

Report to ASPHER COVID-19 Task Group

What are the COVID-19 **Lockdown-induced illnesses and why should European public health systems be investigating their epidemiology, treatment, and prevention?**



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Abstract

The COVID-19 pandemic has had a serious impact on population health across the globe. To curb the spread of the pandemic, many governments introduced country-level lockdowns involving a range of social restrictions designed to limit physical-social interactions and mobility and create 'social distancing'. However, these measures have also resulted in extensive unintended adverse health effects on populations worldwide, with over four billion people estimated to have been under lockdown in 2020. ASPHER, as an academic public health community in Europe, has major concerns about the impacts of the pandemic and lockdown being unequally distributed and exacerbating pre-existing inequalities. This paper aimed to explore the anticipated long-term impacts of pandemic-induced lockdowns across Europe on different aspects of health that have been less commonly studied and explored.

A rapid literature review was conducted which included scientific articles found in PubMed, Medline, and Embase that were published before August 13th, 2020 and limited to the European region. A total of 64 studies from 14 countries were included in this review. The lockdown impacts were categorised into five main themes: 1) addictions, substance use, and dependencies; 2) diet and physical activity; 3) mental illness; 4) violence and abuse, and 5) other health issues.

The UK and Poland reported an increase in alcohol consumption among those who were already heavy drinkers as well as those who had mental health issues. An increase in online gaming addiction amongst young people and increased smoking frequency was addiction-related issues recognized by the studies that are induced by the lockdown. People who use drugs also faced challenges in accessing their dose due to limited mobility, with disruptions in oral substitution therapies and social support resulting in an increased risk of relapse. Many countries, including the UK, Poland, Italy, France, and Spain, reported a drastic change in food consumption patterns, with an increased intake of processed and unhealthy food and a decreased consumption of fruits and vegetables. People who have difficulty controlling their food intake are at particularly high risk since irregular eating behaviours may be further aggravated by frequent snacking and cooking during a prolonged stay at home. One of the most commonly reported effects of lockdown was reduced physical activity and a higher risk of increased weight. Many studies also emphasised mental health issues, such as heightened stress, anxiety, negative feelings, bad mood, and hopelessness. Loneliness, forced isolation, and reduced social contact increased the risk of suicides, which was aggravated by the loss of employment, economic consequences, and limited connection to the community.

The mental health impacts of lockdown were observed across all age groups. However, elderly, and young people were the most vulnerable to experiencing mental distress, as well as people with pre-existing mental illnesses, women, and people in precarious economic conditions. Several studies and news reports also reported increases in domestic and intimate partner violence as a concerning impact of lockdown. Additionally, a reduced ability to access direct health and social care services was reported as a relevant factor that has resulted in extended lockdown consequences.

Lockdown-induced illnesses appeared to be a wide-scale problem across Europe. The studies in this review highlighted the multiple vulnerabilities that exist for people with precarious economic conditions, women, children, and people with mental health issues. Lockdown measures, including social distancing, wearing masks, and working from home, may slow the spread of the virus, but they do not address the issues experienced by many people from lower socioeconomic backgrounds. While limited evidence indicated a rise in addictive behaviour during the lockdown, the long-term effects of lockdown on addictions are still unquantified. Given the short duration of the study period, it is unclear whether the increased risk of obesity is attributed more to the change in food consumption patterns or the increased inactivity induced by the lockdown. Despite mental health being widely discussed, studies have inadequately explored the lockdown-induced mental health issues that students and young people may experience. Additionally, a lack of routinely collected data on measures of violence at home and online platforms could pose a challenge to intervening to reduce violence.

It is crucial that the policies developed to control and address the impacts of the COVID-19 pandemic consider its syndemic nature and act simultaneously on both the health and economic impacts. Further reviews using a systematic approach are required to validate the findings of our review and determine the key areas that policymakers should prioritize. To mitigate the negative impacts of this pandemic, including the winter wave, new policy restrictions should be accompanied by national organised information campaigns on the most relevant themes for protecting the health and well-being of the population.

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1. Introduction

The COVID-19 pandemic has seriously affected the population health at a worldwide level. It has illuminated previously unaddressed health inequalities while changing global perspectives of the nature of public health strategies and population-based approaches to disease prevention and control. In addition to the direct health burden of the COVID-19 cases, ‘the lockdown’ approach - which was implemented to curb the spread of the pandemic – led to extensive adverse effects on populations’ health worldwide (1).

1.1. What is Lockdown?

The country-level lockdown has become a broad-brush term for packages including a range of social restrictions that governments have introduced to limit physical-social interactions and mobility to create ‘social distancing’ (2), aiming at curbing the pandemic dissemination. The restrictions derive largely from the types of Non-Pharmaceutical Interventions (NPIs) that were envisaged for influenza pandemics (3). However, countries have different packages of measures that fit under the ‘Lockdown’ umbrella approaches. Social distancing remains at the heart of lockdown approaches. Countries also vary in their timing and degree of lockdown. There is now increased emphasis on local lockdown scenarios as testing/tracing/case-finding systems have been strengthened in many countries.

Lockdown packages may include:

- * Remaining inside the usual household for most of the time, apart from vital activities of key workers or for essential shopping or urgent health needs.
- * Prohibition of non-essential movement into and out of each local community.
- * Closure of non-essential services, including recreational venues such as restaurants and bars.
- * Closure of school, colleges, and universities.
- * Closure of air flights and public transportation.
- * Working from home wherever possible.
- * ‘Shielding’ of highly vulnerable people within their residences.
- * Restricting access to grouped settings/accommodation like hospitals, care homes, prisons, hostels.

