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COVID-19 confinement impact on weight gain and physical activity in the older adult population: Data from the LOST in Lombardia study

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SUMMARY

Background & aims: COVID-19 containment measures significantly impacted lifestyle of the general population, including physical activity. Although the older adults are particularly susceptible to the potential consequences of sedentary lifestyle and inactivity, few studies investigated pandemic effects in this segment of the population. We aimed to evaluate COVID-19 pandemic effects on weight gain and physical activity in the Italian older adults, and assess the impact of possible changes in physical activity on mental health wellbeing.

Methods: In November 2020, a cross-sectional survey was conducted on a representative sample of 4400 older adults (aged 65 or more) from the Lombardy region, Northern Italy. Changes in body mass index (BMI) and physical activity were assessed, compared to the previous year. Using unconditional multiple logistic models, we estimated the odds ratios (OR) and the corresponding 95% confidence intervals (CI) of a decrease in physical activity during COVID-19 pandemic and we evaluated if decreased physical activity was a determinant of a worsening in psychological wellbeing.

Results: Neither weight gain nor increase in obesity prevalence occurred during the pandemic. Mean time spent in physical activity significantly decreased, with 43.8% of participants reporting a decrease of 1 h/week or more during COVID-19 pandemic. A decreased physical activity was determinant of a worsening of selected mental health outcomes, such as: sleep quality (OR = 2.45; 95% CI: 1.91–3.15) and quantity (OR = 1.54; 95% CI: 1.18–2.02), anxiety (OR = 1.31; 95% CI: 1.14–1.52) and depressive symptoms (OR = 1.61; 95% CI: 1.38–1.88).

Conclusion: During the COVID-19 pandemic, while no major changes in BMI were observed, physical activity significantly declined in the older adults. In this population, the lack of physical activity might have contributed to the observed worsening in mental health. During emergency periods, encouraging physical activity might be effective also to preserve psychological wellbeing.

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1. Introduction

Italy was among the first European countries to report a case of SARS-CoV-2 infection [1] and was also the first country to impose on 9th March 2020 a nation-wide stay-at-home order, as an attempt to stop the coronavirus spread [2]. In particular, the Lombardy region has been the most affected Italian region, reporting the highest number of infections and the maximum congestion of the hospitals [3–5]. The emergency period was prolonged throughout 2020, and shorter lockdowns were repeated in fall and winter. The imperative "stay at home", necessary to control the spreading of COVID-19, impacted lifestyle habits of millions of people, including dietary habits and physical activity [6–9].

Recent studies have assessed the impact of these national lockdowns on body mass index (BMI) in the Italian general population, highlighting a substantial weight gain [10,11]. As expected, a significant reduction in the total amount of performed physical activity during the COVID-19 pandemic was also reported in the scientific literature [6,7,12]. However, most of these studies were based on heterogeneous convenience samples [8], and data were mainly obtained through online surveys, only partially able to reach the older adults [6,7,13,14].

Nevertheless, for several reasons it is crucial to analyze the COVID-19 pandemic effects on BMI and physical activity in this vulnerable segment of the population. First of all, the older adults are more prone to geriatric syndromes and chronic conditions, many of them related to a sedentary lifestyle and inactivity [15–20]. Secondly, it has been shown that in the older adults, a reduction in physical activity, social isolation and changes in daily life or living environment, are related to a deterioration in mental health and psychophysical wellbeing [21]. Several studies highlighted the detrimental effects of COVID-19 lockdowns on population mental health [22,23], in particular in the older adult population [24,25], the demographic subgroup more hit by the pandemic, where most of the confirmed cases and deaths have occurred [26]. A further reduction in physical activity and a modification in lifestyles, may have exacerbated an already fragile mental health status. In addition, findings from the general adult population are unlikely applicable to the older adults: indeed, the increased risk of a worse prognosis in this population, may have caused more radical reactions to confinement, leading the older adults to extremely limit their movements and social contacts; by contrast, their already scarce social lifestyle, and consequently their different baseline exposure to COVID-19 infection, may have caused lower modifications in their habits.

