

# **POLAND'S EXPERIENCES**

from the COVID-19 pandemic  
from a work environment perspective

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## Executive Summary

This report provides an analysis of the COVID-19 pandemic's impact on Poland's work environment, highlighting the immediate response strategies, challenges faced, and lessons for future preparedness. The pandemic prompted widespread shifts across sectors, most notably through a large-scale transition to remote work and the establishment of new workplace safety protocols.

### Main Findings

To minimize the spread of COVID-19, workplaces in Poland implemented significant spatial changes, including redesigned layouts to ensure physical distancing, capacity limits in common areas, and clear protocols for shared spaces. Enhanced hygiene standards, such as regular disinfection of high-contact surfaces and availability of hand sanitizers, became routine. Personal Protective Equipment (PPE) use increased across sectors, though shortages and supply issues were prevalent early in the pandemic, particularly in healthcare settings.

The pandemic prompted a rapid transition to remote work, which was previously uncommon in Poland. This shift offered flexibility but also introduced challenges, such as maintaining clear boundaries between work and personal life, reduced physical activity, and increased psychological strain due to isolation. While many sectors benefited from increased productivity, others, particularly those requiring hands-on work, struggled with remote adaptations.

Remote work fundamentally altered workplace relationships and communication. Maintaining trust and effective communication became critical as employees worked in isolation. Leadership had to adapt by adopting more empathetic and transparent communication practices. Many employees reported challenges in staying connected with their teams and felt isolated due to the lack of face-to-face interaction, affecting team cohesion and morale.

The pandemic accelerated the adoption of digital tools across sectors, boosting digital literacy and driving further innovation in workflow management. Organizations invested in digital collaboration platforms to facilitate remote work and team coordination, though disparities in digital access were evident, particularly in smaller or rural organizations. Cybersecurity also became a pressing concern as more data and operations moved online.

## Recommendations

To build a resilient and adaptable work environment in Poland, several key recommendations have emerged from the pandemic experience:

- Establish hybrid work structures that seamlessly integrate remote and in-office options. These models should be supported by robust digital infrastructure and routine risk assessments, addressing cybersecurity, ergonomic needs, and mental health to ensure a safe, productive work experience.
- Sustain high hygiene standards, ensure continuous access to PPE, and provide mental health resources, especially in high-risk sectors, to improve preparedness for future health challenges.
- Implement transparent, consistent communication channels and invest in digital tools that facilitate remote collaboration, helping to maintain team cohesion and productivity regardless of location.
- Provide flexible scheduling options and family support resources, fostering a workplace culture that values work-life balance to boost employee well-being and prevent burnout.
- Modernize labor policies to accommodate remote work, health screenings, and adaptable working conditions, establishing a flexible and resilient work environment equipped to face future crises.

The COVID-19 pandemic underscored the importance of adaptable, resilient work environments that can respond to health crises effectively. Implementing these recommendations will create a safer, more flexible, and supportive workplace landscape in Poland, strengthening the nation's ability to protect worker health and maintain stability in future crises. By fostering a culture of resilience, preparedness, and well-being, Poland's work environment will be better equipped to support both organizational productivity and employee welfare in a rapidly evolving global landscape.

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### *Disclaimer:*

*The data and analyses presented in this report have been prepared by the authors and do not represent the official position of the Central Institute for Labour Protection – National Research Institute (CIOP-PIB).*

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# 1. Background

## 1.1. Poland at the Onset of COVID-19: Demographic, Economic, and Healthcare Landscape

*Content: Brief summary of Poland's demographic, economic, and healthcare infrastructure context at the start of the pandemic.*

At the onset of the COVID-19 pandemic, Poland had a population of approximately 38 million people, with around 16.5% aged 65 and over, underscoring a significant proportion of elderly citizens [1]. A substantial portion of the population resided in urban areas, especially in major cities such as Warsaw, Kraków, and Łódź, which serve as economic and cultural hubs for the country.

Economically, Poland was experiencing robust growth before the pandemic, with a diverse industrial base and a well-integrated economy within the European market. In 2017, GDP per capita was around EUR 20,900, while the labour market was relatively healthy with an unemployment rate of 4.9% [1]. Despite this, certain sectors faced labour shortages, and the country relied on migrant workers, particularly from neighbouring countries, to fill gaps in the workforce.

Poland's healthcare system is based on universal health coverage, managed by the National Health Fund (NFZ), which provides a broad range of services, including primary care, specialist consultations, and hospital services. In 2019, healthcare spending accounted for 6.5% of GDP, below the EU/EEA/UK average of 8.49%, with per capita health expenditure at 2207 US\$ PPP [2]. These figures reflect a constrained resource base compared to other European nations, impacting healthcare quality and access. Poland faced a shortage of healthcare professionals, with fewer doctors and nurses per capita than the EU average, a gap particularly evident in rural areas [1]. While the country had an established network of hospitals with a higher number of hospital beds per capita (6.6 beds per 1,000 population) compared to the EU average (5.0 beds per 1,000 population), these beds were unevenly distributed across the country. This uneven distribution contributed to inequalities in access to healthcare services, especially in rural regions.

Public health preparedness was mainly focused on communicable disease control, vaccination programs, and health promotion. However, gaps in pandemic readiness, such as insufficient stockpiles of personal protective equipment (PPE) and limited testing capacity, became apparent. Poland had also begun digitizing healthcare services through e-health initiatives, including the implementation of electronic health records (EHRs) and e-prescriptions, although adoption varied across regions and facilities. Telemedicine services, though in early development stages before the pandemic, were not fully integrated into the mainstream healthcare system, and the regulatory framework for telehealth was still under development [3].

Socioeconomic factors also influenced public health outcomes in Poland. The relative poverty rate, at 15.0% in 2017, highlighted socioeconomic disparities that affected health

[1] education levels, which influenced health literacy, varied across the population, impacting individuals' ability to access and utilize healthcare effectively. Disparities between urban and rural regions were also notable, with rural areas often facing limited healthcare facilities and fewer healthcare professionals, leading to differences in healthcare quality and accessibility [2].

Poland's epidemiological profile revealed a high burden of non-communicable diseases (NCDs), including cardiovascular diseases, diabetes, and cancers, which were major causes of morbidity and mortality [4]. Behavioral risk factors, such as smoking, alcohol consumption, and dietary habits, contributed to the prevalence of these diseases. In terms of infectious disease control, Poland maintained vaccination programs for diseases like measles and influenza, although vaccine hesitancy remained a concern in certain segments of the population [5].

## 1.2. Key National Stakeholders and Responsibilities

*Content: Identification of major governmental and health authorities involved in the pandemic response*

The pandemic response in Poland involved coordination across various governmental and health authorities, with responsibilities delineated at both national and regional levels. Poland's crisis management structure is based on the principle of subsidiarity, where actions are taken at the lowest possible level, with the possibility of support from higher levels if necessary [6]. Key stakeholders played distinct roles, although certain gaps in pre-existing pandemic plans became evident during the COVID-19 crisis. Key national stakeholders and their responsibilities are listed below:

### **National Level:**

- **Council of Ministers and the Prime Minister:** They were responsible for the overall direction of crisis management activities, making pivotal decisions related to health policy and public safety. This included enacting emergency regulations, such as lockdowns and mask mandates, often implemented to address the evolving situation.
- **Government Crisis Management Team (Rządowy Zespół Zarządzania Kryzysowego):** This advisory body initiated and coordinated actions in crisis management, comprising representatives from key ministries and government agencies. They played a crucial role in analyzing the crisis, proposing appropriate actions, and ensuring inter-ministerial cooperation. [7].
- **Government Centre for Security (Rządowe Centrum Bezpieczeństwa, RCB):** The RCB was responsible for monitoring threats, coordinating actions, and providing informational support to crisis management bodies. They developed the National Crisis Management Plan, serving as the basis for planning at central and regional levels. The RCB also facilitated communication between various agencies and ensured the dissemination of accurate information to the public [8].

### **Ministerial Level:**

- Ministry of Health: Led activities related to health protection, overseeing the healthcare system, coordinating medical equipment supplies, and implementing medical procedures. They were instrumental in managing healthcare facilities, procuring necessary medical supplies, and establishing public health guidelines. The Ministry also played a key role in the vaccination campaign, ensuring the distribution and administration of vaccines across the country.
- Chief Sanitary Inspectorate (Główny Inspektorat Sanitarny, GIS): The GIS was responsible for epidemiological supervision, monitoring the health situation, and issuing public health recommendations and guidelines. They enforced health safety protocols, particularly through local sanitary-epidemiological stations, focusing on contact tracing, quarantine measures, and infection prevention. The GIS also collaborated with international health organizations (e.g. WHO) to align Poland's response with global standards.

### **Regional Level:**

- Voivode: As the government's representative in the field, the Voivode coordinated crisis management activities at the voivodeship level, including cooperation with local governments and emergency services. They ensured the implementation of national directives and adapted them to regional specifics, addressing local challenges.
- Voivodeship Crisis Management Team: This advisory body to the Voivode analyzed crisis situations and proposed appropriate actions. They facilitated collaboration among regional stakeholders and ensured that crisis management strategies were effectively executed at the voivodeship level.

### **County and Municipal Level:**

- County Governor (Starosta) and Mayor (Wójt/Burmistrz/Prezydent Miasta): They were responsible for crisis management at the local level, organizing assistance for the population and coordinating the actions of local services. Their roles included managing local healthcare facilities, ensuring the availability of essential services, and communicating effectively with residents.
- County and Municipal Crisis Management Teams: These advisory bodies supported the County Governor and Mayor in decision-making during crisis situations. They provided expertise, facilitated resource allocation, and ensured that local responses were timely and effective.

During the pandemic, collaboration among various sectors was crucial, including medical, sanitary, law enforcement services, and non-governmental organizations. The Armed Forces of the Republic of Poland, particularly the Territorial Defence Forces, played a significant role in supporting logistical and medical efforts. They assisted in hospitals, supported the vaccination program, and undertook other tasks, reinforcing the overall crisis management efforts [9].

Additionally, the Central Institute for Labour Protection – National Research Institute (CIOP-PIB) played an important role in supporting the government's response by focusing on occupational safety and health (OSH). CIOP-PIB participated in developing safety guidelines to ensure safe working conditions across various sectors, encompassing protocols for personal protective equipment (PPE) usage, workplace sanitation, and

social distancing measures. The institute conducted studies to assess the pandemic's impact on occupational health and safety, providing valuable insights into emerging workplace hazards and informing the development of effective preventive strategies. CIOP-PIB also organized training sessions, webinars, and disseminated informational materials to raise awareness about COVID-19-related occupational risks, enhancing the workforce's knowledge and preparedness in managing pandemic-related challenges. Collaborating closely with governmental agencies, including the Ministry of Family, Labour and Social Policy, CIOP-PIB ensured that workplace safety measures were integrated into broader public health strategies. Through these efforts, CIOP-PIB significantly contributed to safeguarding workers' health and maintaining workplace safety during the pandemic, thereby supporting the government's overall response to the crisis.

### 1.3. Chronology of the Pandemic in Poland

*Content: Timeline and key political decisions, including lockdowns, travel restrictions, vaccination campaigns, and quarantine policies.*

Poland's response to the COVID-19 pandemic involved several phases, with each phase marked by political decisions, including lockdowns, travel restrictions, vaccination campaigns, and quarantine policies. Below a brief overview of the timeline and the primary actions taken is presented:

- **March 2020: Initial Cases and Early Measures**
  - ⇒ March 4, 2020: Poland reported its first confirmed case of COVID-19 in Zielona Góra, Lubusz Voivodeship [10].
  - ⇒ March 11, 2020: To curb virus transmission, the government closed schools, universities, and cultural institutions, marking the beginning of social restrictions [11].
  - ⇒ March 13, 2020: Poland closes borders as coronavirus spreads; state of epidemiological emergency declared, which led to the closure of borders to international travelers and the suspension of air and rail services [12].
- **March-April 2020: Nationwide Lockdown Implementation**
  - ⇒ March 20, 2020: A state of epidemic was declared, granting broader powers to impose restrictive measures [13].
  - ⇒ March 25, 2020: Poland introduced a full nationwide lockdown, limiting public gatherings to two people and restricting non-essential travel [14].
  - ⇒ April 1, 2020: New measures required individuals to maintain a two-meter distance in public spaces, closed parks and beaches, and restricted minors from going outside without an adult [15].
  - ⇒ April 16, 2020: Wearing face masks in public spaces became mandatory [16].

- **May-June 2020: Gradual Easing of Restrictions**
  - ⇒ May 4, 2020: Shopping malls, hotels, and some cultural institutions reopened with strict sanitary measures in place [17].
  - ⇒ May 18, 2020: Hair salons and beauty services resumed operations, while restaurants could serve customers on-site with specific safety measures [18].
  - ⇒ June 6, 2020: Restrictions on gatherings were loosened, allowing weddings and family events with up to 150 guests [19].
- **Autumn 2020: Second Wave and Reintroduction of Restrictions**
  - ⇒ October 10, 2020: The entire country was declared a “yellow zone,” with restrictions on public gatherings and a mask mandate in public spaces [20].
  - ⇒ October 24, 2020: Poland entered a “red zone” status nationwide, resulting in the closure of restaurants (except for takeaway and delivery), cultural venues, and a transition to remote learning for older students [21].
- **November 2020: National Quarantine Measures**
  - ⇒ November 7, 2020: The government intensified restrictions by closing cultural institutions, limiting retail store capacity, and shuttering non-essential services in shopping centres [22].
  - ⇒ November 28, 2020: Certain stores in shopping malls reopened with strict limitations on the number of customers and sanitation measures [23].
- **December 2020: Start of the Vaccination Campaign**
  - ⇒ December 27, 2020: Poland initiated its COVID-19 vaccination campaign, prioritizing healthcare workers and other high-risk groups [24].
- **January-March 2021: Third Wave and Expanded Vaccination Efforts**
  - ⇒ January 25, 2021: Vaccination was extended to seniors over 70 and educators [25].
  - ⇒ March 20, 2021: A renewed nationwide lockdown was introduced due to rising case numbers, closing hotels, cultural institutions, and non-essential retail [26].
  - ⇒ March 27, 2021: Additional measures included the closure of kindergartens and nurseries, restrictions on places of worship, and a reduced capacity limit in essential stores [27].
- **Spring-Summer 2021: Gradual Reopening and Vaccination Drive**
  - ⇒ April-May 2021: The government began lifting restrictions, opening kindergartens and nurseries (April 19; [28]) and allowing malls, museums, and galleries to resume operations (May 4; [29]).
  - ⇒ May 15, 2021: The outdoor mask mandate was lifted, though physical distancing remained advised [30].