The isolation experienced by people as a result of the lockdown measures can be either social isolation (i.e., from family and friends), or functional isolation (e.g., when peers, social support systems or services are inaccessible) (4). Globally, at least four billion people were estimated to be under lockdown by the end of May 2020 (5). Coping with this unprecedented situation involved various strategies such as working and studying remotely, home-schooling of children, and adapting daily routines under the restrictions. Different countries implemented lockdowns in different phases and times, for varying durations, depending on the spread and severity of their national pandemic's epidemiology. Although the pandemic induced lockdown was a preventive measure, it has increased the vulnerability of many population groups in different ways (6). The lockdown has induced stress and anxiety along with changes in lifestyle habits, food consumption and physical exercise (7,8).

While the direct morbidity and mortality due to COVID-19 infections are more obvious - now being well-recognised and reported -, the indirect effects of 'the lockdown' itself on apparently healthy as well as at-risk populations are still unknown. Although lockdowns were implemented temporarily, they may have long-lasting effects on the health and wellbeing of different population groups (5). ASPHER, as an academic public health community in Europe, has major concerns about the impacts of the pandemic being unequally distributed and exacerbating pre-existing inequalities (9). ASPHER is also concerned about the winter of 2020/21 in European countries that may require a long time of lockdown and also recognises additional winter hazards such as seasonal viruses and cold homes (10,11). Additionally, the pandemic has caused a delay in general health services, shifting the focus from regular health services to the treatment and management of COVID-19 infections (12). Hence, a rise in various health issues as an impact of months-long lockdown can be anticipated all over the world.

While prevention, treatment and contacts' management of COVID-19 infections had been the core of pandemic control, there has been a growing focus on other important indirect impacts of the pandemic, such as physical activity and diet, addiction, violence, and abuse arising from the lockdown. These impacts include mental illness due to limited mobility and extended health effects due to the disruption of health care services for non-COVID-19 patients (13). It is also necessary to have a holistic view of the extent of the lockdown's impact on health and wellbeing of the populations to estimate the total burden of the ongoing pandemic on health and healthcare systems in different countries (14). Therefore, this paper addresses the anticipated long-term impact of the pandemic-induced lockdown on different aspects of health, in European populations that may be less commonly studied and explored. We recognise that there may be some beneficial aspects of lockdown for some people/groups that also may

emerge in the evidence base. Besides, this report will seek to illustrate causal or explanatory pathways that underlie lockdown-induced illness.

2. Methods

To explore the impact of lockdown on different aspects of health and well-being in Europe, NP conducted a rapid literature review and searched scientific articles in three databases, PubMed, Medline and Embase, published from March 2020 up to August 2020, limited to English language and the European region. This search resulted in a total of 113 journal articles after removing duplicates, which, further reduced to 76 articles after the abstract screening. After complete article screening, 49 published studies were included in the review. This review was made comprehensive by also including recent newspaper articles as well as non-journal technical review reports and also online grey literature. An additional search was later performed in the preprint server medRxiv using the same search terms which resulted in a total of 20 preprint articles out of which ten were included. Additionally, useful evidence covered in seven news articles was included in the review. Studies/articles/literature discussing the effects of lockdown/social isolation on various aspects of health were included, and those discussing the consequences of COVID-19 infections were excluded in this review. Evidence from the identified studies concerning lockdown impacts on various health aspects was extracted and summarised separately for the main identified themes. Due to the diversity of methodologies, settings and study outcomes among the included publications, no statistical pooling was possible, and the main findings were synthesised narratively.

3. Findings

A total of 66 studies from 14 countries were included in this review, 44% of the total studies were from the UK, 30% from Italy and the rest from other countries. Diverse categories of health impacts were identified through studies and articles included in this review, which are summarised in Table 1. The lockdown impacts were categorised in five main themes: 1) addictions, substance use, and dependencies; 2) diet and physical activity; 3) mental illness; 4) violence and abuse; 5) other health issues.

Table 1 - Summary of the 64 studies and articles included in this review

Themes	Number of articles	Countries	Type of publication
Addiction/Substance use, dependencies	6 (one grey literature, one study on addiction and diet)	UK, Poland	Opinions, Review, Editorials, News article, Longitudinal study
Diet and physical activity	18 (four preprints)	Italy, UK, Ireland, Germany, Spain, Austria, France, Belgium	Cross-sectional study, Case-control study, Cohort study
Mental illness	30 (six preprints, three news article, one study on physical activity and mental health)	UK, Italy, Spain, Czech Republic, Poland, Switzerland, Austria, France, Malta	Cross-sectional study, Case-control, Cohort study, Viewpoint, Literature review, Qualitative study
Violence and abuse	5 (one preprint, three news article)	UK, Germany, Ukraine	Commentary, Editorial, Viewpoint
Other health issues	9 (one preprint, one news article)	UK, Portugal	Case-control study, Narrative, Viewpoint, Modelling study

Figure 1: Graphical visualisation of lockdown impacts and increased vulnerabilities