The objective of this large representative telephone-based survey is to assess the effects of COVID-19 confinement on BMI and physical activity in older adults from Lombardy region. We also aimed at investigating the determinants of a decrease in physical activity and assessing if that was a determinant of a deterioration in psychological wellbeing after approximately one year (November 2020) from the beginning of the COVID-19 pandemic.

2. Methods

We used data from a telephone-based cross-sectional survey conducted by Doxa, the Italian branch of the worldwide independent network/Gallup International Association, and coordinated by Mario Negri Institute and other Italian universities and research institutes within the project LOckdown and lifeSTyles in Lombardia (LOST in Lombardia) between November 17th and 30th, 2020 [27]. The analysis is based on a representative sample of 4400 individuals (aged 65 or more) from the Lombardy region, the Italian region with highest number of inhabitants [28].

The households and the subjects to be interviewed were selected using a rigorous method: we considered, as the universe of reference, the registers of 30,000 households, already representative, by province and size of municipality, of the families in Lombardy region.

Within these lists, participants to be interviewed were selected randomly by an automatic system. The structure of the sample was defined in advance and, throughout the survey process, the system checked for sampling structure and closed quotas once completed. In particular, quotas were used for the following variables: gender by age and province by municipality size. The protocol of the study was approved by the ethics committee of the coordinating group (Ethics committee of Fondazione IRCCS Istituto Neurologico Carlo Besta, File number 76, October 2020). All the participants provided their informed consent to participate to the study. The study has been carried out in accordance with The Code of Ethics of the World Medical Association (Declaration of Helsinki).

The questionnaire included information on socio-demographic characteristics such as age, sex, level of education, residence province and size of the center (number of inhabitants). Participants provided information on the average number of hours per week of moderate (e.g. fast walking, cycling) or intense (e.g. swimming, running) physical activity. Individuals were also asked to report their height and their weight. BMI was computed as the ratio between self-reported weight (kg) and height (m^2) and then was categorized into four groups, according to the standard classification by the WHO [29], i.e., underweight (BMI <18.5 kg/m^2), normal weight (BMI between 18.5 and 24.9 kg/m^2), overweight (BMI between 25.0 and 29.9 kg/m^2), and obesity (BMI $\geq$30.0 kg/m^2).

In order to evaluate any change in BMI and physical activity, weight and average number of hours per week of physical activity were reported twice, referring to the moment of the interview (reference time: November 2020) and one year before (reference time: November 2019).

A specific section of the questionnaire was focused on mental health outcomes, such as quality and quantity of sleep (using 2 items of the Pittsburgh Sleep Quality Index) [30], anxiety (Generalized anxiety disorder, GAD-2 scale) [31], and depressive symptoms (patient heath questionnaire, PHQ-2) [32]. Again, all the questions in this section were asked twice.

2.1. Statistical analysis

To investigate the negative impact of the pandemic on physical activity and mental health, we performed two separate analyses. Through unconditional multiple logistic regression models we estimated the odds ratios (OR) and corresponding 95% confidence intervals (CI) of a decrease in physical activity during COVID-19 pandemic. We defined a decrease in physical activity as a reduction of 1 h or more in the time per week of physical activity. As a sensitivity analysis, we considered another definition: we defined a decrease in physical activity as a reduction of two or more hours per week. We then assessed if a decreased physical activity was determinant of a deterioration in mental health outcomes. We defined a worsening in: i) sleep quality, as any decrease in the self-reported quality of sleep; ii) sleep quantity, as any decrease in the number of hours per night of sleeping, iii) anxiety symptoms, as any increase in the GAD-2 score; iv) depressive symptoms, as any increase in the PHQ-2 score. All the models were adjusted for selected socio-demographic variables, i.e., sex, age and level of education. A statistical weight was applied to all the analyses to guarantee the representativeness of the sample in terms of sex, age and province of residency. All statistical analyses were performed using the software SAS, version 9.4 (Cary, North Carolina, USA).