- **Fall-Winter 2021/2022: Fourth Wave and Omicron Variant Response**
  - ⇒ October-November 2021: In response to rising case numbers, regional restrictions were imposed, and COVID-19 certificates were introduced for specific gatherings and services [31].
  - ⇒ January 2022: Booster vaccinations were made available to the general population as part of an intensified effort to combat the Omicron variant [32].
- **Spring 2022: Lifting of Major Restrictions**
  - ⇒ March 2022: With a decrease in hospitalizations, most restrictions, including the indoor mask mandate, were lifted, and all economic sectors resumed regular operations [33].
- **2022-2023: Monitoring and Preparedness for Future Threats**
  - ⇒ April 2022: Polish government stopped publishing daily COVID-19 infection reports, citing a decrease in new cases and hospitalizations.
  - ⇒ Throughout 2022 and 2023: Authorities continued to monitor infection rates and prepare for potential future waves, focusing on vaccination and public health readiness.
  - ⇒ June 27, 2023: Polish government formally repealed previous regulations concerning the establishment of specific restrictions, orders, and prohibitions associated with the state of epidemic threat [34].

## 1.4. Pandemic Situation in Poland

*Content: Overview of infection, hospitalization, and death rates, along with reports on mental health impact and public perception over time*

### 1.4.1. Overview of COVID-19 Infection Trends

The COVID-19 pandemic reached Poland on March 4, 2020, when the country reported its first confirmed case in Zielona Góra, located in the Lubusz Voivodeship [10]. This initial case marked the beginning of a public health crisis that quickly escalated, with the government responding by implementing a series of preventive and containment measures. Within days, Poland took action to curb the virus's spread, including suspending in-person classes across educational institutions on March 12, 2020, and initiating border closures to foreign nationals on March 15. Recognizing the pandemic's potential impact, the government declared a "state of epidemic" on March 20, granting officials the authority to enforce stringent public health protocols, such as lockdowns, movement restrictions, and mandatory quarantine for travellers. These early interventions were part of a broader strategy to control the virus's spread and prevent overwhelming the healthcare system, setting the stage for Poland's response to COVID-19.

Poland experienced five **distinct waves of COVID-19** infections from 2020 to early 2022 (fig. 1), each characterized by unique patterns in case numbers, healthcare impact, and

government interventions. Below is a breakdown of these waves, noting case peaks, prevailing viral variants, and key government responses.

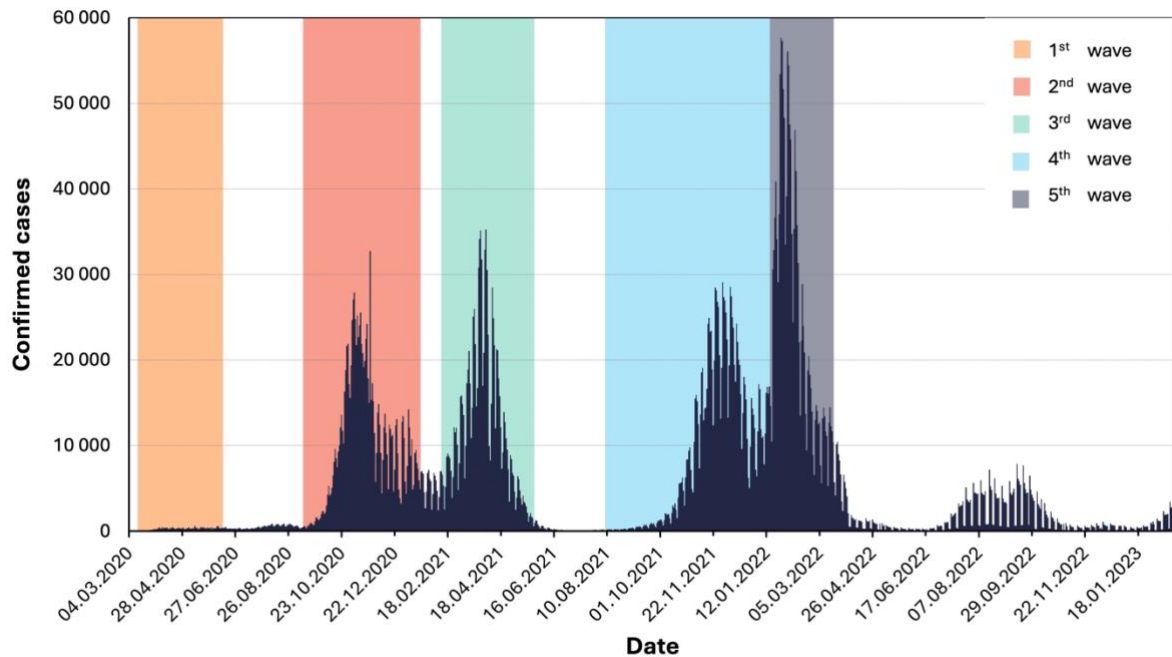


Fig. 1. Number of new Coronavirus (COVID-19) cases confirmed in Poland from 2020 to 2023, by date of report; data sourced from: OWID; Johns Hopkins University.

The **first wave** (March-May 2020) began shortly after the first confirmed case in early March 2020. Due to early interventions, including strict lockdown measures and social distancing policies, infection rates remained relatively low. Key responses included a nationwide lockdown from March 25, school and university closures, travel restrictions, and limitations on public gatherings. By May, daily cases had stabilized, allowing the government to gradually ease restrictions. Case numbers were generally low, peaking in April at approximately 500 new cases per day.

In the **second wave** (September 2020-January 2021), infections surged in September following a period of low transmission during the summer, largely due to the reopening of schools and increased public gatherings. This wave recorded Poland’s first major spike in cases, with new daily infections reaching tens of thousands. To contain the spread, Poland implemented regional restrictions, mask mandates in public spaces, and transitioned older students to remote learning. In November, the country peaked with over 27,000 new cases daily.

The **third wave** (February-May 2021) was driven by the highly transmissible Alpha variant, pushing Poland’s healthcare system to its limits. Hospitalizations and ICU admissions surged, placing a severe strain on medical resources. In response, the government reintroduced strict lockdowns, restricted non-essential retail, and closed kindergartens, schools, and places of worship. By May, daily cases declined, allowing phased reopening. This wave peaked in March 2021, with over 35,000 new cases per day.

The **fourth wave** (August-December 2021), largely due to the Delta variant, displayed an uneven infection spread, primarily impacting the unvaccinated population. Regional case variations led to localized measures rather than a nationwide lockdown. The government opted for regional restrictions, mask mandates, and enhanced vaccination efforts. However, restrictions were less severe than in previous waves. This wave peaked in November 2021, with new daily cases around 25,000.

Finally, the **fifth wave** (December 2021-March 2022), driven by the Omicron variant, brought about the highest recorded daily infection rates in Poland. Although highly contagious, Omicron generally caused less severe illness, especially among the vaccinated population, resulting in fewer hospitalizations relative to case numbers. Booster vaccinations were promoted widely, especially among high-risk groups. Restrictions were gradually lifted as Omicron cases subsided, marking a shift toward managing COVID-19 as an endemic illness. This wave peaked in January 2022, with daily cases exceeding 50,000.

The progression of COVID-19 in Poland was notably influenced by the emergence of the **Alpha, Delta, and Omicron variants** (most frequent), each distinctively affecting infection rates and health outcomes (fig. 2). Generally, the variant distribution over time in Poland reflected that in Europe [35].

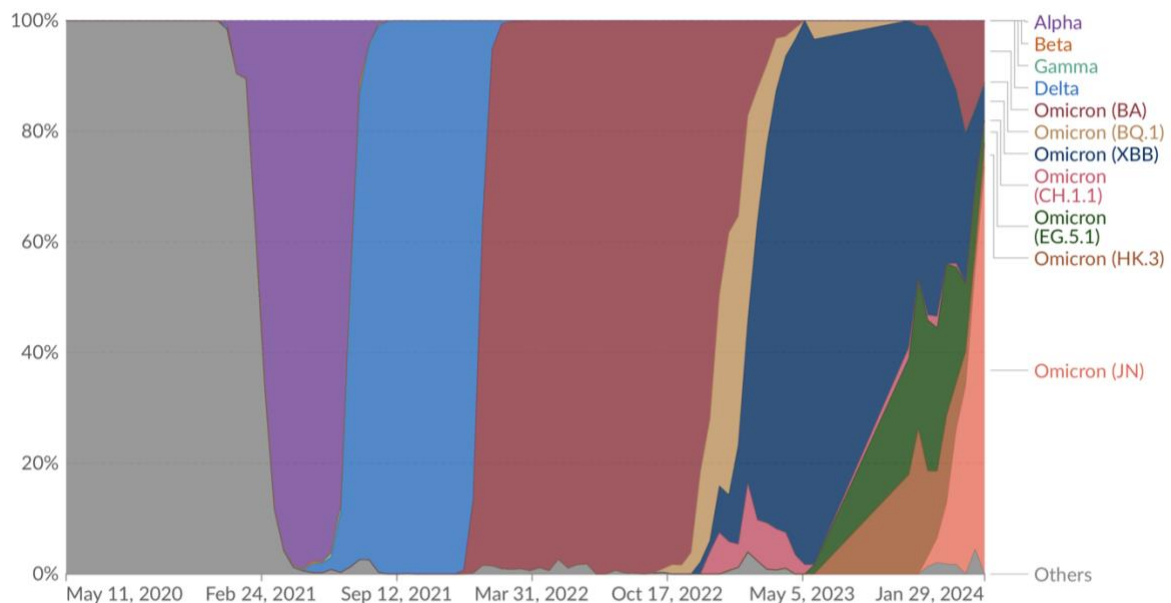


Fig. 2. SARS-CoV-2 variants in analysed sequences, Poland; data source: GISAID, via CoVariants.org (2024); OurWorldinData.org/coronavirus.

The **Alpha variant**, first identified in the UK in late 2020, became prominent in Poland in early 2021, driving the third COVID-19 wave, which peaked in March. This variant exhibited higher transmissibility than the original strain, leading to a sharp increase in cases, with daily infections exceeding 35,000 at the peak. Consequently, Alpha contributed to a marked rise in hospitalizations and ICU admissions, severely straining healthcare resources, and affecting younger populations and regions previously less impacted by COVID-19 [36].

The **Delta variant**, first identified in India in late 2020, drove Poland’s fourth wave in the latter half of 2021. Known for its high transmissibility, Delta resulted in a rapid escalation of infections, especially among unvaccinated individuals, leading to significant regional differences in case rates across the country. Health outcomes associated with Delta were severe, with elevated hospitalization rates and worse outcomes for unvaccinated populations and those with underlying health conditions. Despite advances in treatment protocols, the variant exerted a profound strain on healthcare resources, particularly in certain regions [37].

The **Omicron variant**, identified in South Africa in late 2021, spurred Poland’s fifth and highest wave, peaking in January 2022 with daily case counts surpassing 50,000. While Omicron was highly transmissible, even among vaccinated individuals, it showed reduced clinical severity compared to Delta. Although hospitalizations were lower relative to case numbers, the sheer volume of infections still posed a substantial burden on healthcare facilities. Omicron’s cases were mostly mild to moderate, especially among vaccinated and boosted individuals, though unvaccinated populations remained vulnerable to severe outcomes [36,38].

Poland's **COVID-19 vaccination campaign** commenced in December 2020 following the authorization of the first COVID-19 vaccine in the European Union (fig. 3, left). By mid-2021, eligibility expanded to the general population, with intensified efforts to increase coverage, particularly in rural and underserved areas. In late 2021, booster doses were introduced to enhance immunity against emerging variants, notably Delta and Omicron.

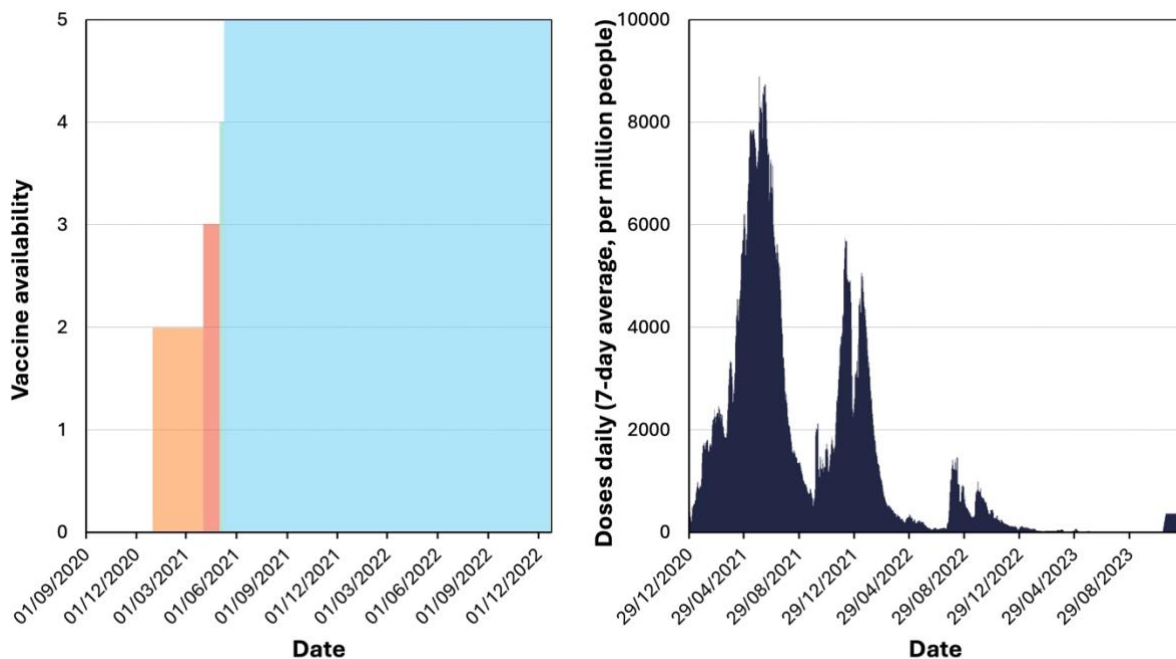


Fig. 3. (left) COVID-19 vaccination policy in Poland: 0 no availability; 2 healthcare workers and high-risk groups prioritized; 3 expansion of eligibility to include elderly populations and individuals with comorbidities; 4 vaccination available to the general adult population, with an increasing emphasis on reaching rural and underserved areas; 5: universal availability; (right) Daily COVID-19 vaccine doses administered per million people; official data collated by Our World in Data (2024); World Health Organisation (2024); Population based.

The initial phase prioritized medical services and security services, including the army, fire brigade, and police, as they were most involved in combating the pandemic's effect [39]. The first vaccine approved and administered was the BNT162b2 mRNA vaccine (Pfizer/BioNTech), with healthcare workers being the first group to receive it [40]. From December 2020 to December 2021, the lowest number of vaccinations was recorded in December 2020, aligning with the start of the National Vaccination Program. The highest number of vaccinations occurred between April and June 2021, accounting for approximately 70.5% of all vaccines administered during this period (fig. 3; right).

Public **attitudes towards vaccination** showed a slight increase in willingness over time, particularly among women, residents of large cities, and individuals with higher education [41]. However, concerns about vaccine side effects and effectiveness persisted, indicating the need for improved communication strategies [41,42].