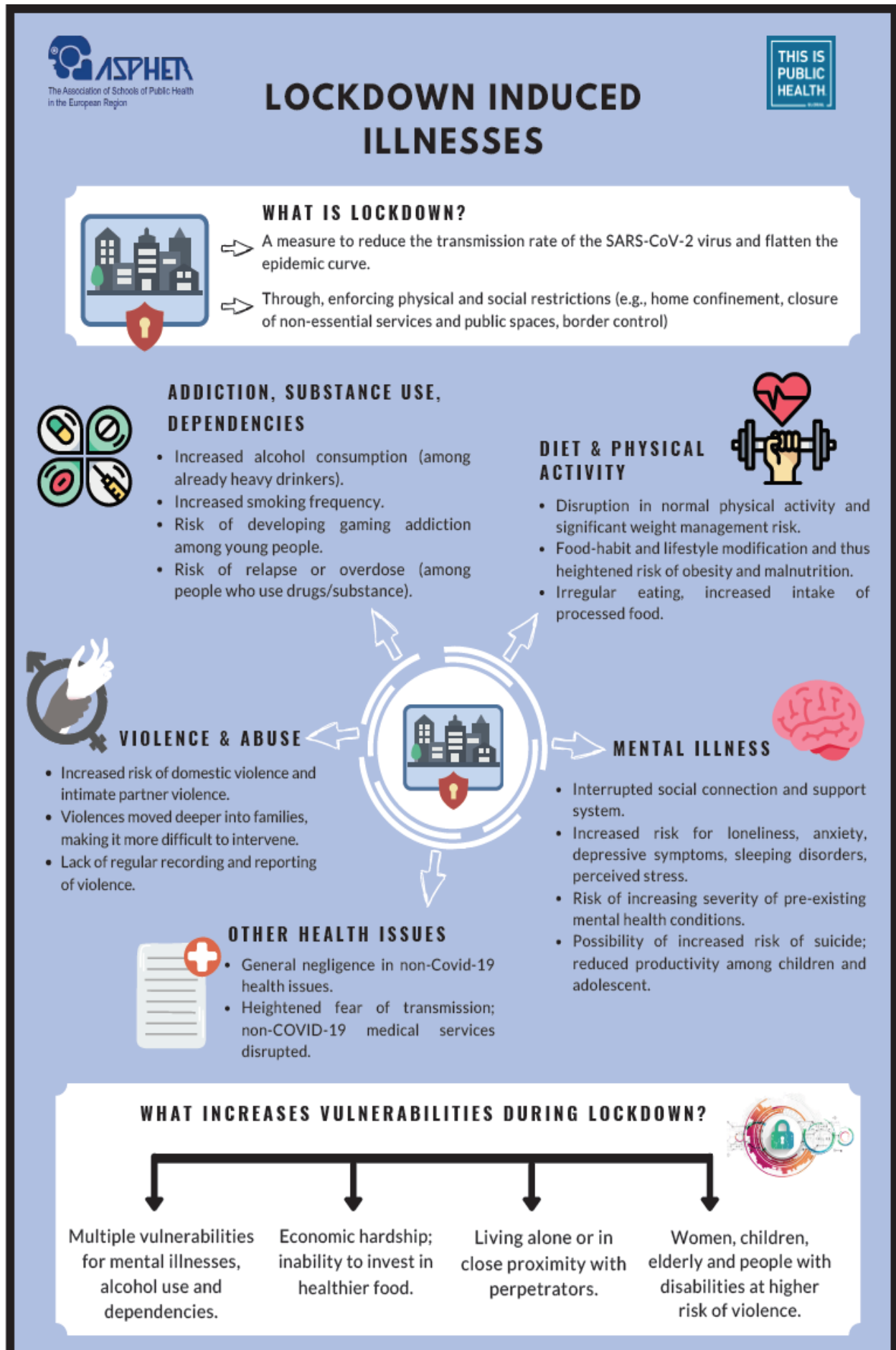


Table 2 - Summary of the key issues from the studies included in the review

Themes	Key Issues	Vulnerabilities	(Health) Policy implications
Addiction, substance use, dependencies	<ul style="list-style-type: none"> - Increased alcohol consumption (among already heavy drinkers) - Increased smoking frequency - Risk of developing gaming addiction among young people - Risk of relapse or overdose (due to limited access and disruption in substitution therapies during lockdown) 	<ul style="list-style-type: none"> - Multiple vulnerabilities for those having mental health issues, and alcohol and substance dependency - Young people more at risk of developing online game addiction due to their frequent use of Internet 	<ul style="list-style-type: none"> - Information campaigns about the risk of alcohol addiction - Consultations and organising self-help groups - Continuity of care for alcohol and substance addiction, including keeping supervised substitution therapy open for people who use drugs - Information campaigns about the risks of gaming addiction.
Diet and physical activity	<ul style="list-style-type: none"> - Disruption in normal physical activity and significant weight management risk with the closure of gyms, fitness centres and restricted outdoor activities - Food-habit and lifestyle modification and thus heightened risk of obesity and malnutrition - Irregular eating, increased intake of processed food - Increased sedentary time and anxiety related to food habit and thus the weight 	<ul style="list-style-type: none"> - Young people and adolescent at higher risk of developing irregular food habits and higher consumption of process food - Additional challenges for already obese and diabetic people - People with lower socioeconomic background face a higher challenge to eat healthily - Loss of jobs during lockdown limited the ability to invest in healthier food 	<ul style="list-style-type: none"> - Offering online, TV or app-based training programmes to work out from home - Consider occupancy, limits required in gyms/fitness studios instead of their closure - Offering information campaigns about healthy “lockdown” diets as well as digital consultations and help-line support - Providing vouchers for fruits and vegetables for populations with lower income
Mental illness	<ul style="list-style-type: none"> - Increased risk for loneliness, anxiety, depressive symptoms, sleeping disorders perceived stress due to interrupted social connection and support system - Risk of increasing severity of pre-existing mental health conditions - Possibility of increased risk of suicide - Possible consequences on the productivity of children and adolescent; poor home-schooling space and facilities; women overburdened with added responsibilities in families 	<ul style="list-style-type: none"> - Populations living alone (younger adults, single women, elderly) - Precarious reserves and disposable income; Loss of job during the lockdown - Extra hours worked from home in unsuitable work environments - Unequal connectivity with online educational interaction or resources - Lack of parental schooling skills or access to professional home teaching support 	<ul style="list-style-type: none"> - Provide mental health support while social distancing in safe and interrupted way - Assuring continuity of mental health treatment - Increasing the capacity of existing mental health support helplines - Communication of all policies in a transparent way to reduce anxiety - Work arrangements that prevent loss of income and allow for home-schooling for both parents
Violence and abuse	<ul style="list-style-type: none"> - Increased risk of domestic violence and intimate partner violence - Violence has moved deeper into families and become difficult to intervene - Lack of regular recording and reporting of violence 	<ul style="list-style-type: none"> - Living close to the perpetrators during the lockdown - Women, children, elderly, and people with disabilities are at higher risk - Discontinuation of social support services 	<ul style="list-style-type: none"> - Promoting and expanding capacities of helplines - Strengthening the network of social workers, regular telephone checks - Expanding the capacity of shelters for victims where they can safely social distance