3. Results

Compared to the previous year (reference time: November 2019), during the COVID-19 pandemic (reference time: November 2020) the proportion of overweight/obese older adults increased from 48.8% to 50.2% (p-value<0.001; Fig. 1). It significantly increased both in men (p-value = 0.001) and women (p-value = 0.003), and in individuals aged 70–74 (p-value = 0.021) and those aged 75–79 years (p-value<0.001). When considering the proportion of obesity only, no statistically significant difference was observed overall (p-value = 0.183) or in strata of sex and age.

Regarding weight gain, no difference in BMI (p-value = 0.376) was detected during COVID-19 compared to the previous period (Supplementary Table 1).

In the overall sample, mean time dedicated to moderate or intense physical activity significantly decreased from 3.8 h/week (standard deviation, SD = 4.7) to 2.8 h/week (SD = 4.3) in the considered period (p-value<0.001; Fig. 2).

A significant decrease was observed in both sexes (p-value<0.001) and in each age group (p-value<0.001 for age group <85 years; p-value = 0.013 for age group ≥85 years).

Table 1 shows the ORs for physical inactivity and for a decrease in physical activity during the COVID-19 pandemic compared to the previous year, by 1 h/week or more, and, as a sensitivity analysis, by 2 h/week or more.

On the total sample of 4400 older adults, 39.5% was inactive before the COVID-19 pandemic. Among the determinants of physical inactivity there were being a woman (OR = 1.25; 95% CI: 1.10–1.41, compared to men), more aged (p for trend<0.001) and with a lower level of education (p for trend<0.001). Compared to individuals from Milan, subjects from most of other Lombardy provinces more frequently reported physical inactivity before the COVID-19 pandemic (OR ranging between 1.14 and 1.59, even if not all significant). Older adults with higher BMI more frequently reported inactive lifestyle (p for trend<0.001) before the pandemic.

Among the 3157 participants reporting at least 1 h/week of physical activity in November 2019, 43.8% reported a decrease of 1 h/week or more in physical activity during the COVID-19 pandemic. Among the 2663 older adults who dedicated two or more hours/week of physical activity in November 2019, 42.4% decreased it by 2 h/week or more during the COVID-19 pandemic.

A decrease in physical activity was more frequently reported in women (OR = 1.36; 95% CI: 1.18–1.57 for a decrease of 1 h or more; OR = 1.29; 95% CI: 1.10–1.51 for a decrease of 2 h/week or more) and with increasing age (p for trend = 0.033, for a decrease of 2 h/week or more, respectively). Compared to Milan, participants from most of other Lombardy provinces, reported a lower reduction in physical activity during the pandemic (OR ranging between 0.59 and 0.91 for 1 h/week or more, even if not all significant). Similar results were observed for a decrease of 2 h/week or more. Participants living in centers with more than 100.000 inhabitants more frequently reported a decrease by 1 h per week or more in physical activity compared to those living in smaller centers (OR = 1.30; 95% CI: 1.08–1.57). Older adults with higher BMI before the COVID-19 pandemic more frequently reported a reduction in physical activity during the COVID-19 confinement (p for trend<0.001 for a decrease of 1 h/week or more and p for trend = 0.033, for a decrease of 2 h/week or more).

A decrease in physical activity during the COVID-19 pandemic was more frequently reported among participants who had a more active lifestyle before the COVID-19 pandemic (p for trend<0.001 for both a decrease by 1 h/week or more and 2 h/week or more).