**Monitoring and reporting** COVID-19 cases in Poland faced significant challenges, particularly due to limited testing capacity and disparities between urban and rural areas. Initially, testing resources were concentrated in urban centres, causing delays in remote regions with limited healthcare infrastructure. As cases surged, testing capacity was strained, especially during the Delta and Omicron waves, leading to backlogs and delays in rural areas. To address these issues, Poland adapted its protocols including:

- expansion of testing sites additional centres and mobile units improved access in smaller towns and rural regions,
- introduction of rapid tests that allowed quicker detection, especially in regions with limited PCR capacity,
- digital reporting to enhance data sharing and real-time case tracking,
- targeted testing during peaks focused on symptomatic and high-risk individuals to optimize resources.

Despite these efforts, challenges persisted, but these adaptations improved monitoring and reporting, supporting a more responsive public health approach.

#### 1.4.2. Hospitalization and Intensive Care Needs

The COVID-19 pandemic significantly strained healthcare systems worldwide, and Poland was no exception. The surge in hospitalizations and the demand for intensive care units (ICUs) challenged the country's healthcare infrastructure, revealing pre-existing vulnerabilities and necessitating rapid adaptations. Between early April and mid-September 2020, Poland's daily **hospital occupancy** fluctuated significantly, with peaks in mid-April and a notable decrease through the summer, reaching a low by July. However, a consistent upward trend began in late September, indicating the start of an intensified wave of COVID-19 hospitalizations that continued to increase throughout the autumn months (fig. 4).

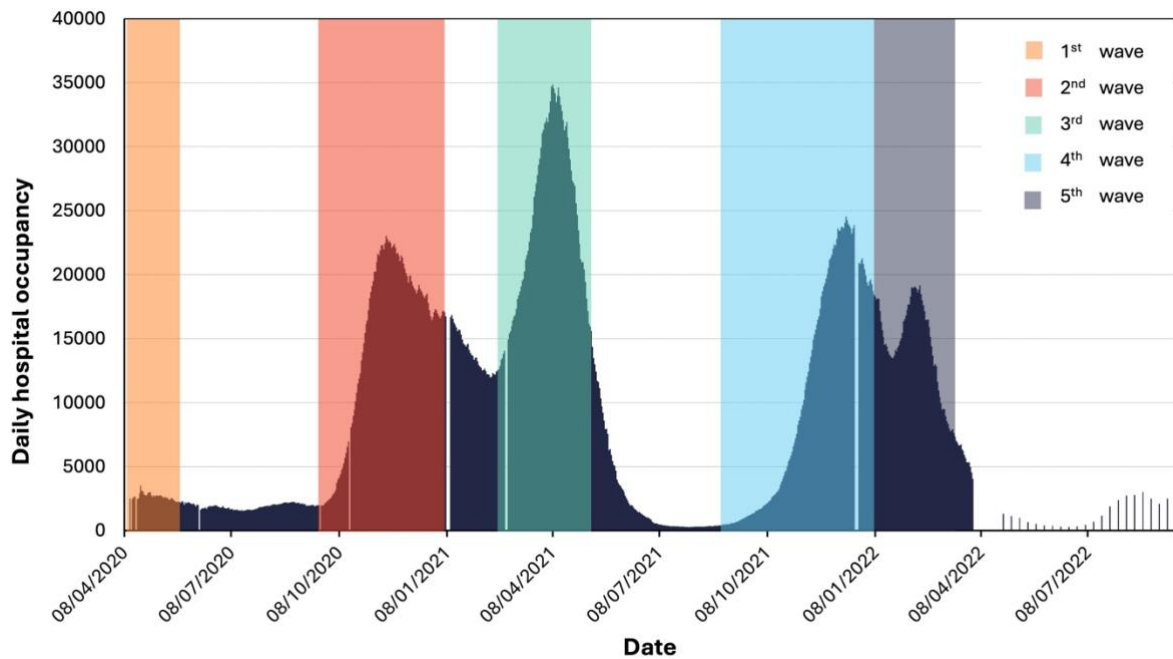


Fig. 4. Number of COVID-19 patients in hospital, data source: Official data collated by Our World in Data (2024).

At the onset of the pandemic, Poland restructured its healthcare services to prioritize COVID-19 patients. Hospitals were transformed into dedicated COVID-19 facilities, leading to a substantial decrease in non-COVID-19 hospitalizations. A study by Kasiukiewicz and Wojszel (2021) assessed hospitalizations in a hospital converted into a COVID-19 facility during the "spring wave" of the epidemic in 2020. The findings indicated that the transformation resulted in **underutilized healthcare resources and limited patient access to medical services**, particularly for non-COVID-19 conditions [43]. This reallocation of resources underscored systemic inefficiencies and highlighted the need for flexible hospital management strategies capable of adapting to changing epidemiological demands. The reduction in overall hospitalizations also had long-term implications for patient health outcomes, as individuals with chronic conditions or requiring elective procedures faced delays in receiving necessary care [44–46]. The pandemic emphasized the importance of maintaining essential health services even during public health emergencies to prevent indirect morbidity and mortality associated with untreated non-COVID-19 conditions.

On the other side the pandemic led to a **significant increase in ICU admissions** due to severe COVID-19 cases requiring intensive medical intervention. Several studies reported high ICU mortality rates in Poland. Kokoszka-Bargieł et al. (2020) observed an ICU mortality rate of 44.4% among COVID-19 patients during the first months of the pandemic [47]. Similarly, Mikiewicz et al. (2022) reported an ICU mortality rate of 70.7% in a cohort of patients requiring mechanical ventilation during the pandemic's peak [47]. Factors contributing to these high mortality rates included delayed access to critical care, limited availability of ventilators and essential equipment, and the severe respiratory complications associated with COVID-19 [48–50]. The sudden influx of critically ill patients strained ICU capacities, leading to challenges in maintaining optimal care standards.

The demand for **ICU resources fluctuated across different pandemic waves**, correlating with the emergence of new variants and changes in infection rates. The third wave, associated with the Alpha variant, saw a notable increase in ICU admissions and complications. Mikiewicz et al. (2022) reported that during this period, patients exhibited more severe symptoms, including higher incidences of pneumothorax and thromboembolic events, leading to increased ICU stays and mortality rates [51]. In contrast, during the Omicron wave, despite high infection rates, there was a comparatively lower demand for ICU care. This was attributed to the variant's lower virulence and the protective effects of vaccination among the population. Żółtowska et al. (2021) observed that improved preparedness and vaccination efforts contributed to better management of ICU resources during later waves [52].

**Patient demographics** played a crucial role in hospitalization and ICU admission rates. Older adults and individuals with pre-existing comorbidities were disproportionately affected. Gujski et al. (2021) analysed data from over 116,000 hospitalized patients in Poland and found that those over 60 years of age had significantly higher odds of ICU admission and in-hospital mortality [53]. Comorbidities such as cardiovascular diseases, diabetes, and chronic respiratory conditions further increased the risk of severe outcomes. Sex-based differences were also evident in COVID-19 outcomes, with men experiencing higher risks of severe disease progression. Szmyd et al. (2021) conducted a cross-sectional study and found that male patients had higher rates of infection, hospitalization, ICU admission, and mortality compared to female patients [54]. Palus et al. (2023) highlighted that male patients were more likely to require ICU care and had higher mortality rates compared to females [55]. Biological factors, such as differences in immune response, hormonal influences, and genetic predispositions, may contribute to these disparities. Recognizing these differences is crucial for developing gender-sensitive health policies and interventions, including targeted public health messaging and prioritization in vaccination campaigns.

To address the escalating demands on the healthcare system, Poland implemented several strategic adaptations:

- Hospitals converted general wards into ICUs and established temporary facilities to increase capacity. Kasiukiewicz and Wojszel (2021) highlighted how **hospitals were repurposed to accommodate more ICU beds**, though this sometimes led to underutilization of other medical services [43]. Additionally, field hospitals were set up in certain regions to manage overflow patients.
- **Healthcare professionals took on extended roles**, and additional staff were recruited. Tysiąc-Miśta and Dzedzic (2020) noted that dental practitioners faced challenges due to PPE shortages but also indicated the broader impact on staffing across medical fields [56]. The involvement of military medical personnel and medical students supplemented the workforce during critical periods. Bazan et al. (2021) described how medical students volunteered in various healthcare settings, providing valuable support and highlighting the potential of utilizing this group during health emergencies [57].
- **Clinical guidelines were continuously updated** as new evidence emerged. For example, Goh et al. (2020) discussed the importance of adapting ICU management

strategies, including the use of high-flow oxygen therapy, prone positioning, and timely initiation of mechanical ventilation to improve patient outcomes [58]. Hospitals in Poland adopted these practices, aligning with global best practices to enhance care quality.

- To reduce the burden on hospitals and limit virus exposure, **telemedicine services** were expanded. Jaroń et al. (2023) reported that teleconsultations became a vital component of healthcare delivery, especially for patients with haematological conditions, ensuring continuity of care while minimizing infection risk [59–61]. Telemedicine also facilitated monitoring of patients recovering at home, allowing for early intervention if symptoms worsened.

These adaptations highlight the healthcare system's resilience and ability to respond to unprecedented challenges. However, they also emphasize the need for ongoing investment in healthcare infrastructure, workforce development, and emergency preparedness planning to enhance readiness for future crises.

### 1.4.3. Mortality and Excess Deaths

The COVID-19 pandemic led to an unprecedented increase in mortality rates worldwide, with Poland experiencing significant spikes across different pandemic waves. Fig 5 (left) shows the daily record of biweekly COVID-19-related deaths in Poland, beginning with no cases in early 2020, then gradually increasing with notable peaks as the pandemic progressed. The death count illustrates periods of rapid escalation, especially during major waves, followed by subsequent declines, with smaller fluctuations continuing into 2024. The early months of each year typically align with peak periods, reflecting the seasonal impact and the effect of new virus variants on mortality trends.

In Poland, direct COVID-19 deaths peaked notably during waves associated with the Alpha and Delta variants, which were characterized by high transmission rates and severe disease outcomes. Mortality rates among patients hospitalized with COVID-19 were markedly high. In a cohort of 116,539 COVID-19 patients hospitalized in 2020, 18.4% died during their hospital stay, with the risk being significantly elevated for older individuals, men, and those with pre-existing conditions like cardiovascular disease [53]. Furthermore, the mortality rate for COVID-19 patients with acute respiratory distress syndrome (ARDS) was 73%, the highest reported in Europe, reflecting the severe burden on healthcare resources [62].

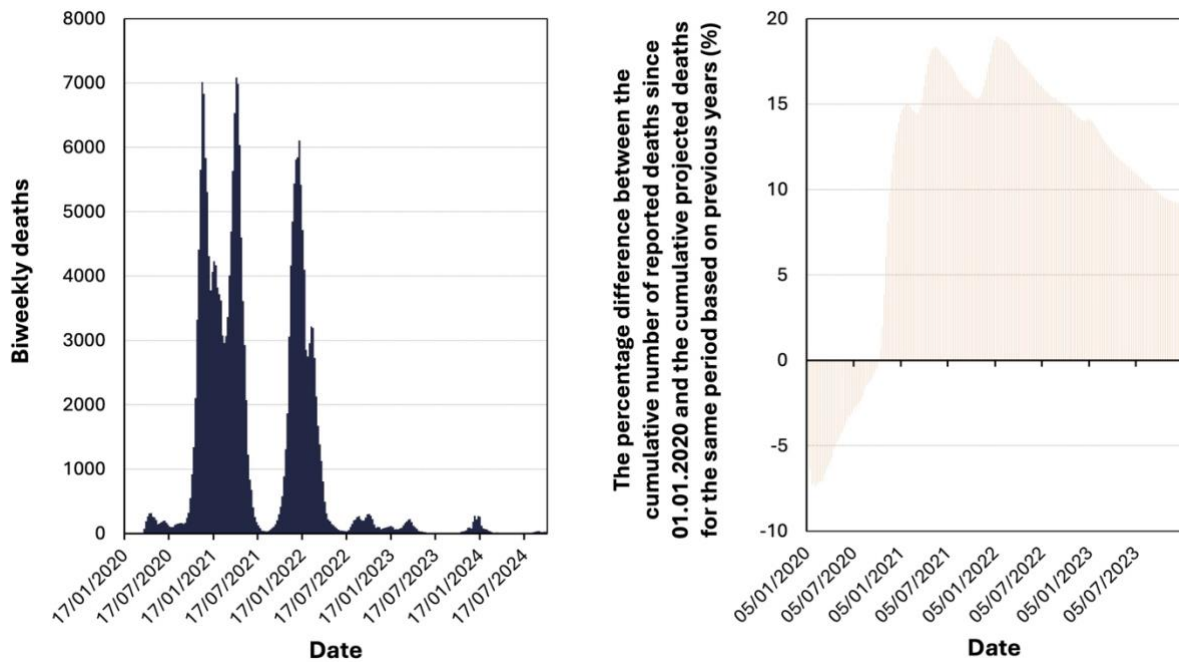


Fig. 5: Biweekly mortality rates over time (left) and excess mortality (cumulative deaths from all causes compared to projection based on previous years; right); data source: Human Mortality Database (2024); World Mortality Dataset (2024); Karlinsky and Kobak (2021); Human Mortality Database (2024); World Mortality Database (2024); Karlinsky & Kobak (2024); processed by Our World in Data.

Beyond direct COVID-19 deaths, **excess mortality** as a metric for capturing the pandemic's indirect toll was significant (fig. 5; right). Excess deaths represent the number of deaths exceeding expected levels based on historical trends and serve as a broad measure of the pandemic's impact. In Poland, excess mortality rates reveal a substantial indirect burden, stemming from factors such as delayed medical treatments, limited healthcare access, and the overwhelming strain on healthcare infrastructure. In 2020, Poland saw a 14.9% increase in deaths compared to the 2016–2019 average, which further rose to a 23.9% increase in the first half of 2021. Approximately 43% of these excess deaths were directly attributable to COVID-19, while 27% involved deaths among infected individuals, and 30% were non-COVID-related deaths among individuals without confirmed infection [48]. Excess mortality rates were also significantly elevated for non-COVID-related conditions, such as cardiovascular disease, neurological disorders, and mental health issues, highlighting the pandemic's broader implications for public health [63].

**Poland's mortality trends during the pandemic were comparatively higher than those of the European Union**, where COVID-19-related and all-cause mortality rates were lower from March 2020 to February 2022. This disparity is partly explained by the lower vaccination rates in Poland compared to the EU, where higher vaccine coverage correlated with reduced mortality [64]. This suggests that increased vaccination uptake could have mitigated some of the mortality burden in Poland, underscoring the need for improved public health messaging and vaccination strategies.

The pandemic's impact on mortality extends beyond immediate death counts to include substantial effects on life expectancy and quality-adjusted life years. COVID-19 was responsible for an estimated 630,027 standard potential years of life lost and 270,572 quality-adjusted life years lost in Poland in 2020, with these figures disproportionately affecting men and older populations [65]. Excess mortality was also notably higher for men than for women, with men experiencing 191 excess deaths per 100,000 compared to 180 per 100,000 for women [66].