Other health issues	<ul style="list-style-type: none"> - Non-COVID-19 medical services disrupted - General negligence in non-COVID-19 health issues including major deaths causes such as cardiovascular diseases (myocardial infarction and stroke) and cancer (diagnostic paths) 	<ul style="list-style-type: none"> - Interruption of regular non-COVID-19 related health services like a routine health check-up 	<ul style="list-style-type: none"> - Digital e-health treatment solutions, home visits for elderly

3.1. Lockdown and addictions / substance use / dependencies

Six studies discussed the impact of the lockdown on addictions and dependencies. Initial evidence shows that lockdown appears to have induced some newer addictions and dependencies while increasing the severity for people who already had one. The UK reported that almost one in five individuals who drank alcohol daily had further increased the amount since the beginning of lockdown. There was a 31.4% increase in retail alcohol sales during the lockdown (12). Even though alcohol sales increased, the closure of many local bars and alcohol outlets might have aggravated the condition for those already having alcohol dependency, thus worsening their withdrawal symptoms (15).

A study conducted in Poland suggested that those who have increased the consumption of alcohol after the start of lockdown were already having some mental health issues such as lower coping mechanism, hopelessness, low self-esteem depression and suicidal thoughts (16). Another study in Poland conducted on a representative sample from the general population showed that 14.6% of people reported increased levels of alcohol consumption, which was higher among those already having alcohol dependency compared to those who were not alcohol dependent. Similarly, 45.2% of the respondents reported an increase in smoking frequency.

On the other hand, in Italy, a small proportion (3.3%) of people who were highly aware and conscious about the increased risk of respiratory distress and increased mortality from COVID-19 have reported a remarkable decrease in smoking frequency (17). In the UK, some groups of people also have reported a decrease in their alcohol consumption frequency following lockdown (12). The groups that reported a reduction in alcohol consumption or abstinence were usually younger populations. However, in these populations, some individuals developed online gaming addiction (18). In Europe, it was found that the rate of the games download was the highest worldwide (19). While gaming can serve as a short term adaptive coping strategy for the anxiety due to lockdown (20), several months of lockdown with the cancellation of sports and other activities, younger populations appear more likely to develop online gaming addiction, sleep disorders and obesity (18,21). As the lockdown restricted the movement of people, including injecting drug users (IDU), it limited access to their drug of choice. This specific situation might lead IDU to use alternative drugs and thus result in overdoses due to unfamiliarity with the new substance (14,22). The lockdown also increased the risk of relapse

due to disruptions in IDUs social network, social support, and access to oral substitution therapies (OST).

3.2. Lockdown, diet, and physical activity

Many studies (n = 18) have demonstrated that the lockdown posed a significant weight management risk particularly for overweight and obese people due to disruption in normal physical activity, with restraints from going to gyms or outdoor activities (5,7). The lockdown also appears to have interfered with the individuals' ability to control their food intake due to lack of routine and boredom. People who have difficulty in controlling their food intake are already at high risk due to their irregular eating behaviours (23) which may be further aggravated by frequent snacking and cooking during a prolonged stay at home (5,24). Adults in Malta reported overeating (25), while one-third of respondents in Poland (5) reported having consumed less fresh vegetables and fruits daily, also declared an increase in the daily consumption of sweets. Similarly, in Italy, 86.0% of respondents reported that they were unable to control their diet sufficiently (26) and 20% of students have started eating more or having worse diet habits (26).