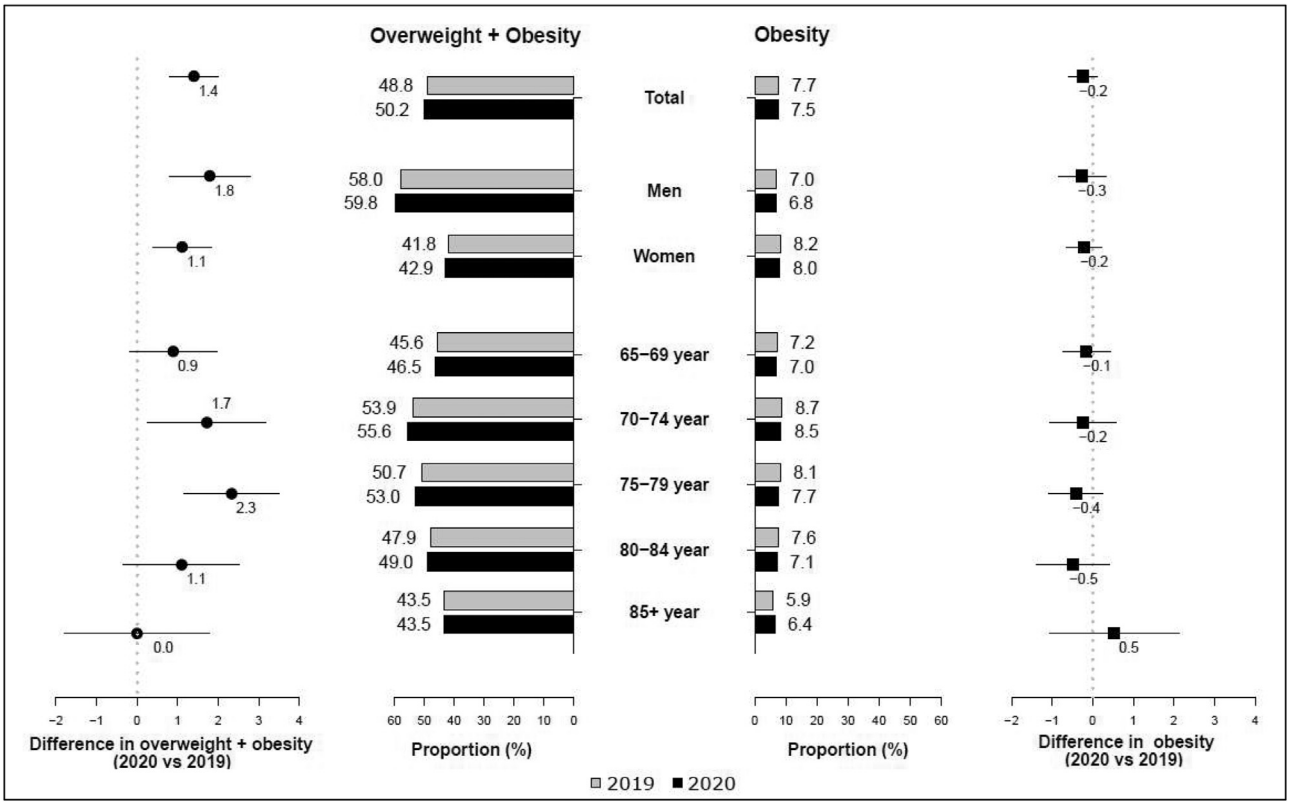

Fig. 1. Distribution of 4400 individuals aged 65 years or more according to levels of body mass index before and during the COVID-19 pandemic, overall and by sex and age group. Lombardy region, Italy 2020.