**Regional and demographic disparities** further influenced mortality outcomes in Poland. Urban areas, particularly cities with populations exceeding 100,000, experienced significant increases in mortality, exacerbated by top-down infection control measures that were not always adapted to regional healthcare needs. Rural areas, often characterized by limited healthcare access, faced distinct challenges that compounded the mortality burden. Differences in healthcare access across these regions, combined with socioeconomic factors, underscore the need for region-specific healthcare strategies to address pandemic impacts effectively [67].

The mental health toll of the pandemic also contributed to mortality indirectly. Poland observed **increased sickness absences due to mental health disorders and a rise in suicide attempts** [68,69]. An increase in suicide attempts was observed, especially among younger age groups (7-24 years and 25-65 years) and women during the pandemic. University students experienced high levels of suicidal thoughts and behaviours, with almost 40% reporting suicidal ideation and 1.4% reporting suicide attempts [70,71].

#### **1.4.4. Public Perception and Trust in Pandemic Measures**

During the initial stages of the COVID-19 pandemic, public perception in Poland was significantly shaped by government responses, especially economic measures intended to mitigate the crisis. However, the **early public reaction** was predominantly critical. Economic concerns, particularly about the effectiveness of relief policies, dominated public discourse. Social media analysis conducted between March and June 2020 highlighted that discussions among Poles were more focused on the immediate economic impacts of the pandemic rather than its health implications, with widespread skepticism regarding the sufficiency of governmental support [72]. In September 2020 a survey by Inquiry Market Research of 1,000 Polish adults, 55% supported mask-wearing and social distancing, with 53% viewing gatherings without masks as irresponsible. While 53% saw the pandemic as a serious threat, 48% expressed pandemic fatigue. Opinions on economic measures were split, as 39% believed freezing the economy caused more harm than good, whereas 22% felt it averted severe outcomes. Some scepticism persisted, with 23% calling the pandemic “artificially induced panic” and only 6% dismissing concerns for young people (fig. 6). An informative campaign launched by the government to promote awareness of relief packages was effective in reducing some of this negative sentiment, indicating the importance of transparent communication to foster public trust.

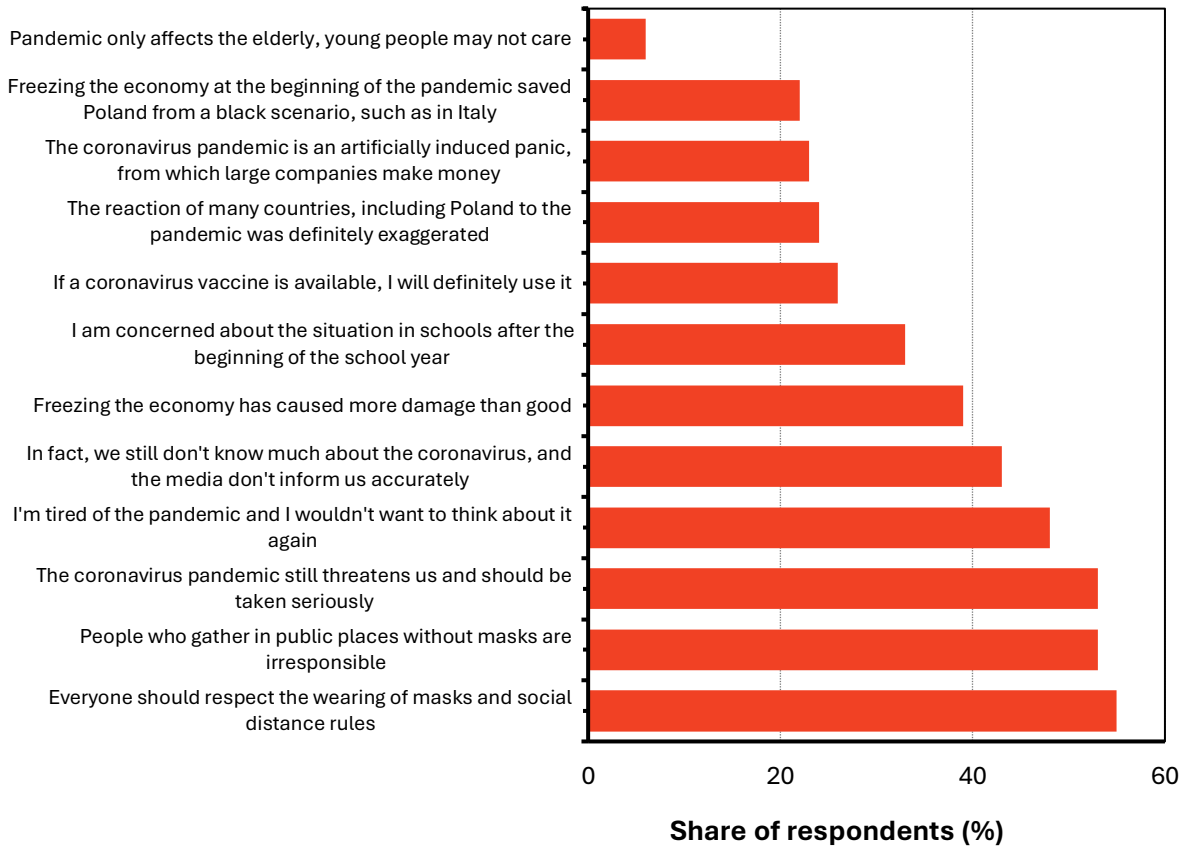


Fig. 6. Attitudes towards COVID-19 pandemic in Poland 2020; data source: Poland; Inquiry Market Research; September 22-24, 2020; 1,000 respondents; 18 years and older; computer-assisted web interviews.

**Compliance with behavioural measures** such as mask mandates and social distancing was essential in the efforts to curb COVID-19 spread. However, adherence to these measures in Poland was relatively low compared to other countries, due in part to a perceived lack of governmental support. Some surveys revealed that misinformation and conspiracy theories, particularly prevalent during the lockdown phase in April 2020, exacerbated public scepticism and hindered compliance [73]. For instance, a study found that a significant portion of the population subscribed to various conspiracy theories, which included unfounded beliefs regarding the origins of the virus and the motives behind health restrictions [74]. In 2020, opinions on COVID-19-related conspiracy theories in Poland showed mixed views, with some scepticism about protective measures and virus origins. While 30% questioned the effectiveness of masks, only 4.6% believed the theory linking COVID-19 to 5G networks, with 79% dismissing it as false. Regarding the virus's origin, 44.8% thought it likely originated in a lab, and 23% considered the pandemic a deliberate act to harm the economy. However, belief in COVID-19 as an "international conspiracy" was lower, with only 23.5% leaning towards this view, while 46.2% rejected it. This climate of mistrust reduced adherence to critical preventive measures and highlighted the need for reliable, accessible information to counteract misinformation.

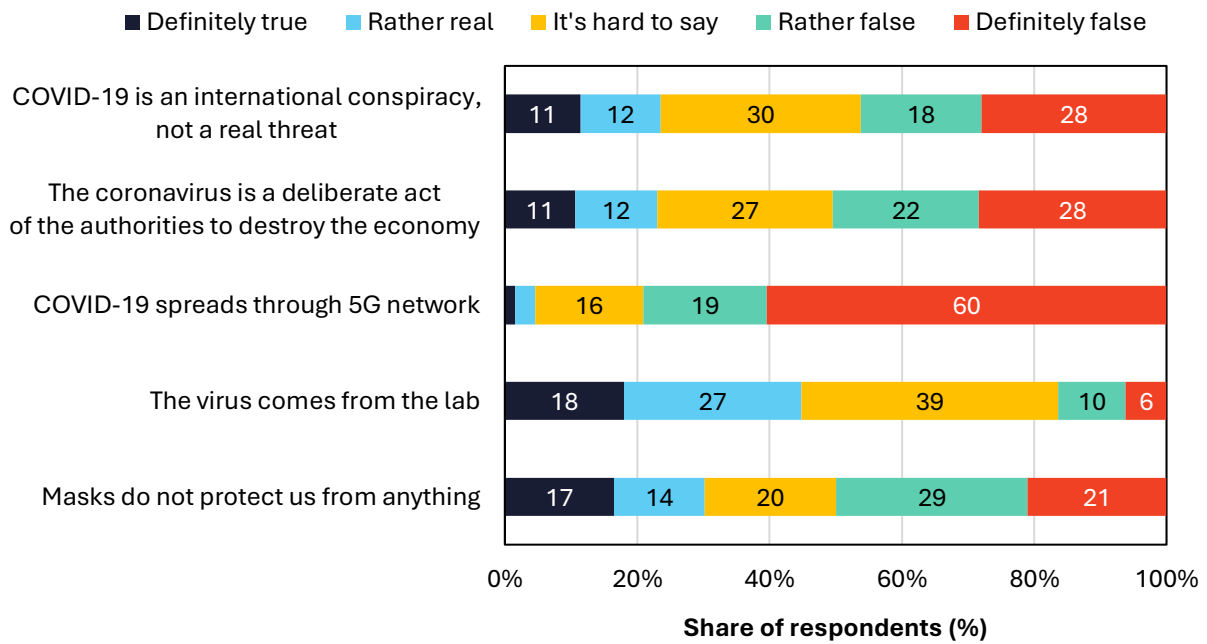
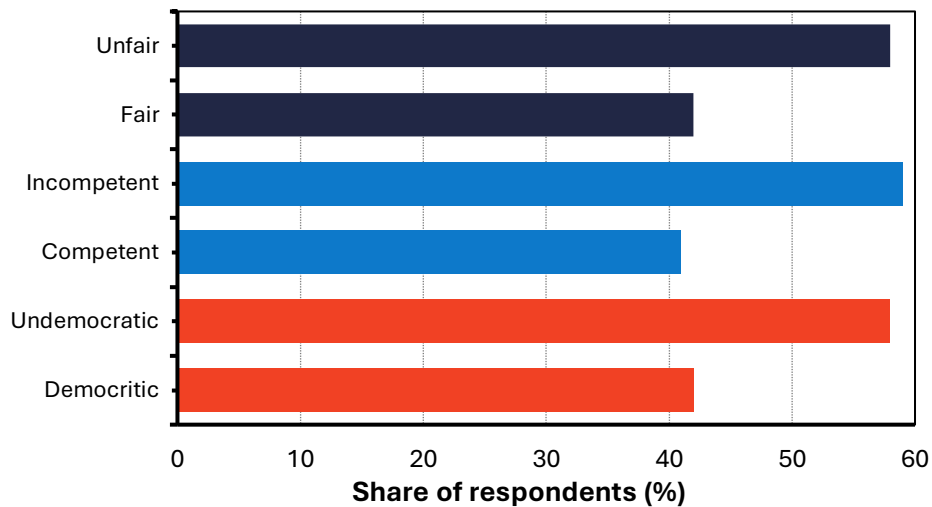


Fig. 7. Opinion on conspiracy theories related to the coronavirus (COVID-19) epidemic in Poland in 2020; data source: Poland; BioStat; Wirtualna Polska; September 12-13, 2020; 1,000 respondents; computer-assisted web interviews.

The pandemic revealed discrepancies between **expressed public attitudes and actual behaviour**. Although many Poles voiced concerns over COVID-19 and supported health protection measures in principle, their actions often diverged from these stated views. Individuals who reported a lack of reliable information or who felt inadequately informed about pandemic developments were less likely to comply with restrictions and recommendations [75]. Furthermore, personality traits influenced compliance; individuals with higher levels of traits associated with the “Dark Triad” (Machiavellianism, psychopathy, and narcissism) were found to be less likely to follow health protocols, highlighting the complex interplay between individual personality and public health adherence [76]. **Public perception of risk** was a critical determinant in adherence to COVID-19 preventive measures. Later on, both vaccinated and unvaccinated individuals in Poland recognized the seriousness of COVID-19 and reported feeling vulnerable to infection. However, scepticism about the effectiveness of government measures was notably higher among unvaccinated individuals, who expressed lower perceived efficacy in the implemented health protocols [77].

**Trust in government institutions** and health authorities was crucial in fostering public adherence to health measures, yet trust levels fluctuated throughout the pandemic. Higher initial trust in government correlated with greater adherence to recommended health behaviours, including handwashing, mask-wearing, and physical distancing. Studies found that clear, transparent communication and perceived competence of government officials were essential in maintaining public trust [78]. However, over time, trust levels declined as individuals perceived inconsistencies in government actions or doubted the effectiveness of certain measures. In 2020, a majority of respondents in Poland viewed the government’s handling of the COVID-19 crisis critically: 58%

described it as undemocratic, unfair, and incompetent, while only around 40% assessed it positively in these areas (fig. 8).



*Fig. 8. Assessment of the government's handling of the crisis caused by the coronavirus (COVID-19) epidemic in Poland in 2020; data source: Poland; Kantar; July 1-8, 2020; 2,000 respondents; online survey.*

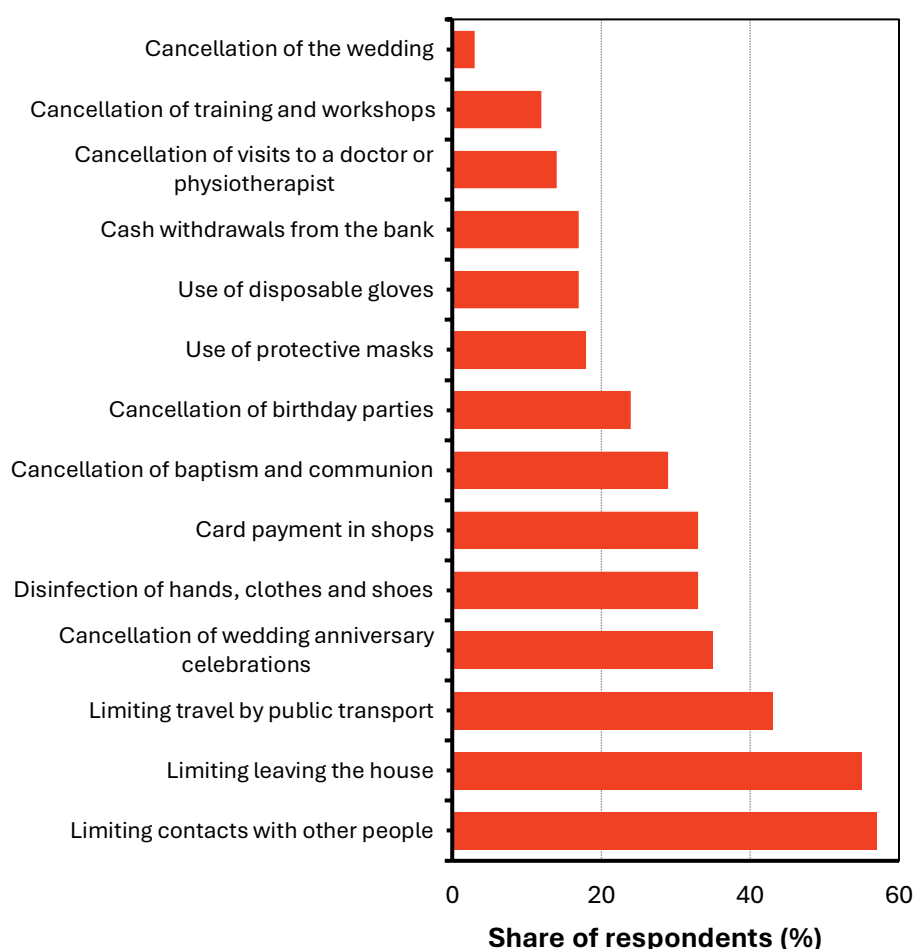
The pandemic profoundly **impacted public transport usage** in Poland, with a substantial drop in patronage observed in cities such as Gdansk and Warsaw. Concerns about safety while using public transport led many to reduce or completely cease their use of these services, as passengers expressed doubts about the ability to maintain adequate hygiene and physical distancing [79]. In Warsaw, this shift was mirrored as well, with studies finding that public safety concerns led to a notable decrease in transport use, with people favouring alternative travel modes or avoiding non-essential travel altogether [80]. The disruption in public transport usage underscores the need for measures that address public safety concerns in mobility and rebuild trust in public transportation systems post-pandemic.