Some countries, including France, Spain, and Italy, implemented stringent lockdown, restricting people from doing sports or physical activity in groups. In contrast, other countries such as Belgium or Austria were relatively liberal on lockdown to allow people to exercise, albeit under clear restrictions (27). Although the sharp reduction in physical activity was attributed to higher fear of infection and transmission in France, Spain and Italy (28), it is apparent that the lockdown in European countries, in general, has disrupted daily activities especially sports and exercise (8,29). A study conducted among Italian students reported that following lockdown, 50% of the students had reduced physical activities which was further confirmed by a comparative study conducted in Europe and Latin America (8). The latter reported a higher prevalence of physical inactivity and consumption of ultra-processed food, especially among the young population and adolescents. Similarly, between the UK and Ireland, a study reported that younger people (18-29 years) demonstrated more negative changes in exercise behaviour compared to all other age groups during early COVID-19 lockdown (30). Another study estimated that as a result of physical inactivity due to the implemented restrictions, up to 392,948 new cases of Diabetes in the 70+ age group may be expected in England, resulting in the estimated excess healthcare costs related to new diagnoses of Diabetes of £1.17 billion (31). These adverse changes in the dietary patterns,

especially in early years of life is important as they increase the subsequent risk of degenerative diseases such as obesity, diabetes, and cardiovascular pathologies (6), also leading to poorer mental health and well-being (30,32).

As a result of such dietary changes, people have reported notable increases in their weight. People that were already overweight before the lockdown reported a further increase in their weight (30% in Poland and 48.6% in Italy) (5,17,29). Some underweight people reported a further decrease in weight (18% in Poland) (5) during the lockdown period, which potentially might make them more vulnerable to infection and other illnesses. In a French cohort, during the lockdown, trends for unfavourable nutritional behaviours were observed, such as weight gain (for 35%; +1.8kg on average) or weight loss (for 23%, -2kg on average), decreased physical activity (53%), increased sedentary time (63%), increased snacking, decreased consumption of fresh food products (especially fruit and fish), increased consumption of processed foods such as sweets, biscuits and cakes (33).

These dietary changes are worrisome, as they increase the risk of not only malnutrition and obesity but also of a possible more severe course of infection of COVID-19 and risk of fatality (34–37). Increased weight gain was further found to be associated with adverse mental burdens linked to COVID-19 (29). Another online survey conducted in Italy also reported that half of the respondents felt anxious about their eating habits and resulted in consuming more comfort food (usually junk and fatty) to make themselves feel better (38). For people who were more concerned about weight and eating habits, the lockdown has induced this vicious cycle which in the long-term might lead to eating disorders. Therefore, people with already increased BMI are more prone to lockdown-related adverse dietary modification, leading to higher vulnerability of the obese and overweight people to infection and its severity. Moreover, as the French study reported, the behavioural dietary trends were related to the sociodemographic and economic position, professional situation during the lockdown (teleworking or not), having children at home, anxiety and depressive symptoms, as well as diet quality before the lockdown (33).

However, a multi-country study which also included Italy and Spain reported that the lockdown-related dietary habits improved with more consumption of fruits and vegetables when the mothers were well-educated and possibly linked with higher-income families (6). A study conducted in Belgium showed that people who were aware of the physical activity's importance and were highly active before the lockdown also reported higher physical activity during the lockdown (27). This finding further reinforces the idea that people who have low-

income and unable to invest in healthier food are more likely to rely on unhealthier food habits during the lockdown, making them more vulnerable to multiple related health conditions.

The continuation of regular physical exercise is indeed very crucial for people who are already obese and diabetic. Studies conducted in Italian adolescents (39) and adults (40) reported that even during the lockdown there has been an effective glycaemic control among diabetic people when they adhered to regular physical activity at home, had access to good meals, were self-aware of their condition and had a better lifestyle. However, the lockdown has made it more challenging than ever for individuals who could not adhere to their regular physical exercise routine for various reasons. For example, due to the lack of space in their homes (41), restricted access to public spaces or lack of support from family.

One study estimated that severe obesity alone was generally not associated with high mortality risk for COVID-19, compared with other high-risk conditions including cardiovascular disease, diabetes (CVD), COPD, and chronic kidney disease (CKD). However, the study estimated, that a 3-month long lockdown could result in 97,755 to 434,104 obese individuals in England transitioning to “high-risk” groups, CVD, COPD, diabetes and CKD, that have a higher risk of mortality from the COVID-19 infection (42). The study highlighted that physical activity could be protective against adverse outcomes during the lockdown and prevent people from transitioning to high-risk conditions.

3.3. Lockdown and mental illness

Even though the lockdown remarkably helped in flattening the epidemic curve, the fear of infection and death, pandemic restrictions and greater social distance, produced psychological distress, anxiety and behavioural modifications (17,43). The lack of physical contact with family members, cancellation of many celebrations such as weddings and graduations, being unable to meet loved ones in hospitals and attend funerals, had a detrimental effect population’s mental health, possibly inducing post-traumatic stress disorder (PTSD) (44). Several studies have evaluated the mental health burden during the COVID-19 lockdown, such as increase in negative emotions, rate of anxiety disorders, depressive symptoms, perceived stress, post-traumatic stress disorders, and sleep disorders (29,44–47). A total of 30 studies discussing mental health and well-being impacts of lockdown across European countries were included in this review.

Loneliness, forced isolation, and lesser social contact increased the risk of suicides, which was aggravated by people losing jobs, economic consequences and limited contacts with their community (45,48). By the beginning of lockdown, the severity of pre-existing mental health conditions increased (45), along with many lockdown-related mental health issues. For example, claustrophobia due to prolonged stay in the same space, and reduced ability of self-care (49).

