whether changing cosmetic products and the initiation of facial decontamination before and after wearing masks occurred first, and only then did the exacerbations occur, or whether these events occurred in reverse. The effect of the type of mask and what fiber it is made of on skin exacerbation are noteworthy and may become the subject of further research. All above conclusions and collected data pose useful content for the future, as with the recent spread of Monkeypox a risk of another pandemic looms over the world.

## 6 | LIMITATIONS

This study also has its limitations. The main one is that often acne lesions were self-diagnosed by the study participants. It is therefore probable that these were not acne lesions but other dermatological disorders. Secondly, also exacerbations and flare-ups of acne skin condition were recognized by the respondents themselves, thus the results may be somehow biased.

### AUTHOR CONTRIBUTIONS

Stanisław Anczyk, Maciej Stępień, Michał Raczyński, Adam Anczyk, Maja Woźniakowska, Bartosz Miziołek conceived and designed the analysis. Stanisław Anczyk, Maciej Stępień, Michał Raczyński, Adam

Anczyk, Maja Woźniakowska collected the data. Stanisław Anczyk, Maciej Stępień, Michał Raczyński, Adam Anczyk, Maja Woźniakowska, Bartosz Miziołek, Karina Polak contributed data or analysis tools. Bartosz Miziołek performed the analysis. Stanisław Anczyk, Maciej Stępień, Michał Raczyński, Adam Anczyk, Maja Woźniakowska, Karina Polak, Beata Bergler-Czop wrote the paper.

## CONFLICT OF INTEREST

The authors declare no potential conflict of interest.

## DATA AVAILABILITY STATEMENT

The data that support the findings of this study are available from the corresponding author upon reasonable request.

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