The **psychological toll** of the pandemic was considerable, with anxiety levels rising significantly in certain demographics. Factors such as age, gender, marital status, and parental responsibilities played a role in susceptibility to pandemic-related stress. Studies found that women, older adults, and those with children were more likely to experience heightened anxiety, often due to perceived infection risk and extensive exposure to COVID-19 information, which contributed to mental distress [81]. The labour market in Poland was also heavily impacted by the pandemic, with sectors such as retail, hospitality, and transportation facing significant disruption. The government introduced various measures, including anti-crisis shields and financial support, to counter these effects and provide relief to affected workers and businesses. However, the reception of these measures varied. **Employers were generally more supportive of government efforts, while employees expressed concerns about job security and income stability** [82]. This divide in perception highlights the necessity for comprehensive support strategies that address the concerns of both employees and employers and provide stability for the workforce.

## 2. Measures Taken in Occupational Settings

*Content: Overview of comprehensive workplace safety measures introduced during the pandemic to protect employee health and well-being<sup>1</sup>*

At the beginning of the COVID-19 epidemic in Poland in March 2020 measures taken by individuals (not yet enforced by the government) primarily focused on reducing physical interactions and maintaining hygiene (fig. 9). The most common practices included limiting contact with others (57%), restricting outings from home (55%), and reducing public transport usage (43%). Personal hygiene practices, such as disinfecting hands, clothing, and shoes (33%), along with opting for card payments in shops (33%), were widely adopted to reduce the risk of transmission. Protective equipment was used less frequently, with 18% of people wearing masks and 17% using disposable gloves.



*Fig. 9. Most common preventive measures during coronavirus (COVID-19) epidemic in Poland in 2020; data source: Poland; Izba Gospodarki Elektronicznej; Mobile Institute; March 19-23, 2020; 1,779 respondents; 18 years and older; internet users; computer-assisted web interviews.*

<sup>1</sup> Prepared based on materials from the Central Institute for Labour Protection – National Research Institute (CIOP-PIB), developed in collaboration with the Chief Labour Inspectorate (GIP) and incorporating legal requirements and the state of knowledge as of May 18, 2020. Available at: [https://www.ciop.pl/CIOPPortalWAR/appmanager/ciop/pl?\\_nfpb=true&\\_pageLabel=P53400246641588681924899&html\\_tresc\\_roo\\_t\\_id=1151&html\\_tresc\\_id=1151&html\\_klucz=55555&html\\_klucz\\_spis=](https://www.ciop.pl/CIOPPortalWAR/appmanager/ciop/pl?_nfpb=true&_pageLabel=P53400246641588681924899&html_tresc_roo_t_id=1151&html_tresc_id=1151&html_klucz=55555&html_klucz_spis=)

These preventive measures extended into the workplace, significantly impacting occupational settings and necessitating the implementation of formalized safety protocols.

According to Polish law (Article 207 § 2 and Article 304 of the Labor Code) [83], the responsibilities for ensuring safety and health protection for workers rest:

- with the employer – in relation to employees employed based on an employment relationship and individuals performing work for the employer on a basis other than employment (including self-employed individuals), provided the work is performed on the employer's premises or in a location designated by the employer;
- with the entrepreneur – in relation to individuals employed by them on a basis other than employment (including self-employed individuals).

Among the actions undertaken by the employer to ensure safety and health, a fundamental measure is the employer's assessment of occupational risk and the application of necessary preventive measures to mitigate that risk (Article 226, Item 1 of the Labor Code) [84]. According to these provisions, the employer, in conducting a risk assessment, is obligated to consider all factors present in the work environment and related to the performance of work.

With the COVID-19 pandemic, workplaces faced a new hazard posed by the SARS-CoV-2 coronavirus, adding to existing occupational risks. Employers were therefore obligated to take measures aimed at reducing the risks associated with exposure to this biological agent. As the virus posed a serious health threat to the general population, including workers, assessing the risk of SARS-CoV-2 exposure and applying all feasible measures to mitigate it became essential. Preventive actions by employers and business owners were necessary to ensure that work-related activities did not increase employees' likelihood of contracting SARS-CoV-2 beyond the estimated level for the general population adhering to pandemic-related restrictions, mandates, and prohibitions.

Measures to be implemented in every workplace during the pandemic included:

- Developing an action plan to protect workers' health under epidemic conditions;
- Implementing strategies to reduce the likelihood of SARS-CoV-2 infection in the workplace;
- Establishing principles to minimize the psychosocial burdens caused by the pandemic;
- Ensuring effective communication about actions taken to mitigate SARS-CoV-2 transmission at work;
- Defining procedures for responding to suspected COVID-19 cases.

## 2.1. Action plan to protect workers' health

To reduce the risk of employee exposure to SARS-CoV-2 at work, it was recommended to develop and implement a preventive action plan. This plan would ideally be formulated by management representatives in consultation with employee representatives, and with input from an occupational health physician and occupational health and safety specialists.

Key considerations in developing such a plan included:

- legal requirements and recommendations from government authorities in effect during the epidemic;
- types of work performed in the workplace and the associated likelihood of infection;
- the number of employees, organized into teams performing specific tasks;
- workplace infrastructure, including spatial conditions;
- technical solutions aimed at preventing the spread of harmful biological agents.

It was understood (and lately proven [85]) that the probability of SARS-CoV-2 infection at work could be heightened by:

- social interactions (among employees and with individuals outside the organization, such as clients, contractors, subcontractors, etc.);
- shared use of work equipment, machinery, tools, and other items;
- shared use of sanitary facilities, walkways, and common areas.

Actions taken were to comprehensively address all factors increasing the likelihood of SARS-CoV-2 infection. Preventive measures were to be tailored to the specific needs of each workplace.

## 2.2. Measures to Reduce the Risk of SARS-CoV-2 Exposure

During the COVID-19 pandemic, Poland implemented several universal workplace safety measures to mitigate virus transmission. These measures included the mandatory use of personal protective equipment (PPE), enforcement of social distancing, establishment of sanitation protocols, and implementation of health screenings across various workplaces (for legal framework see section 1.3).

### 2.2.1. Ensuring Physical Distancing

One of the primary measures used to reduce the likelihood of SARS-CoV-2 infection in the workplace involved ensuring adequate physical distancing between employees. This was achieved by:

1. Limiting the number of people present simultaneously: (i) on the premises (with individual work schedules implemented as recommended) and (ii) in sanitary, social, and changing rooms (e.g., through staggered break times and displaying current occupancy status outside rooms).

2. Arranging workstations to maintain a minimum distance of 1.5 meters between employees (unless unfeasible due to the nature of the work, in which case personal protective equipment was provided). Where possible, employees were positioned back-to-back.
3. Defining rules for using passageways (e.g., stairs, corridors, elevators), such as implementing one-way movement or limiting the number of people in elevators.
4. Establishing protocols for areas where people tended to gather (e.g., building entrances at start and end of shifts, attendance checkpoints, tool and material distribution points), with appropriate spacing and signage.

Reducing direct contact between employees often required adapting workspaces, marking areas, and reorganizing work (e.g., through shift work, rotation, or remote work). These measures frequently necessitated updates to workplace regulations or issuance of appropriate notices, followed by informing employees as was customary.

If direct contact with other employees or customers was unavoidable, measures to reduce infection likelihood included:

- working in fixed teams with limited direct interaction (2-3 people);
- using transparent barriers (e.g., glass or plastic) to separate employees from customers or contractors;
- limiting direct contact time (to a maximum of 15 minutes);
- using personal protective equipment, such as respiratory protection (filtering half masks or masks with filters), eye and face shields, goggles, single-use gloves, protective clothing, and footwear;
- providing hand and surface disinfectants.

In-person meetings (e.g., seminars, training, or conferences) were generally avoided, and tele- or videoconferencing was used instead. When in-person meetings were essential, the number of participants was limited (up to 15), safe distancing of at least 1.5 meters was maintained, and meeting duration was minimized.

### **2.2.2. Remote Work**

To reduce direct employee contact, it was recommended to organize work remotely if the nature of the work allowed. To facilitate safe remote work practices, employers often:

- Defined remote work policies, including working hours, availability for supervisor contact, and task reporting requirements.
- Allowed flexible hours for remote work, recognizing that employees might be in settings with other people (e.g., children), which could impact task execution.
- Permitted temporary use of work equipment at home (e.g., computers, printers, lamps, ergonomic chairs).
- Supported ergonomic workstation setup at home and provided necessary tools and software, including tele- and videoconferencing tools. Employers communicated these guidelines via electronic means or online training.

### **2.2.3. Limiting Direct Contact with External Individuals**

Whenever possible, electronic communication was used. Business trips and meetings requiring direct contact with external individuals were minimized. For essential in-person interactions with external visitors on company premises, it was recommended to register visitor details (name, phone number) and entry/exit times and inform visitors of current workplace rules to reduce SARS-CoV-2 exposure risks. With visitor consent, temperature checks (forehead or lower neck) were advised.

Facilitating individual employee transportation and minimizing public transport use was encouraged. Providing parking spaces or secure bicycle storage and encouraging nearby employees to walk to work were also recommended.

### **2.2.4. Adherence to Hygiene Standards in the Workplace**

Effective reduction of infection risk required strict adherence to workplace hygiene practices, which included:

- daily disinfection of areas, including frequently touched surfaces (doorknobs, worktops, desks, keyboards, sinks, toilets, soap dispensers, etc.);
- providing access to handwashing stations with soap and water, followed by disinfectants, and displaying clear instructions on effective handwashing and disinfection;
- daily “wet cleaning” of floors, tables, chairs, and lockers in social rooms with detergents;
- preventing shared use of tableware in social rooms and ensuring kitchen utensils were disinfected after use;
- removing magazines, brochures, and informational materials from social rooms, waiting areas, and reception desks;
- regular cleaning and disinfection of company vehicles and equipping them with hand sanitizers, paper towels, and trash bags.

Disinfectant mats were recommended at building entrances. Limiting the number of employees sharing work equipment and tools was advised. Where shared use was unavoidable, frequent disinfection and mandatory use of single-use gloves were recommended. Mail, packages, or courier deliveries were stored for 2-3 hours in dedicated containers in a designated area whenever possible and disinfected before distribution.

Considering that SARS-CoV-2 spread easily in enclosed spaces with prolonged exposure [86,87], ensuring adequate air exchange in work areas involved:

- regularly ventilating rooms in buildings without mechanical ventilation, during work hours (10 minutes every hour) and continuously overnight, at least 2 hours before and after room use;
- extending operating times of mechanical ventilation systems in buildings; ideally, ventilation ran continuously (24/7) with proper maintenance;
- avoiding central and local air recirculation (except ventilation units and recirculation sections with high-efficiency return air filters).

### **2.2.5. Personal Protective Equipment and Work Clothing**

If the nature of the work prevented maintaining physical distance (minimum 1.5 meters) and required contact times exceeding 15 minutes with a high risk of SARS-CoV-2 exposure or contact with COVID-19 cases, employees were provided with suitable personal protective equipment (PPE), including respiratory protection, eye and face protection (goggles, shields), single-use gloves, and protective suits. PPE was used and disinfected according to manufacturer guidelines. Additional guidelines, prepared by health and safety specialists, outlined the correct use, maintenance, and disposal of protective gear to minimize contamination risks [88–90]. These guidelines addressed proper procedures for donning and doffing equipment, disinfecting reusable items, and the safe storage and disposal of single-use items.

Employees with cardiovascular or respiratory conditions, as well as older workers (65+), were generally not assigned to physically demanding tasks requiring respiratory protective equipment, such as filtering half masks.

Employers also implemented regular cleaning and laundering of work clothing, ensuring it was stored separately from personal clothing and from other employees' or clients' items.

Training employees on the proper donning and doffing of PPE was essential, as improper use, particularly during removal, was a frequent source of contamination. These training sessions followed additional guidelines from health and safety specialists, which covered the correct use, maintenance, and disposal of protective gear to further reduce contamination risks. Procedures included guidance for donning and doffing equipment, disinfecting reusable items, and appropriately storing or disposing of single-use items.

Due to a global shortage of PPE—especially medical masks and respiratory protective devices—rationalizing its use became crucial. The rapid increase in COVID-19 cases had sharply driven demand, while production capacities remained limited, making it challenging to meet global needs. Health authorities recommended strategies to optimize PPE use, safeguarding healthcare workers without compromising protection. These strategies included remote patient assessments through telemedicine, the use of physical barriers at high-contact points, and restricted access to COVID-19 patient areas for non-essential personnel.

PPE use was tailored to the risk level and transmission mode, with healthcare personnel using equipment appropriate to their exposure risk—medical masks, gowns, gloves, and eye protection for direct care, and respirators for aerosol-generating procedures. This approach helped to conserve PPE supplies while maintaining essential protection for healthcare workers and other personnel.

### 2.3. Reducing Psychological Strain Caused by the Pandemic

The crisis brought about by the COVID-19 pandemic created anxiety not only among business owners but also raised significant concerns among employees. Poland's most significant public concern during pandemic was related to the economy. More than 80 percent of respondents feared deep depression. Seven out of 10 Poles were also afraid of restrictions on freedom, social divisions, and political instability (fig. 10).