An Italian survey reported that, for various reasons, 61.3% of the respondents had a lower/bad mood during the lockdown (38), while 70.4% reported anxious feelings, such as exhaustion and depressed moods. Around 37% of respondents reported lower productivity, 62.7% suffered from subthreshold insomnia, 16.3% suffered from moderate clinical insomnia and 1.1% from severe clinical insomnia. Other Italian studies reported a higher prevalence of depressive symptoms, anxiety, and sleeping disorder during the lockdown when compared to the pre-lockdown period (50,51). On the contrary, a smaller proportion of people reporting a feeling of happiness (46). Similar findings were reported in Spain (41), the UK (52), and Austria (53). In Spain, 49% showed mental health problems during lockdown (41). In a UK study, the levels of anxiety and depression symptoms during lockdown were substantially higher than normative data derived for the UK adult population (52). In Austria, the prevalence of depressive symptoms was five-fold higher compared to years between 2013 and 2015 (20% compared to 4%, respectively)(53) that were associated with physical and social isolation (52), proximity to COVID-19 positive cases, longer duration of lockdown and sleep disorder (51,54).

A quasi-experimental study conducted in Austria, Germany and Switzerland showed that the lockdown has also drastically changed the sleep cycle and reduced the quality of sleep, thus leading to an increased self-perceived psychological burden (55). Such irregularities in the sleep cycle is a risk factor for mental health symptoms, hopelessness, and depression.

Negative mental health impacts of the lockdown could be observed not only in the adult population but also in children, adolescents, and their parents. For instance, a study from Spain reported that, during the lockdown, children felt sad, nervous, overwhelmed, worried, lonely, bored and angry even though they enjoyed learning and playing games at home (56). Limitation in going outdoors, and staying away from their schoolmates, friends, grandparents, cousins also had a detrimental effect on their mental well-being. Another study in Italy showed that the closure of schools and the restrictions to leave home affected children's emotions and behaviour. According to the study, 26% of children showed regressive symptoms of the demand for physical proximity to their parents during the night, 18% manifested unprecedented fears (57). A study of young adults in Switzerland showed that during lockdown

students felt significantly more socially isolated, depressed, anxious, worried about family and friends, the economy, and their future career (58). Italian parents of children with a mental or physical disease experienced higher levels of parental burnout and perceiving less social support compared to other parents during lockdown (59).

Another longitudinal study from the UK showed that both loneliness and decreased physical activity were associated with worse mental health in 2020, compared to previous years (60). The most vulnerable groups to experience mental health distress were identified in the literature, such as individuals with pre-existent mental illnesses (59), the elderly (48), women (41,48,50,51,58,61,62), young people (51,61), people in precarious economic conditions, people with lower attained education or income, the economically inactive, people living alone and urban residents (41,62,63). A study from the Czech Republic highlighted that fear of economic burden, unavailability of health care and insufficient supply of food (62) induce the risk of anxiety among vulnerable population.

On the other hand, those people with higher socioeconomic backgrounds were better able to derive some positive perceptions and psychological outcomes from the lockdown period (49). Considering the presence of depressive symptoms, being married, a cohabitant and being employed was considered to be a protective factor (50).

3.4. Lockdown, violence, and abuse

Another appalling lockdown consequence is the increased rate of domestic violence, intimate partner violence and abuse, where women, children, the elderly, and people with disability are at increased risk (64). In this review, five studies and press reports were identified that discussed the increased domestic violence during lockdown (45), which has long been associated with alcohol abuse (16). Forced isolation, living in close proximity to perpetrators, and limited access to the support services increased the risk of PTSD among the domestic violence victims. In the UK, domestic violence, sexual violence, and abuse increased during the first two months of lockdown, as shown by the increased demand for different support services and help-lines (65). A 34% increase in calls to their help-line was verified since the beginning of lockdown (65). Despite seeming to decrease during the first days of lockdown, the victims of intimate partner violence reported social isolation, functional isolation, surveillance, and control of daily activities by perpetrators. These situations were aggravated by greater exposure, psychological and economic stressors and negative coping mechanisms such as addiction and excessive alcohol consumption (4). With increased time spent in the

online platform, there is a foreseeable risk of online grooming and sexual abuse for children and adolescent, but none reported in the studies.

3.5. Lockdown and other health issues

The remaining nine studies included in the review focused on other issues related to the lockdown, mostly about the response of health care systems and health care use. Hospitals in Germany (66) and Spain (67) have reported up to 25% reduction in hospital admissions due to stroke, not suggesting a decrease in its incidence, but more importantly a sheer avoidance of early symptoms due to lockdown and restrictions. In a worldwide Health Care Professionals' (HCP) survey conducted by the European Society of Cardiology (141 countries, 3101 responses; 50% responses from Europe), 79% of the HCPs confirmed decreased admission rate of patients with ST-elevation myocardial infarction (STEMI) decreased, and 65% confirmed a reduction of more than 40% as compared to the period before lockdown (68). Additionally, the HCPs also reported delayed hospital presentation, with more than 40% a presentation beyond the optimal window for primary percutaneous intervention or thrombolysis. While all efforts were made to keep the treatment of cancer patients as in a normal situation, a UK population-based modelling study reported that substantial increases in the number of avoidable cancer deaths in England are to be expected as a result of diagnostic delays due to the Covid-19 pandemic and lockdown (68). Following the identified trend, health care providers forecast serious healthcare and economic consequences as a result of undiagnosed and untreated strokes. Also, many countries observed a significant reduction in the number of psychotherapy sessions during country-specific lockdowns (69–71). For example, in Austria, the number of patients treated during lockdown (personal, phone or virtual contacts) decreased by one-third (69). These situations can exert pressure on all aspects of the health system, and the burden could be more pronounced in less equipped and less organised systems. This provides a perspective on the need for health care institutions to prepare for the upcoming burden due to increased number of severe stroke cases. Digital e-health treatment solutions were recommended to assure the continuity of treatment, along with the protection of the health of patients and professionals (69–71).