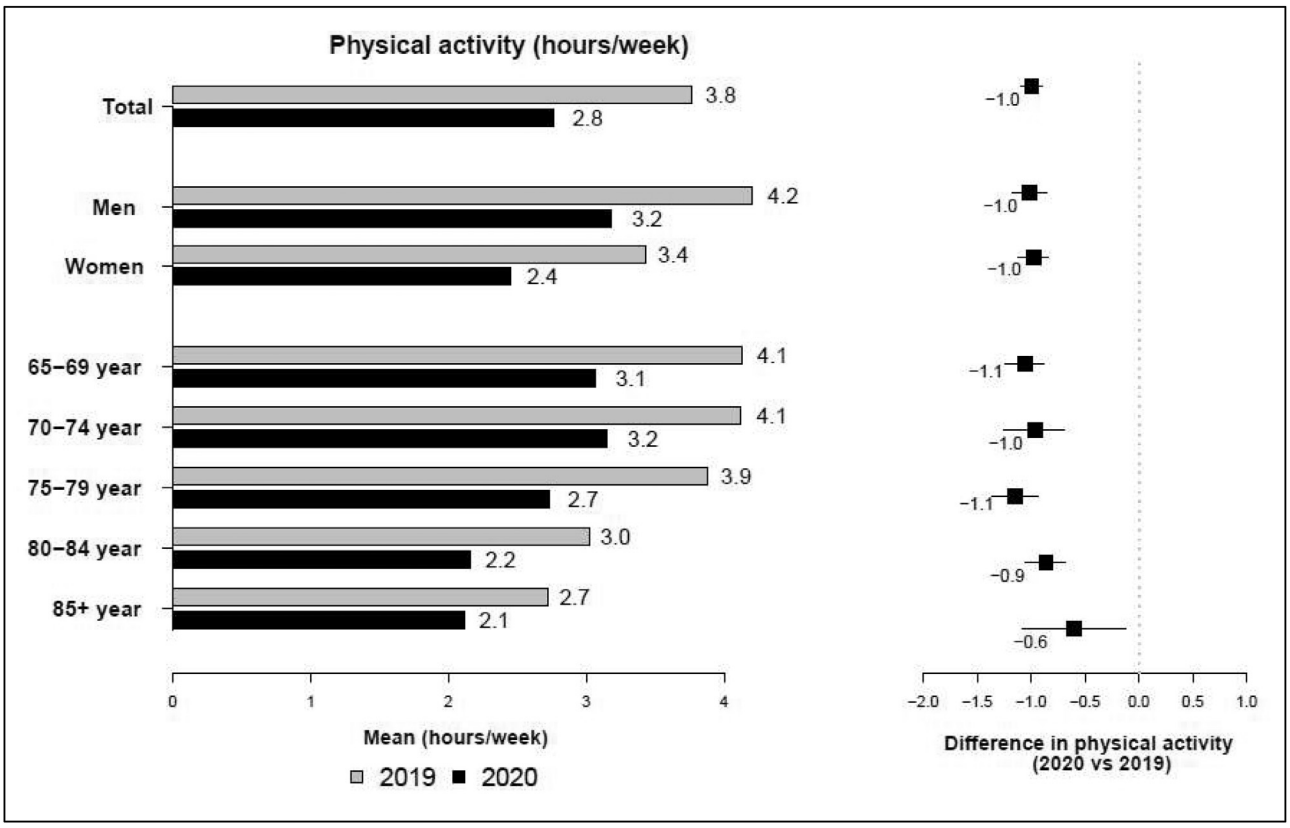

Fig. 2. Distribution of 4400 individuals aged 65 years or more according to their mean physical activity (hours/week) before and during the COVID-19 pandemic, overall and by sex and age group. Lombardy region, Italy 2020.

Table 2 shows the ORs for a worsening in mental health outcomes according to a decrease in physical activity during the COVID-19 pandemic. A decreased physical activity by 1 h per week or more, was determinant of a decrease in sleep quality (OR = 2.45; 95% CI: 1.91–3.15), an increase in anxiety (OR = 1.31; 95% CI: 1.14–1.52) and depressive symptoms (OR = 1.61; 95% CI: 1.38–1.88).

A decrease in physical activity by 2 h per week or more resulted in a determinant also of a decrease in sleep quantity (OR = 1.54; 95% CI: 1.18–2.02).

4. Discussion

Considering a large representative sample of older adult individuals from Lombardy region, no substantial weight gain occurred during the COVID-19 pandemic. On the contrary, time spent in physical activity significantly declined by 27%. Individuals reporting a decrease in physical activity were more frequently those reporting also a worsening in mental health outcomes.