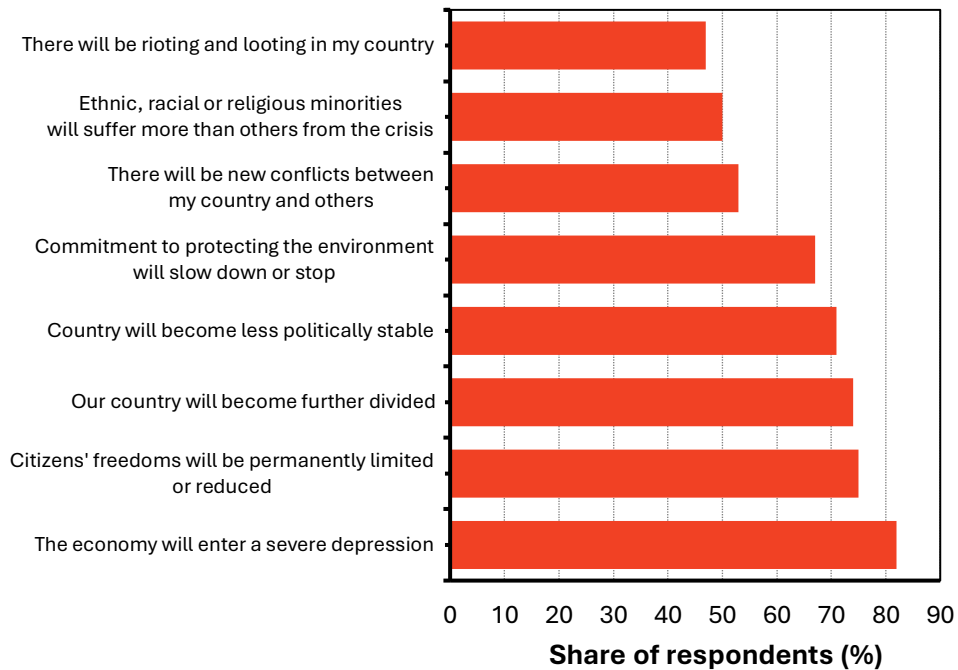


Fig. 10. Main concerns of the society during the coronavirus (COVID-19) pandemic in Poland in 2020; data source: Poland; Kantar; July 1-8, 2020; 2,000 respondents; online survey.

Moreover pandemic hurt the financial situation of nearly half of Poles in 2020. Thirty-seven percent of respondents felt the negative impact of the virus on their mental health (fig. 11).

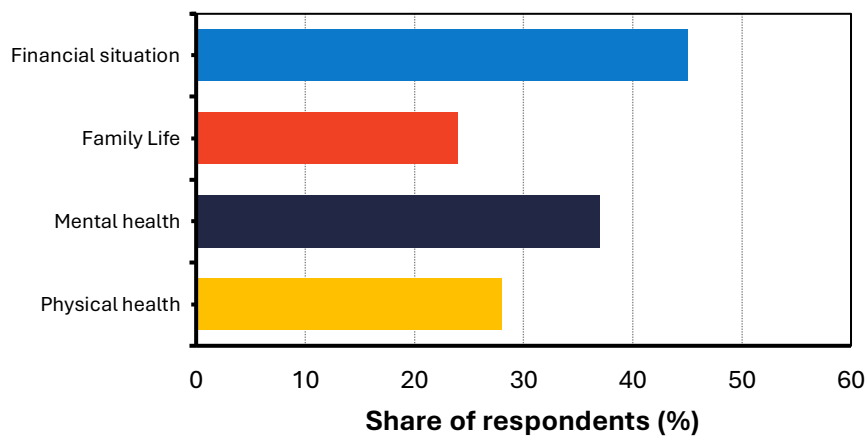


Fig. 11. Negative impact of the coronavirus (COVID-19) pandemic on personal lives in Poland in 2020; data source: Poland; Kantar; July 1-8, 2020; 2,000 respondents; online survey.

On the enterprise level factors contributing to the psychological strain on employees [91–94] that required consideration during the COVID-19 pandemic included:

- potential conflict situations with other employees or customers stemming from fear of direct contact with others;
- prolonged, intensified workload in essential sectors, such as healthcare, which were critical during the pandemic;
- requirements for maintaining social distance.

These additional psychological burdens were to be addressed through appropriate preventive measures. Key actions included:

- providing employees with support in performing tasks under pandemic conditions, including the option for individualized work hours;
- considering the organization of additional training for employees working on-site, as part of informational support, on fulfilling tasks of those absent for reasons such as childcare or quarantine;
- setting up a regular online forum where employees could express concerns, ask questions, and encourage mutual support through phone or social media interactions;
- offering support for middle management, such as training on online team management techniques;
- ensuring employees access to individual psychological assistance or participation in workshops on coping with stress related to the fear of SARS-CoV-2 infection. Where this was ineffective or impractical, considering temporary assignments to roles that did not require contact with others was essential;
- preventing stigmatization, social isolation, and exclusion from the workplace community of employees who had recovered from COVID-19.

## **2.4. Communication with Employees**

Effective communication with employees was essential for the successful implementation of measures aimed at reducing the likelihood of SARS-CoV-2 infection.

Clear communication procedures were established to ensure:

- accessible information was provided to employees about the measures implemented to reduce the risk of infection and protect their health;
- online training sessions were conducted as needed to educate employees on preventive measures, proper application, and the importance of compliance;
- in some cases platforms or systems allowed employees to submit suggestions, raise concerns, and make recommendations for improvements in work organization and safety protocols;
- regular updates informed employees of any changes to preventive measures or policies, keeping them engaged and informed.

## 2.5. Procedures in Case of Suspected COVID-19 Infection

Specific procedures were implemented to respond to suspected COVID-19 cases among employees. These procedures outlined steps to:

- manage an employee showing symptoms of COVID-19, including providing a protective mask and gloves, and ensuring immediate isolation from other employees;
- identify and document individuals who had close contact with the symptomatic employee to assess potential exposure risks;
- report the suspected COVID-19 case promptly to the relevant local or regional sanitary-epidemiological station, in compliance with public health requirements;
- coordinate follow-up actions, such as workplace disinfection and further medical guidance, to prevent further spread.

## 2.6. Medical Care

In many companies cases employees had access to individual, in-person, or telephonic consultations with an occupational health physician responsible for preventive health care. Consultations focused on:

- addressing concerns related to SARS-CoV-2 infection risks, including guidance on preventive practices both at work and home;
- managing additional health considerations for employees with pre-existing chronic conditions, which might increase susceptibility to COVID-19;
- providing psychological support and guidance on managing stress or anxiety related to health concerns during the pandemic, particularly for high-risk groups or roles.

Offering timely and accessible medical care ensured employees felt supported, helping maintain a healthy, safe workplace environment.

During the COVID-19 pandemic, periodic occupational health examinations in Poland were temporarily suspended as part of the public health response to reduce virus transmission [95]. This measure was enacted to limit unnecessary physical contact in healthcare settings and minimize the risk of spreading SARS-CoV-2 among employees and healthcare providers. The suspension applied primarily to routine health checks that are typically required to ensure workers' fitness for specific job functions. Instead, priority was given to essential health services and urgent cases, with the understanding that mandatory examinations would resume once the public health situation stabilized.

## 3. Impact Of The Covid-19 Pandemic And Response Measures On The Work Environment

### 3.1. Occupational Health and Safety

*Content: spatial adjustments and capacity limitations, enhanced cleaning protocols and availability of hygiene supplies, increased PPE usage and shortages; adverse health effects on healthcare workers, waste management challenges and environmental impact*

#### 3.1.1. Physical Layout Changes and Workspace Reorganization

The primary goal of physical layout modifications and workspace reorganization during the COVID-19 pandemic was to support physical distancing and minimize potential contact points among employees, clients, and visitors. This approach aimed to reduce viral transmission within workplaces, particularly where remote work was impractical, by **rethinking spatial arrangements to manage both proximity and flow of people** [96–98].

To adhere to physical distancing guidelines, workspaces were redesigned to maintain a minimum distance between workstations, especially in open-plan offices. Many companies implemented **capacity limitations** in shared spaces such as cafeterias, meeting rooms, and elevators to prevent overcrowding. These limitations were often supported by **staggered shifts or alternate schedules**, which distributed occupancy more evenly throughout the day.

In many organizations, designated zones were created to limit cross-contact among teams or employees with different job functions. This was particularly effective in high-contact areas, where one-way walkways and **controlled flow at entry and exit points** helped manage movement and reduce unnecessary interaction. For example, companies marked safe distances in queue areas (e.g., with adhesive tape or paint) and recommended touchless time tracking methods like proximity badges instead of traditional attendance lists. Checkpoints at entrances and designated areas for break rooms minimized traffic and maintained better control over shared spaces [98,99].

In construction and other hands-on industries, strategies were adopted to reduce the number of personnel required on-site, thus facilitating physical distancing [97,100]. Physical reorganization efforts were often complemented by remote work policies, allowing employees with non-site-dependent tasks to work from home. This approach effectively reduced on-site density, allowing essential on-site workers to maintain safer distances. Companies explored flexible workspace arrangements, such as hot-desking or hoteling systems, where employees could reserve workspace as needed, supporting a more adaptable and health-conscious workplace environment.

To minimize physical gatherings, traditional meeting rooms were largely replaced by **digital collaboration platforms**. Virtual tools enabled training, team coordination, and meetings to shift online, reducing the need for physical reorganization in conference rooms and other shared areas. Many companies used emerging technologies, including virtual inspections and remote monitoring, to reduce in-person oversight for employees who could perform these tasks digitally, thus further reducing contact risk [100,101].

### 3.1.3. Hygiene and Sanitation Standards

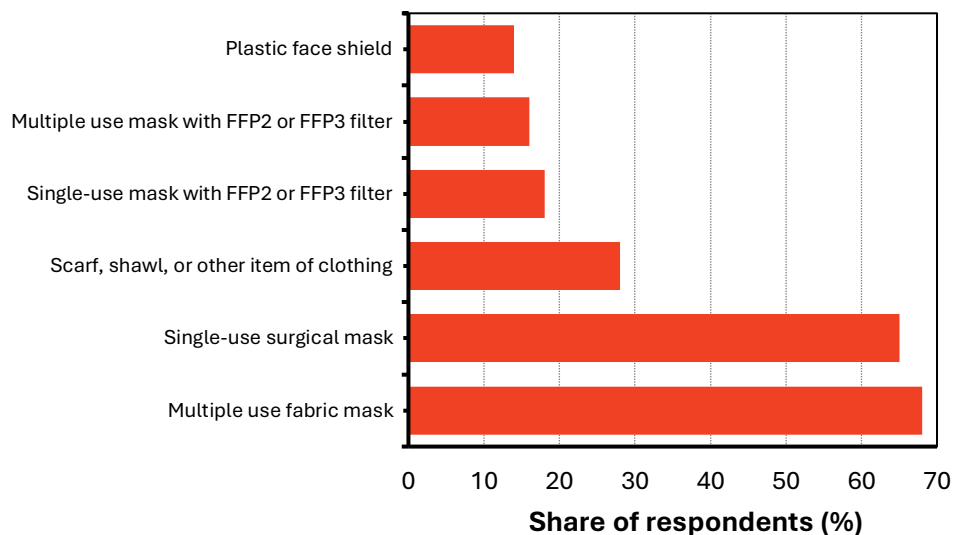
Employers implemented regular disinfection protocols to ensure the safety of shared spaces and high-contact surfaces, such as desks, door handles, and restrooms. Small and medium enterprises (SMEs) adopted additional measures, including **frequent cleaning and disinfection of work areas**, to mitigate the risk of virus transmission [102]. Updated hygiene plans often required daily disinfection of commonly touched surfaces and equipment, including telephones, counters, door handles, and soap dispensers.

To support these enhanced cleaning protocols, workplaces made hygiene supplies widely available. Employers ensured access to hand sanitizers, disinfectants, and other protective supplies, while also providing clear instructions on maintaining proper hygiene practices. **Handwashing and disinfection stations** were strategically located in accessible areas for employees and clients, equipped with touchless dispensers to minimize contact points. Posters displayed effective handwashing techniques and reinforced the facility's hygiene rules. [98]. SMEs, in particular, introduced hand sanitation stations at entrances and other common areas, helping to reinforce infection prevention measures across different types of work environments [103].

Proper ventilation emerged as a critical element in workplace safety strategies to reduce airborne transmission risks. Guidelines emphasized regular air circulation in enclosed spaces, either through mechanical ventilation systems or by opening windows frequently. **Improved ventilation protocols were introduced** in several sectors, particularly where physical distancing was challenging to maintain, ensuring better airflow and reducing the potential accumulation of virus particles in indoor environments [104]. In some cases, employers installed transparent barriers between workstations to further reduce the risk of respiratory droplet transmission where spacing was constrained. CIOP-PIB advised that companies implement detailed guidelines for ventilation systems in workplaces to improve air quality by reducing the concentration of virus-laden aerosols [105]. Such measures were vital for sectors with high personnel density, like lignite mining and energy, where adaptations in work organization further supported employee health and safety [106].

### 3.1.3. Impact of COVID-19 on the Use of PPE

The COVID-19 pandemic led to a global surge in personal protective equipment (PPE) usage, with Poland experiencing similar challenges in demand and supply constraints. Healthcare and frontline workers across the country required additional protective gear to safely perform their duties, prompting many Polish employers to update occupational risk assessments and provide increased numbers of PPE to employees, with approximately 90% of workplaces **securing additional supplies** [103]. In the broader public setting, data from 2021 show diverse patterns of mask usage in Poland. The most common type was multiple-use fabric masks, used by 68% of individuals, followed closely by single-use surgical masks at 65%. Other forms of face coverings included scarves, shawls, or similar clothing items (28%), as well as single-use masks with FFP2 or FFP3 filters (18%) and multiple-use masks with these higher-grade filters (16%). Additionally, plastic face shields were utilized by 14% of people. This variety in face protections reflects both personal choice and **availability issues in different stages of the pandemic** (fig. 12).



*Fig. 12. Type of protection (face covering) used in public places during the coronavirus (COVID-19) epidemic in Poland in 2021; data source: Poland; Business Insider; SW Research; March 2021; 1,017 respondents; Computer-assisted web interviews.*

However, shortages became a significant issue, exacerbated by global supply chain disruptions, as China, the primary manufacturer of PPE, faced unprecedented demand from countries worldwide [107]. This dependence on external suppliers highlighted vulnerabilities in PPE distribution, particularly in primary care and dental settings, where shortages forced some healthcare providers to suspend operations entirely [56].

In response to these shortages, Polish healthcare workers and institutions adopted a range of mitigation strategies. Rationing, reusing, and even creating **alternative forms of PPE became common**, although these measures often came at the expense of optimal protection and convenience. Additionally, the increased demand for PPE led to significant price hikes, a trend observed globally, which further strained resources and limited accessibility in some areas [108–110]. The intensified usage of PPE across various

sectors also raised concerns about future preparedness and highlighted the need for regulatory improvements. Experts advocated for enhanced market regulation, better stockpiling practices, and the development of local manufacturing capabilities to reduce dependence on international suppliers and mitigate similar shortages in potential future health crises.

CIOP-PIB conducted a survey among 190 healthcare workers in Poland in 2023, as part of a study on the impact of personal protective equipment (PPE) on thermal strain and occupational health during the COVID-19 pandemic. The survey explored various aspects of PPE use, such as respiratory protection, physical and thermal comfort, hydration, and psychosocial conditions. Results indicated significant discomfort, with many respondents reporting thermal stress and ergonomic issues due to PPE. Moreover, knowledge gaps were identified regarding specific PPE standards and classifications, particularly in terms of resistance to contaminated liquids and aerosols. The study provided insights into healthcare workers' challenges and suggests areas for enhancing workplace safety and PPE standards, that will be explored in the upcoming years.

The surge in PPE usage presented **significant waste management challenges** across Poland. Local governing bodies introduced specific measures to handle PPE waste, yet only a limited number of waste collection companies adapted their schedules due to the high costs involved [96]. Improper disposal of PPE also raised concerns about environmental pollution, as single-use masks, gloves, and other disposable items began to accumulate in public spaces and waterways. The pandemic underscored the need for improved public information campaigns on proper PPE disposal and the implementation of sustainable waste management solutions to mitigate environmental impacts.