People with pre-existing medical conditions might have experienced an intensification of their health conditions and overall lower quality of life compared to healthy individuals. A cohort study in the UK observed a significant increase in pain among people suffering from chronic

pain compared to the pre-COVID period, as well as higher levels of depression and anxiety compared to those without chronic pain (72).

4. Discussion

The lockdown-induced illness appears to be a genuine phenomenon on a large scale. This review provides an overview of the priority topics that should be considered by policymakers in the future planning of the pandemic-related restrictions and lockdowns. The 64 studies included in this review revealed some of the complexity of relationships with new or exacerbation of pre-existing health conditions, due to: restrictions in mobility, social contact, reduced exercise, outdoor activity, dietary habits, substance and alcohol use, and various psychological conditions (73). Reduced ability to have direct healthcare contact or social care support was a relevant factor that resulted in the extended consequences of the lockdown.

Coping strategies suggested during the lockdown, such as social distancing, wearing masks, teleworking, etc., do not adequately address the issues and challenges of people from lower socioeconomic backgrounds (74). Inadequate social representation in adaptive strategies for lockdown increases the vulnerability of the aforementioned population groups, not being addressed with the required attention, intervention and support to cope with health issues during the lockdown (64). The closure of several industries, including construction work, transport, tourism, and factories, has cut the income source for many workers and their families, whereas, those who could retain their jobs and work from home had less or no economical strain (42,75). The socioeconomic impact was dramatic, reflecting GDP reductions by 13.9% across the EU in the second quarter of 2020, compared to the same quarter in 2019, as per OECD reports (73). Similarly, countries in Europe, such as Denmark, Germany and Finland -that was top on the list for reducing inequality index in 2018 (76) - have also failed to maintain the reduction in inequalities (77).

Socioeconomically disadvantaged and vulnerable people (e.g., the elderly, people in care homes, living with HIV, people with addictions and survivors of violence (13,41,49) who required more frequent social contact, support and health services) were disproportionately affected by consequences of lockdown (e.g., cancellations of social gatherings, religious ceremonies, community events, etc.) (78,79). Although some studies recommended continuation of social support and health services through digital media (69–71,78), there was

a gap in identifying the needs of the elderly population and other individuals who have limited access to social media, online communications and other digital platforms (2). The approach and implementation of future lockdowns should be re-defined to protect all groups in society.

Despite limited evidence indicating an increase in addictive behaviour during the lockdown, long-term effects of this measure on addictions are still unquantified. There is inconclusive evidence on the mechanisms through which lockdown induces stress, boredom, isolation, and physical distancing might affect substance use or alcohol consumption patterns of individuals at higher risk. Similarly, in Europe, despite the record of the highest downloads of online games, only a few studies have been published on online gaming disorders. India, a country with one of the highest proportion of young people, reported an almost 200% increase in the gaming user base during the lockdown as compared to before lockdown (80,81). This new addition of online games requires adequate attention, with the risk of leading to online gambling (82), as the boundaries between gaming and gambling are getting increasingly blurred.

Although evidence on change in patterns of food intake and increased inactivity was verified in the reviewed articles, the temporality, and the direction of association for the lockdown induced inactivity, frequent consumption of unhealthy diet and, thus, the risk of obesity, is not fully understood. Given the short duration of the study period, it is unclear whether the increased risk of obesity could be attributed more to changes in food consumption patterns or increased physical inactivity induced by the lockdown. Also, the lockdown appears to have affected the general availability and use of food, increasing the risk of food insecurity among people from low socioeconomic backgrounds (83,84).

Mental health had been one of the common issues discussed widely during the lockdown. However, studies have inadequately addressed the mental health issues among students and young people (41,49), along with a foreseeable loss of creativity as a consequence (85). Elderly in care homes are more prone to endure other mental illness due to social isolation resulting from restrictions in receiving visitors and families due to lockdown (86). Very limited studies on the effects of lockdown on violence were identified in this review, despite the frequent press coverage about the increased domestic violence against women. However, this might also reflect already existing violence in society. Nevertheless, due to lockdown and discontinuation of social support, the risk of violence has been more severe and deeper into families where it is normally very difficult to recognise and intervene. Despite the multifactorial causation of violence and the wider COVID-19 crisis, the lockdown has certainly heightened the risk of violence in homes (65). Following the pandemic, violence against women had been

declared as ‘the shadow pandemic’ by the UN Women (87). With many countries having uplifted the lockdown, PTSD among victims can be expected to increase and thus the need for services that provide adequate support (88). The lack of routinely collected data on measures of violence at home and online platforms (65) could pose a challenge in addressing this shadow pandemic.

Studies included in this review rarely discussed the challenges faced by people with disabilities. In Europe, it is estimated that up to 2.2 million people experiencing disability are suffering from collateral damage due to the lockdown and closure of rehabilitation services (89), and thus are in a higher risk of household and sexual abuse. Many vulnerable groups who are already facing disadvantage, including the migrant, refugee, asylum-seeker population in Europe could be facing deeper impacts of the lockdown (90). These groups are more likely to live in crowded houses, exert manual labour jobs (where the risk of infection is higher), become unemployed and have limited access to the Internet (91). Poor housing conditions, fuel poverty, cold homes and possible health consequences have rarely been discussed.