The lack of a significant weight gain in this segment of population is in line with the recent scientific literature based on the older adults [33,34]. In the general population, a substantial increase in BMI was consistently observed during the COVID-19 pandemic [10,11,35], possibly due to modifications of daily routines [36], a greater overall food intake [35], a less healthy diet during confinement [35,37], or the reduction in physical activity [6,7,12]. On the contrary, on the older adults who already use to spend a large amount of time at home, confinement restrictions might have had a minor impact on their habits [35,37]. The older adult population –more reluctant to changes– had unlikely modified their dietary habits during COVID-19 restrictions. Furthermore, although we noticed a decrease in physical activity during confinement in approximately 44% of participants, the decrease was on average of 1 h per week only, and this limited reduction may not have allowed for a significant impact on weight gain. In addition, in old people, often in critical physical conditions, even a few days of sedentary life can cause opposite effects, inducing muscular and weight loss, that can lead to frailty and geriatric syndromes [19,20,33]. While we did not observe an increase in obesity prevalence, overweight slightly increased. This is due to a negligible number of participants (2.7%) passing from normal weight to overweight, compared to an even smaller number of individuals stepping from overweight to normal weight (1.3%).

Our findings on a decrease in physical activity are in line with those from other studies on the older adult population [13,14,38]. A Croatian study [39], in agreement with our findings, reported that women, who exercised less than men before the lockdown [40], were those who decreased most their physical activity during confinement. COVID-19 lockdown might indeed have accentuated their pre-existing sedentary lifestyle, and this behavior might persist after the confinement period [39].

Our data revealed that the impact of the COVID-19 pandemic on physical activity was higher in older individuals (i.e., aged 80 years or more). However, in contrast with another study [38], this result points out that the oldest old have been the most affected by the COVID-19 confinement with a further reduction in their already scarce physical activity, and that this might have led to a rapid deterioration of their health status [19,20].

Despite older adults from province of Milan (the regional capital of Lombardy) being more active than others before the COVID-19 pandemic, they, and in general those living in more populous

Table 1
Distribution of 4400 individuals according to their physical activity habits before COVID-19 pandemic and a worsening in their physical activity habits during the COVID-19 pandemic, overall and by selected characteristics. Lombardy region, Italy 2020.