## 3.2. Shift in Work Modalities and Flexibility

### 3.2.1. Transformation of Work Models

The COVID-19 pandemic fundamentally reshaped work models in Poland, accelerating the **shift toward remote work** across a range of sectors. This shift was part of a broader digital transformation, which, as highlighted by Śledziewska and Włoch (2020), has led to the virtualization of many social and economic activities, including the labour process itself [111]. Koziół-Nadolna and Suchocka (2021) emphasize that the adoption of technological solutions has facilitated the evolution of work, particularly during the pandemic [112].

Before the pandemic, remote work (often termed "telework," "e-work," or "remote work" in international literature) was a marginal practice in Poland, primarily due to legal and cultural barriers. For example, in 2019, only 0.18% of the Polish workforce was engaged in telework, as defined by labour law, amounting to approximately 28,150 employees [113]. The COVID-19 pandemic, however, created an immediate need for remote work, with the enactment of the "COVID Act" on March 2, 2020, allowing employers to direct employees to work outside of organizational premises [95].

According to Statistics Poland (GUS), the share of **remote workers** in Poland experienced a dramatic increase. By the end of the first quarter of 2020, 11% of the workforce was working remotely, a significant jump from the pre-pandemic level of 0.18%. The adoption peaked in Q1 2021, with 14.2% of the workforce engaged in remote work. This high level of remote work fluctuated with the pandemic waves and government restrictions, with a noticeable decline as restrictions were lifted. By the end of 2022, only 3.4% of the workforce remained in remote work settings, indicating a partial return to more traditional work environments post-pandemic [114].

The percentage of employed persons **working from home (including remote workers)** in Poland fluctuated moderately from 2010 to 2019, staying around 4.5% to 5.6%. In 2010, 4.5% of the workforce worked from home, a figure that varied slightly but remained relatively stable, peaking at 5.6% in 2015 before stabilizing around 4.6% in the years leading up to 2019. The onset of the COVID-19 pandemic in 2020 dramatically increased the rate of remote work, as seen in the jump to 9%, which nearly doubled the pre-pandemic levels. The following year, in 2021, the percentage decreased to 7% as some employees returned to in-person work. By 2022, this figure fell further to 5%, and in 2023, it rose slightly to 5.4%, suggesting a partial but lasting shift towards remote work in the Polish labour market (fig. 13).

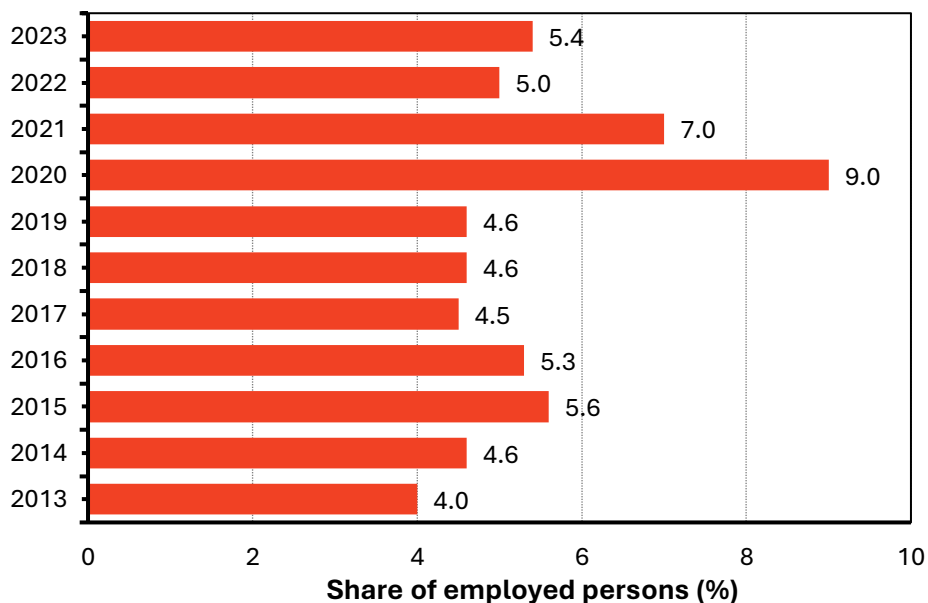


Fig. 13. Employed persons working from home as a percentage of the total employment in Poland from 2010 to 2023; data source: Poland; Eurostat; 2010 to 2023; 15-64 years; employed persons.

The **sectors most affected** by this transition included information and communication, education, and finance. For instance, during first quarter of 2020, nearly 38% of employees in education and 37% in information and communication were working remotely. By contrast, industries such as manufacturing faced greater obstacles to adopting remote work due to the nature of their operations. Notably, even with restrictions easing, sectors like finance and information technology maintained relatively high levels of remote work due to their compatibility with digital workflows [113].

**Geographical disparities in remote work adoption** were also evident. The Warsaw region led with the highest share of remote workers, reaching 9.9% by the end of 2022, followed by regions such as Małopolska and Dolnośląskie. Rural and less economically developed regions, however, reported much lower levels of remote work, in part due to digital infrastructure limitations and the prevalence of industries requiring physical presence [114]. Furthermore, **larger companies**, particularly those employing over 49 people, were generally better equipped to support remote work, while smaller companies struggled due to limited resources and organizational constraints [115,116].

### 3.2.2 Positive and Negative Effects of Remote Work

The shift to remote work in Poland during the COVID-19 pandemic brought a variety of positive effects for both employees and organizations, as well as some significant challenges, according to recent studies and analyses [117].

One of the primary benefits of remote work was the **increased flexibility** it provided. With more control over working hours, employees were able to balance professional and household responsibilities more effectively, resulting in a more harmonious work-life integration [118]. This flexibility was particularly valuable for employees with family obligations, contributing to higher job satisfaction and overall well-being [119]. However, data showed that only 62% of remote employees had a fixed space **designated for work at home**, often shared with other activities, which affected focus and comfort [120]. Additionally, while this flexibility came with benefits, it also introduced **challenges in maintaining boundaries between work and personal life**. The lack of clear boundaries between work and personal life often led to poor work-life separation, as many employees struggled to "switch off" from work, resulting in extended hours and a feeling of being constantly on-call. This blurring of boundaries increased stress and fatigue among some remote workers [119].

Remote work also impacted **physical health and lifestyle habits** [121]. Many employees reported changes in eating behaviours, with some increasing food intake and experiencing weight gain. **CIOP-PIB findings indicated that 64.4% of employees noticed changes in eating habits during lockdown, with 44% eating more than usual** [120]. Reduced physical activity, especially among employees in sedentary roles, further contributed to health issues [122]. Additionally, remote work led to heightened levels of anxiety, stress, and psychological distress, particularly among women and those experiencing job insecurity [123]. **According to the CIOP-PIB report, nearly half of remote work increased stress and mental health concerns due to difficulties in maintaining work-life balance and reduced physical activity** [120].

Studies show that remote work enhanced employee satisfaction and commitment due to the autonomy it offered. Employees reported feeling more committed to their roles, as remote work allowed them to focus on tasks without the usual office distractions [124]. While certain sectors, such as IT, experienced **productivity gains** in remote settings, other sectors faced **challenges**. For instance, the investment and construction

industries encountered delays and extended working hours, as remote workflows sometimes hindered efficient project completion [125].

The **elimination of daily commutes** saved employees significant time and money, contributing to a calmer, less stressful work atmosphere [100]. Reduced commuting expenses also provided financial benefits, effectively adding indirect income. Additionally, the time saved on commuting allowed employees to dedicate more hours to personal interests or work tasks, which enhanced productivity [118].

The shift to remote work also fostered **improvements in digital literacy and IT skills** across the workforce. Many employees had to adapt to new tools and platforms, which expanded their skill sets and boosted digital confidence, particularly in sectors like finance and IT [126]. In response to the pandemic, companies in various fields accelerated their digitization processes. In sectors such as design and construction, remote work facilitated faster data acquisition and more efficient project management through digital platforms, underscoring the productivity gains possible with technology integration [100]. However, the rapid digital transition also highlighted a **digital divide** in Poland. Smaller organizations, particularly in rural areas, struggled with limited internet access and insufficient digital infrastructure, which impacted productivity. Many employees lacked the necessary digital skills and resources to adapt quickly to remote work demands [115,127].

Remote work also had some **positive environmental impacts**, as it reduced energy consumption in office buildings and lowered emissions associated with commuting. Many organizations observed decreased utility usage, while reduced car travel helped lower air pollution levels [100].

Interestingly, remote work **improved communication between employees and managers**. Digital platforms facilitated more structured interactions, making it easier for managers to conduct regular check-ins and feedback sessions with their teams. This structured communication strengthened working relationships and boosted employee engagement [128]. However, the absence of face-to-face interaction also led to a sense of social isolation for many employees. The **lack of in-person contact** with colleagues reduced team cohesion and affected workplace morale [119].

### 3.3. Changes in Workplace Culture and Employee Relations

*Content: Trust-building, communication challenges, leadership adaptations, job security, and peer relations*

The COVID-19 pandemic brought profound changes to workplace culture and employee relations, particularly in terms of trust-building and communication between employees and management. The sudden shift to remote work, combined with the general uncertainty and stress of the pandemic, disrupted traditional methods of fostering trust and maintaining clear communication within organizations. These new dynamics placed additional demands on leaders to communicate effectively and empathetically, as well

as to create environments of support and stability for employees facing unprecedented challenges. This section explores how these changes impacted workplace trust and communication, examining the strategies that proved effective in sustaining employee engagement and cohesion during a period of significant transformation.

### 3.3.1. Trust and Communication Challenges

The COVID-19 pandemic brought transformative changes to workplace dynamics, particularly impacting trust and communication between employees and management. The sudden shift to remote work, combined with the stress and uncertainty of the pandemic, challenged traditional methods of fostering trust and maintaining clear communication within organizations.

Many Polish employees reported a **positive assessment of their superiors** during the pandemic, which correlated with better job satisfaction and stability. Effective leadership, characterized by clear communication and support, became an important factor in maintaining productivity and employee morale. Studies by Sady and Sedlak (2022) indicate that those employees who viewed their managers positively experienced an overall improved professional situation, showcasing the importance of managerial competence and empathy in sustaining a productive work environment during times of crisis [128].

Trust in management emerged as a critical **element in buffering the adverse effects of COVID-19 stress** on employee performance and psychological well-being. Trusting relationship with management helped employees manage pandemic-induced anxieties, positively influencing their mental health and work effectiveness [129,130]. This trust not only supported employees' emotional resilience but also contributed to a stronger organizational culture by reinforcing mutual respect and understanding between employees and leaders.

An essential factor in **trust-building within virtual project teams** during the pandemic was the establishment of reliable communication and structured trust-building practices. Research found that trust was crucial to team effectiveness in remote settings, and the absence of physical interactions made this task especially challenging. Research suggest that creating a code of best practices specifically for crisis contexts—such as the COVID-19 pandemic—could significantly aid project managers in maintaining team cohesion, highlighting trust as a component of successful virtual teamwork [131].

Perceptions of workplace security among Polish employees varied significantly based on managerial styles, illustrating the influence of leadership approaches on employees' sense of stability. Wojtkowska et al. (2021) found that employees led by “developer” or “executive” managers reported a higher sense of security and maintained a positive work attitude. In contrast, employees under “compromiser” or “deserter” managers felt a sharp decline in workplace security and motivation. This variation highlights how the ability of leaders to foster a secure, supportive environment can make a profound difference in employees' workplace experience and trust [132].

### 3.3.2. Adaptations in Leadership and Management Approaches

In the initial phase of the pandemic, leaders prioritized survival-oriented decisions to maintain operational stability. Many organizations implemented remote work as a fundamental measure to ensure continuity while complying with health and safety protocols. Additionally, selective employment reduction and extended payment deadlines for clients were common strategies used to minimize financial strain and retain essential talent. These measures were crucial for companies to sustain production levels and prevent resource depletion. Such decisions reflect a **pragmatic leadership** approach, which balanced immediate survival needs with long-term organizational health [133].

The pandemic underscored the effectiveness of **feminine leadership attributes**, particularly in sectors like hospitality, where inclusivity, collaboration, and empathy became highly valued. Leaders who adopted these traits were more successful in engaging employees, maintaining morale, and creating a supportive work environment during a time of widespread anxiety [134]. Research indicates that employees preferred leadership styles emphasizing transparency and emotional support over traditional, masculine approaches characterized by decisiveness and risk-taking.

The role of **e-leadership** also emerged as essential during this period. E-leadership indirectly enhanced organizational performance by driving employee engagement, which enabled employees to dynamically adapt to changing job responsibilities [135]. Work engagement functioned as an enabler of employees' dynamic capabilities (EDC), facilitating the translation of e-leadership into improved organizational outcomes. This combination of e-leadership, engagement, and EDC ultimately led to enhanced job and organizational performance.

The pandemic's economic impact pushed many organizations to seek methods that would maximize efficiency. Lean Management principles proved effective in helping organizations streamline operations and reduce waste. By emphasizing efficiency and productivity, **Lean Management** helped companies navigate the resource constraints and unpredictability associated with the pandemic [136]. In sectors where operational consistency was crucial, such as manufacturing and logistics, Lean Management enabled leaders to **make data-driven decisions that maintained productivity** while managing costs.

The ICT sector, known for its innovation-driven culture, leveraged **cooperative leadership and open communication** to foster adaptability and creativity during the pandemic. Leaders in this sector prioritized transparency, encouraging team collaboration and ensuring that employees had access to the resources and information needed to continue their work effectively [137]. This cooperative approach not only promoted innovation but also helped retain skilled talent by maintaining high levels of employee engagement and satisfaction.

### 3.3.3. Employee Relations

The COVID-19 pandemic brought about significant changes in employee relations, reshaping interactions between managers and employees, as well as among employees themselves. While **manager-employee relations** deteriorated due to increased stress and communication challenges in remote settings, **employee-employee relations** saw improvements, with colleagues forming stronger connections as they adapted to new work environments and shared challenges [138].

Collective bargaining and social dialogue were also affected, as traditional means of employee representation were challenged by the shift to digital interactions. This shift raised concerns about the long-term impacts on **employee rights and freedom of speech** within the workplace, with some employees feeling that their voices were less likely to be heard in the absence of in-person forums [139,140].

The pandemic also accelerated changes in recruitment and employer branding strategies, with organizations increasingly relying on digital platforms and social media to strengthen connections with both current and prospective employees. By actively engaging on these platforms, companies not only adapted to social distancing measures and the limitations on in-person recruitment events but also reinforced a **sense of community and transparency** that resonated with existing staff. This shift encouraged employees to feel more connected to their organization's values and mission, even while working remotely, and helped to attract candidates who aligned with these values, fostering a more cohesive workforce [141].