Having identified the extended consequences of the lockdown, it is equally important to address the fact that COVID-19 is not a stand-alone pandemic. This pandemic needs to be addressed as syndemic to underline the social origins of the identified vulnerabilities (92). A syndemic approach could provide opportunities for integrating public health, clinical medicine, and social equity, rather than only simply controlling the pandemic through treatment and social isolation. “The Global Syndemic of Obesity, Undernutrition, and Climate Change: The Lancet Commission report” (93) published by Lancet in 2019, highlighted the synergies of coexisting epidemics that produce complex sequelae and share common underlying societal drivers. The ongoing COVID-19 pandemic exhibits similar syndemic nature (94) and has occurred at time of several societal, racial and environmental issues, including racial inequality movements, widening the inequality between various groups of the population. Several studies reported that lower socioeconomic status, racial and ethnic discrimination were associated with worse COVID-19 outcomes (higher infection and mortality rates) (95–99). A report from Amnesty International on enforcement of lockdown in 12 European countries highlighted that it has led to greater marginalisation, stigmatisation and violence against ethnic minorities (96,100). However, in European countries, there is surprisingly scarce evidence on the impact of the pandemic on racial and ethnic minorities (98). It is crucial for future policies to consider synergies between health, societal and environmental issue, acting on a transversal way to achieve the best possible impact.

During the lockdown, although many countries introduced work arrangements to retain jobs, the protection coverage for all population groups was not successful, which led to higher unemployment rates. For instance, the Austrian government's employment support policy announced and implemented the quick introduction of a short-term working scheme to help retaining jobs (101), yet the unemployment rate increased from 8.7% in January to 12.8% in April 2020 (102). In Germany, the highest unemployment rate since 2016 was verified, in April and May 2020 (103). On the other hand, for people whose jobs were retained and who could telework, long working hours, physical inactivity, and irregular sleep cycles could indicate the emergence of new occupational risk.

Currently, health/support services are more limited than ever (15). Furthermore, many health specialists anticipate a rise in untreated mental illnesses following lockdown, which can worsen in time and might require greater input for treatment (104) placing more strain on the health system. The current reported numbers of stress and anxiety cases in studies and registered in health centres can represent an underrepresentation for people with lower socioeconomic backgrounds. As presented in the "Health at a Glance" report, large reductions in the use of outpatient services and specialist care appointments have been reported in several countries. More worrisome, there were noticeable delays in cancer care, including diagnoses and treatments, which might impact patients' survival rates in the future (73). The most frequently appearing impacts of the lockdown could serve as a starting point for the formation of educational campaigns and policy actions (Table 2).

As a second or winter wave of COVID-19 has started in most countries in Europe, there is an urgent need to formulate and evaluate emerging supportive interventions and public health strategies to prevent lockdown-induced illnesses.

5. Conclusions and Recommendations

Although the lockdown was introduced to curb the spread of the epidemic, it also resulted in many negative impacts on the population. These impacts could be in large part attributed to lifestyle behaviour changes that were necessary to adapt to the unprecedented new circumstances. Lockdown has substantially increased the addiction problems alongside the increase in unhealthy diet and physical inactivity. Mental illnesses were the most prominent health conditions that resulted from lockdown, along with domestic violence. Most of the consequences are complex in nature and can have a long-term impact on individuals. These impacts reiterated and manifested the pre-existing social inequities in health. The burden of

the pandemic is hardened on the vulnerable population, which is also very likely to be aggravated in subsequent pandemic waves. The coping strategies for lockdown were non-comprehensive and were unsuccessful in protecting the most vulnerable population groups. This context calls for the need of governments to re-design the strategies and to be prepared for the possible second wave.

More studies from all countries in Europe are needed to estimate the scale of the problem, to highlight inequalities and explore the effects of lockdown in detail. Lockdown highlights the need to further emphasise the importance of promoting and supporting a healthy lifestyle, especially for physical exercise and dietary adjustments, for the periods this measure is implemented.

A large proportion of studies focused on mental health impacts, which could still be under-representing the actual situation. **Many general health services, along with mental health support services, should be extended in all areas, especially in low socioeconomic settings to improve access of services by vulnerable populations.** Limited data and studies were found to be available on vulnerable population groups as well as on violence. **More extensive community support services are required to identify the victims of violence during the lockdown and provide them with appropriate support services.**

Organised nutrition support during future lockdowns that can be achieved through the engagement of health authorities, social media campaigns, and remote dietitian services. **Public health awareness actions regarding excessive alcohol use, unhealthy diet and inactivity during quarantine should also be issued to protect more vulnerable subjects.**

Health systems and educational system **should develop integrated and tailored support services for students, as a strategy for the reopening of schools that help students who might have been affected by lockdown.** The integrated approach could include safe social interaction, alternative education activities to address the possible gaming disorders and mental illnesses among students and young people.

Studies exploring the differences in lockdown effects across different socio-economics groups and vulnerable populations are required to further understand the extent of impact by income groups. There is now an opportunity for follow up studies to assess the long-term impact of the pandemic on different vulnerable populations.

More reviews in a systematic manner are required to validate the findings of our review, as well as the actions needed to inform governments and others about the key areas to

prioritise and prepare. Additional funding and proactive measures will be needed, as lockdown type scenarios are being considered as the pandemic resume more pervasively over the coming Winter months. To mitigate the negative impacts of this pandemic, **new policy restrictions should be accompanied by national organised information campaigns on the themes most relevant for the health and well-being of the population.**

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