Characteristics	N	Physical inactivity before COVID-19 (1 h/week or less)		N[c]	Decrease in physical activity during COVID-19 by 1 h/week or more		N[d]	Decrease in physical activity during COVID-19 by 2 h/week or more	
		%	OR[a] (95% CI)		%	OR[a] (95% CI)		%	OR[a] (95% CI)
Total	4400	39.5		3157	43.8		2663	42.4	
Sex									
Men	1902	35.6	1.00[b]	1423	39.7	1.00[b]	1224	39.2	1.00[b]
Women	2498	42.4	**1.25 (1.10–1.41)**	1735	47.0	**1.36 (1.18–1.57)**	1439	45.2	**1.29 (1.10–1.51)**
Age group (years)									
65-69	1289	35.0	1.00[b]	973	42.7	1.00[b]	838	40.1	1.00[b]
70-74	838	34.4	0.94 (0.78–1.13)	630	44.2	1.08 (0.88–1.33)	550	41.5	1.09 (0.87–1.36)
75-79	1188	39.2	1.13 (0.96–1.33)	854	45.9	1.14 (0.95–1.38)	722	44.4	1.21 (0.99–1.49)
80-84	739	45.8	**1.42 (1.18–1.72)**	493	42.9	1.01 (0.81–1.27)	401	43.4	1.18 (0.92–1.51)
85+	346	55.9	**2.11 (1.64–2.70)**	206	40.2	0.91 (0.66–1.24)	152	46.8	1.35 (0.95–1.92)
P for trend			**<0.001**			0.976			**0.033**
Level of education									
Low	788	48.0	1.00[b]	482	43.1	1.00[b]	410	40.9	1.00[b]
Intermediate	3168	39.4	**0.84 (0.71–0.99)**	2314	43.6	1.07 (0.87–1.31)	1921	43.1	1.20 (0.96–1.50)
High	444	25.3	**0.44 (0.34–0.57)**	361	45.5	1.17 (0.88–1.55)	332	40.8	1.11 (0.82–1.51)
P for trend			**<0.001**			0.280			0.438
Province									
Milan	1424	35.9	1.00[b]	1066	48.9	1.00[b]	912	47.0	1.00[b]
Varese	387	41.5	1.23 (0.97–1.55)	274	39.4	**0.68 (0.52–0.90)**	226	41.4	0.80 (0.60–1.08)
Como	262	40.1	1.25 (0.95–1.64)	192	46.5	0.92 (0.68–1.26)	157	42.8	0.87 (0.61–1.22)
Sondrio	81	44.9	1.53 (0.96–2.41)	53	36.2	0.60 (0.34–1.06)	44	30.0	**0.50 (0.26–0.97)**
Bergamo	488	38.7	1.14 (0.92–1.41)	357	36.1	**0.59 (0.46–0.75)**	299	35.7	**0.63 (0.48–0.83)**
Brescia	550	44.9	**1.43 (1.16–1.75)**	370	38.7	**0.65 (0.51–0.82)**	303	36.4	**0.64 (0.49–0.83)**
Pavia	238	41.9	**1.34 (1.01–1.78)**	163	42.4	0.76 (0.54–1.06)	138	43.0	0.87 (0.60–1.25)
Cremona	157	44.8	**1.51 (1.07–2.11)**	103	44.2	0.83 (0.55–1.25)	87	43.3	0.87 (0.56–1.37)
Mantova	182	46.4	**1.59 (1.16–2.18)**	117	35.8	**0.58 (0.39–0.87)**	97	36.9	0.66 (0.43–1.02)
Lecco	147	40.9	1.23 (0.86–1.75)	105	39.7	0.69 (0.46–1.05)	87	37.2	0.68 (0.43–1.07)
Lodi	101	40.2	1.23 (0.81–1.86)	73	46.4	0.91 (0.56–1.46)	60	48.2	1.04 (0.62–1.76)
Monza-Brianza	385	34.5	0.96 (0.76–1.22)	285	49.3	1.04 (0.80–1.36)	252	45.9	0.99 (0.75–1.31)
Size of the center (number of inhabitants)									
<100.000	3621	40.1	1.00[b]	2584	42.5	1.00[b]	2169	41.7	1.00[b]
≥100.000	779	36.7	0.86 (0.73–1.02)	573	49.6	**1.30 (1.08–1.57)**	494	45.9	1.15 (0.94–1.40)
BMI before COVID-19									
Underweight	120	32.5	0.74 (0.50–1.11)	88	48.6	1.18 (0.76–1.82)	81	41.9	0.98 (0.62–1.55)
Normal weight	2133	37.4	1.00[b]	1563	42.5	1.00[b]	1336	40.4	1.00[b]
Overweight	1808	41.2	**1.23 (1.07–1.40)**	1291	44.4	1.14 (0.98–1.32)	1062	45.1	**1.27 (1.08–1.50)**
Obese	338	45.9	**1.43 (1.13–1.80)**	216	47.1	1.22 (0.92–1.63)	183	42.0	1.10 (0.80–1.51)
P for trend			**<0.001**			**<0.001**			**0.033**
Physical activity before COVID-19 (hours/week)									
1-2			–	969	27.2	1.00[b]	475[e]	22.7	1.00[b]
3-6			–	1220	51.0	**2.88 (2.40–3.46)**	1220	44.3	**2.80 (2.20–3.58)**
7+			–	968	51.2	**2.95 (2.43–3.58)**	968	49.7	**3.54 (2.75–4.55)**
P for trend						**<0.001**			**<0.001**

OR: odds ratio; 95% CI: 95% confidence interval.
[a] Estimated by unconditional multiple logistic regression models, after adjustment for sex, age, and level of education; estimates in bold are those statistically significant at 0.05 level.
[b] Reference category.
[c] Individuals doing at least 1 h/week of physical activity.
[d] Individuals doing at least 2 h/week of physical activity.
[e] All these individuals reported 2 h/week of physical activity.

centers, were those who experienced a higher decrease in physical activity. Living in a big and high-dense city, where the disease can spread quickly and effectively, may have heightened the fear of getting infected, discouraging people from going out for activities perceived as not strictly necessary.