## 3.4. Technological Advancements and Digital Transformation

*Content: Accelerated adoption of digital technologies tools and platforms; training and skill development for digital proficiency; cybersecurity challenges*

The COVID-19 pandemic significantly reshaped work environments in Poland, prompting a rapid shift towards remote work and digitalization across multiple sectors. The IT industry experienced the most substantial change, with 66.8% of workers transitioning to remote work. Other industries, including financial services, education, and construction, also saw significant increases in remote work adoption as companies sought to maintain operations amid restrictions [118,125,126,142]. Remote work offered advantages, such as enhanced productivity and flexibility, but it also introduced challenges like cybersecurity risks and limited access to essential company resources. These obstacles highlighted the need for organizations to adapt quickly to maintain productivity and ensure security in a digital-first environment [118,124,143].

### 3.4.1. Accelerated adoption of digital technologies tools and platforms

The COVID-19 pandemic significantly accelerated digital transformation and automation in Poland, intensifying a shift that was already underway [144,145]. This shift compelled many Polish enterprises to expand their **investments in digitalization**, with nearly half of companies increasing their budgets for such initiatives to remain competitive and adaptable in a digital-first economy [145]. These investments were essential for enhancing operational efficiency, improving customer interactions, and enabling remote work capabilities, especially in sectors heavily reliant on traditional processes.

About 20% of organizations reported a significant increase in digital initiatives, while 38% saw moderate growth, indicating a broad push for digital solutions. However, 38% of organizations reported no change, and 4% experienced setbacks, illustrating a mixed response where most companies advanced digitally, but some faced constraints in their efforts (fig. 14).

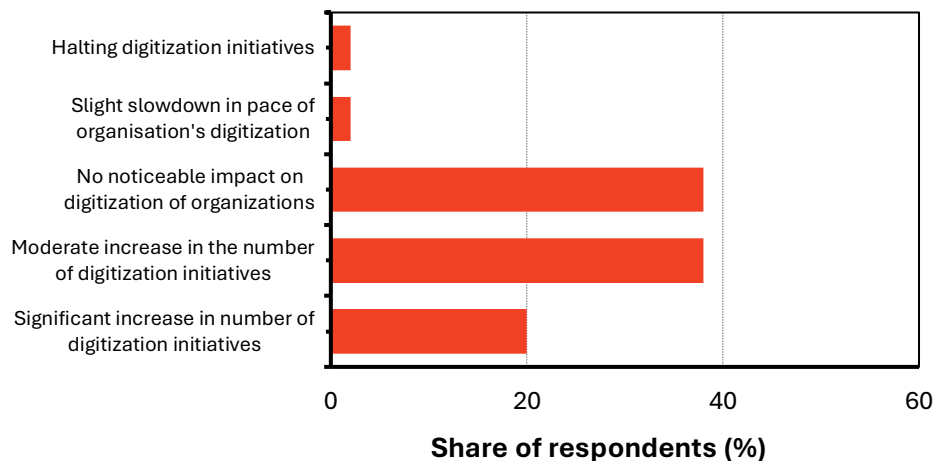


Fig. 14. Impact of the coronavirus (COVID-19) pandemic on organizations' digitization activities in Poland in 2021; data source: Poland; Norstat; KPMG Poland; January to February 2021; 100 respondents; Companies in Poland; computer-assisted telephone interviews.

However, while progress was notable, Polish industrial firms continued to lag behind their Western European counterparts in the implementation of advanced Industry 4.0 technologies, such as the Internet of Things (IoT), robotics, and artificial intelligence, which are essential for achieving full digital integration [146]. This gap pointed to broader structural challenges in Poland's industrial sector, including limited access to the high-speed internet infrastructure required for modern digital processes. Overall Poland had one of Europe's highest internet access rates, over 90 percent (in 2020). However approximately 4% of Poles was lacking any internet coverage and an additional 10% did not have access to internet of sufficient quality for effective remote work or online learning [127], which underscored **issues of digital deprivation**. This digital divide hindered some businesses and individuals from fully participating in the digital economy, posing a significant barrier to equitable workforce transformation.

Organizations faced **varying levels of preparedness** for digital transformation, with larger companies generally better equipped [115,147]. **Larger companies and private enterprises were generally better equipped** for the transition compared to smaller firms and public entities [148]. Factors influencing successful adaptation included previous experience, employee support, performance monitoring, and IT tool implementation [147].

### 3.4.2. Training and skill development for digital proficiency

The rapidly changing labour market and the growth of Economy 4.0 sectors, including fintech, e-commerce, and digital services, created new opportunities for employees to develop skills aligned with technological advancements [149]. In response, many organizations began prioritizing upskilling and reskilling programs to prepare workers for roles that demand digital fluency. Within Polish SMEs, digital transformation significantly influenced job satisfaction and work characteristics, as digital tools enabled greater flexibility, streamlined processes, and new forms of collaboration, though they also introduced increased technical skill requirements [150]. This shift toward digitalization has reshaped the Polish labour market and work environment, positioning businesses to adapt to an increasingly technology-driven future while highlighting the need for continued investment in digital infrastructure and inclusion.

The COVID-19 pandemic's acceleration of remote and hybrid work further emphasized the critical need for new digital skills at all organizational levels [151]. In 2020, the Digital Economy and Society Index (DESI) ranked Poland 23rd out of 28 EU countries in terms of digital skills (fig. 15). Approximately 44% of Poles possessed at least basic digital skills, compared to the EU average of 56%. In terms of advanced digital skills, 15% of Poles were proficient, while the EU average stood at 31%. Regarding digital content creation, 50% of Poles had basic abilities, slightly below the EU average of 58%.

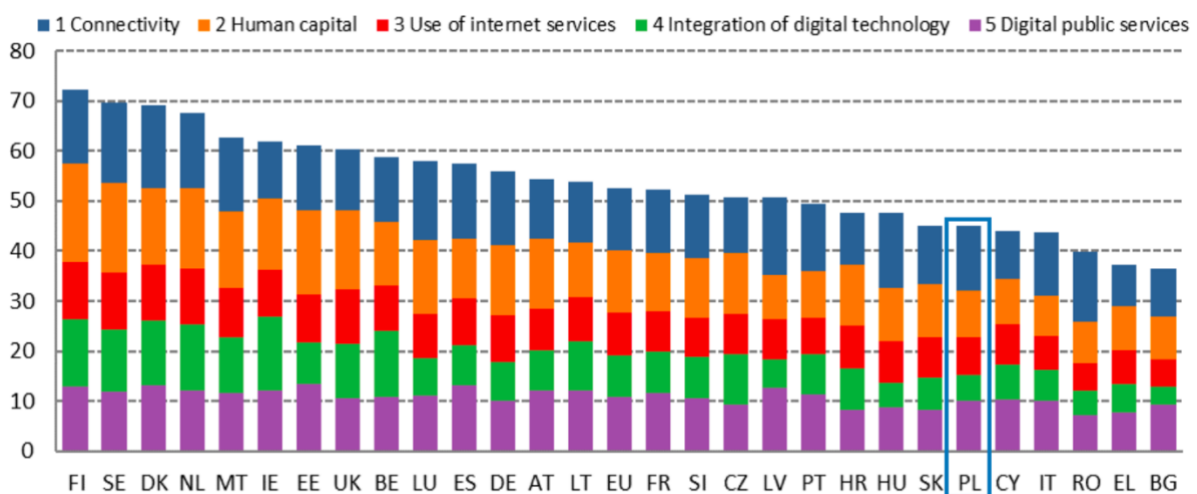


Fig. 15. Digital economy and society index (DESI) 2020 ranking; source: [152].

As companies adapted to digital-first practices, employees were increasingly required to reskill and upskill to keep pace with the technological demands of the fourth industrial revolution. Training efforts focused on building proficiency in digital tools, virtual collaboration platforms, and data analytics, enabling employees to work effectively within redefined workspaces. Many Polish companies responded by revising their training and development policies to meet these emerging needs [153].

Polish SMEs, in particular, prioritized this digital shift by increasing their budgets for digitalization and adjusting training programs to support evolving technological demands [146,154]. For younger employees, such as those in Generation Z, the fast-paced technological change presented unique challenges, underscoring the need for foundational digital skills to navigate remote work successfully [155]. Meanwhile, executives in large enterprises also focused on enhancing their digital competencies, enabling them to lead their organizations through the complexities of digital transformation [156].

### 3.4.3. Cybersecurity Levels

During the pandemic, Poland saw a **significant rise in cybercrime** targeting electronic banking users, as consumer behaviour shifted dramatically towards online banking and e-commerce. This surge in online transactions and electronic payments created new opportunities for cybercriminals, leading to a spike in cyber incidents within the financial sector. Cyber-attacks on e-banking users involved account takeovers, phishing schemes, and fraudulent transactions, contributing to significant financial losses [157]. This trend highlighted the pandemic's role in creating an environment where rapid digital adoption sometimes outpaced security awareness and infrastructure. Users, under psychological stress from pandemic-induced anxiety, became more vulnerable to manipulation, inadvertently creating additional openings for attackers.

The pandemic also prompted a significant **shift in cybercrime tactics**, effectively creating a “cyber pandemic.” Cybercriminals adapted to the new digital landscape by developing innovative techniques, particularly in phishing and identity theft schemes tailored to pandemic-related fears and information needs. Phishing schemes, for example, commonly mimicked government announcements or health organization advisories, deceiving users into revealing sensitive information [158]. Cybercriminals also exploited pandemic-related misinformation to manipulate user behaviour, targeting users with malware and ransomware attacks that exploited the vulnerabilities inherent in hastily expanded digital infrastructures for remote work.

Alongside these issues, **ransomware attacks** surged during the pandemic, posing additional challenges for businesses and organizations in Poland. The increase in ransomware incidents had serious financial and operational consequences, affecting a wide range of sectors as attackers capitalized on the vulnerabilities in remote work arrangements [159]. Defending against ransomware became increasingly complex, with organizations investing in advanced security tools and prioritizing cybersecurity training for employees.

Although financial institutions in Poland managed to maintain robust security defences, the dramatic increase in attacks targeting their customers posed significant risks. The rise in cybercrime exposed financial institutions to **new operational, reputational, and legal challenges**. As a result, institutions had to enhance their cybersecurity measures beyond standard protocols to support secure transactions in response to the elevated online activity. This shift required innovative approaches, including stepped-up user education initiatives to raise awareness about cybersecurity risks among customers. Polish banks, in particular, took proactive steps to inform their clients about secure online practices, emphasizing the importance of user vigilance in safeguarding personal and financial information.

The pandemic also underscored the **need for adaptive regulatory frameworks** to enhance cybersecurity resilience. Regulatory bodies in Poland, alongside EU agencies, responded by tightening cybersecurity protocols and updating regulations for financial services to better protect users. Financial institutions adapted their cybersecurity strategies to comply with these new regulations, often integrating enhanced monitoring systems, comprehensive risk assessment measures, and strengthened incident response plans [160].

A significant challenge highlighted by the pandemic was Poland's **digital literacy gap**, which remains a critical factor in determining the country's cybersecurity resilience. Compared to other EU countries, Poland lags in digital literacy, which has made certain populations more susceptible to cyber threats [161,162].

## 4. Lessons Learned and Recommendations for the Future Work Environment

### 1. Improving Work Organization and Remote Work Adaptation

The COVID-19 pandemic prompted a substantial shift to remote work across sectors in Poland, fundamentally altering work organization. While remote work offered employees flexibility and autonomy, it also presented challenges, including maintaining productivity, communication, and team cohesion. Different sectors faced unique obstacles; for example, higher education and healthcare experienced distinctive challenges in adapting to remote or hybrid models.

#### **Recommendations:**

- Organizations should adopt flexible hybrid models that balance in-office and remote work to meet diverse employee needs. These models should be customized to the specific demands of each sector, recognizing that some roles are suited to remote work while others require on-site presence.
- Ensuring robust digital infrastructure and cybersecurity is essential for supporting remote work effectively. Employees should be equipped with digital tools and

trained in cybersecurity practices to maintain productivity and safeguard organizational data.

- To address new health and safety concerns in remote settings, employers should establish risk assessment frameworks that include ergonomic assessments, mental health support, and cybersecurity risk management.

## **2. Enhancing Employee Safety and Health Support**

The pandemic emphasized the need for prioritizing employee safety, prompting organizations to adopt measures such as physical distancing, PPE provisions, and enhanced sanitation protocols. Psychological support also became critical as employees faced heightened stress, anxiety, and work-family conflicts.

### **Recommendations:**

- Companies should continue the hygiene practices established during the pandemic, including regular sanitation of high-contact surfaces, routine air quality monitoring, and ensuring PPE availability in high-risk environments.
- Organizations should provide mental health resources, such as counselling services, stress management workshops, and peer support networks. Flexible work hours and adjustments for employees balancing work and family responsibilities should be integral to crisis response.
- Safety protocols should be tailored to the unique health risks of different sectors. Continuous risk assessment and adaptive strategies will ensure organizations are prepared for future health crises.

## **3. Strengthening Communication, Trust, and Collaboration**

During the pandemic, maintaining clear communication and trust between employees and management proved challenging. Remote work, in particular, intensified communication gaps and sometimes strained professional relationships, impacting team cohesion and morale.

### **Recommendations:**

- Organizations should establish consistent communication guidelines that prioritize transparency. Regular updates on workplace policies, health measures, and available resources help build employee trust and reduce uncertainty.
- Employers should actively counter misinformation by providing reliable information channels and clear guidance on health measures. This can be accomplished through regular briefings, internal FAQs, and access to verified resources.
- Investment in high-quality digital communication tools will strengthen team connectivity, reduce isolation, and support productivity in remote and hybrid environments.

#### **4. Supporting Work-Life Balance and Addressing Work-Family Conflicts**

The pandemic intensified work-family conflicts, particularly for parents with young children and women, who often bore additional caregiving responsibilities. Balancing professional and personal obligations became increasingly challenging, affecting mental health and job satisfaction.

##### **Recommendations:**

- Flexible scheduling options, especially for employees with caregiving responsibilities, should become standard practice. Options may include flexible start and end times, compressed workweeks, and expanded leave policies during health crises.
- Resources such as on-demand childcare support, family counselling, and parental leave policies can help alleviate work-family conflict. Workshops on balancing work and family responsibilities can also provide valuable support.
- By fostering a workplace culture that values work-life balance, organizations can improve employee well-being, reduce burnout, and enhance productivity. Training management to promote work-life balance and recognize employee needs will further support a healthier work environment.

#### **5. Legal and Policy Adaptations for Occupational Health and Safety**

The pandemic revealed the need for adaptable legal frameworks that allow rapid implementation of safety measures. Policies regarding remote work, health screenings, and flexible working arrangements should be updated to reflect the evolving work environment.

##### **Recommendations:**

- Legal frameworks should reflect remote work realities, ensuring employees' rights are protected and safety standards are upheld. Policies should cover aspects such as work hours, ergonomics, and employer responsibility for providing necessary equipment.
- Occupational health standards should include provisions for infectious disease prevention and crisis management. This includes policies for mandatory health screenings, remote work during health crises, and enhanced health and safety protocols.
- Policymakers and employers should work together to create regulations that balance flexibility with employee protection, ensuring occupational safety standards are both feasible and comprehensive.

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