According to previous research [41], higher BMI in the year before the pandemic was associated with lower levels of physical activity during the COVID-19 pandemic suggesting that, as a result of the COVID-19 crisis, people with a higher BMI may be at major risk of long-term weight gain due to physical inactivity. High values of BMI, besides being an established risk factor for all-cause mortality [17], have been shown to be also a risk factor for COVID-19 severity and mortality [42]. Thus, monitoring BMI, remains an essential activity throughout the overall duration of the emergency period.

In our study we observed that a worsening in selected mental health outcomes (i.e., sleep quality and quantity, depression, and anxiety) was more frequently observed in older adults who reported a decrease in physical activity during the confinement. In line with recent evidence from the literature [24,25], in the older adult population, a reduction in physical activity contributes to a deterioration in mental health wellbeing [21].

Studies on previous epidemics have demonstrated that such periods require particular attention because they may have strong negative effects on vulnerable segments of population causing depression and anxiety symptoms, sleep disorders, mental illnesses, and lead, in more severe cases, to suicide [26]. During the SARS outbreak in 2003, for example, a substantial increase in the suicide rate in the older adults was observed [26]. Therefore, maintaining an active lifestyle can prevent a worsening in general

Table 2
Distribution of older adult individuals according to a worsening in mental health outcomes by changes in physical activity habits during the COVID-19 pandemic. Lombardy region, Italy 2020.

Characteristics	Reduction in sleep quality	Reduction in sleep quantity	Increase in anxiety symptoms	Increase in depressive symptoms
	OR[a] (95% CI)	OR[a] (95% CI)	OR[a] (95% CI)	OR[a] (95% CI)
Change in physical activity during pandemic				
Decrease by 1 h per week or more vs no decrease or increase[b]	**2.45 (1.91–3.15)**	1.06 (0.85–1.33)	**1.31 (1.14–1.52)**	**1.61 (1.38–1.88)**
Change in physical activity during pandemic				
Decrease by 2 h per week or more vs decrease by 1 h or less[c]	**2.01 (1.55–2.60)**	**1.54 (1.18–2.02)**	**1.40 (1.20–1.64)**	**1.41 (1.20–1.67)**

OR: odds ratio; 95% CI: 95% confidence interval.
[a] Estimated by unconditional multiple logistic regression models after adjustment for sex, age, and level of education; estimates in bold are those statistically significant at 0.05 level.
[b] Individuals doing at least 1 h/week of physical activity.
[c] Individuals doing at least 2 h/week of physical activity.

wellbeing. Consequently, campaigns to promote physical activity should be prioritized to prevent a decline in mental health outcomes in the older adult population.

Our study needs to be interpreted in light of several strengths and limitations. Among its strengths, there are the large sample size and the use of validated evidence-based psychiatric assessment tools. Moreover, to our knowledge, this is the first study on the issue based on a representative sample of the older adult population. The adopted study design allowed us to simulate a pre-post analysis in the context of a cross-sectional study which, however, does not help to establish any causal relationship. Limitations of our study include those inherent to the used mode of data collection. A telephone based-survey, in fact, introduces a selection bias towards a portion of the population actively having a phone at home. However, the representativeness by socio-economic characteristics of the sample of the older adult population from Lombardy was ensured. Moreover, the method used for the data collection in this emergency period, when physical distancing was imposed due to the restrictions in place, is the most accurate and effective one, at least for the older adult population. A recall bias might also have occurred, affecting information provided by the individuals in relation to the year before the pandemic: this applies particularly to older participants. In addition to this, in general, people are inclined to report that things get worse by time: the negative responses might be in part related to this effect.

5. Conclusion

Even though confinement measures were needed to protect against SARS-CoV-2, older adult people have been affected by an increased sedentary lifestyle. Physical inactivity can have a significant impact on several geriatric conditions and comorbidities, including impaired mental wellbeing. Therefore, during public health crises or potential future infections outbreaks, public health authorities should provide support for older people, promoting physical activity in order to minimize negative effects on mental and physical health.

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Author contribution

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Availability of data and materials

Data that support the findings of this study and materials are available from the corresponding author, upon request.

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Declaration of competing interest

None.

Appendix A. Supplementary data

Supplementary data to this article can be found online at https://doi.org/10.1016/j.clnesp.2022.01.024.

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