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Original article

Adherence to social distancing and use of personal protective equipment and the risk of SARS-CoV-2 infection in a cohort of patients with multiple sclerosis

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ABSTRACT

Background Aiming to safeguard its population from COVID19 infection, Italian government provided specific advices, especially to fragile individuals such as those affected by Multiple Sclerosis (MS), to respect social distancing, to arrange remote work and to use personal protective equipment (PPE). The aim of this study is to investigate real adherence to these measures among MS patients and to evaluate its impact on exposure to infection.

Methods MS patients followed at the MS center of Tor Vergata University hospital, Rome, Italy were asked to complete an anonymous 35-items web-survey exploring demographics, residency, employment, social distancing habits, use of PPE, MS features and COVID19 infection data, including self-reported information about contacts with SARS-CoV-2 positive/presumed positive persons. In order to estimate adherence to social distancing and use of PPE, an overall ‘Lockdown Score’ (LS) on 0–10 scale was created analyzing four main domains (Working (0 - 4), Social distancing and PPE use (0 - 4), Assistance for shopping needs (0 - 2), Residency (-2 - 0)). Mean scores for several pre-defined subgroups of patients were compared using both univariable and multivariable analyses. Accuracy of the score in discriminating subjects at higher risk of coming in contact with SARS-CoV-2 positive/presumed positive individuals was calculated as the area under the receiver-operator characteristic curve (AUC). The optimal cut-off was identified and used to dichotomize LS (high/low). Logistic regression model was applied to estimate individuals’ characteristics associated with high/low LS and odds ratio of coming in contact with SARS-CoV-2 positive/presumed positive persons based on continous and dichotomised LS.

Results Respondents (N = 551) had a mean (± SD) overall LS of 6.52 ± 2.11 (Working 3.16 ± 1.19, Social distancing and PPE use 2.69 ± 1.33, Assistance 0.66 ± 0.62, Residency penalty applied in 4 cases). Female, disabled and unemployed individuals had significantly higher mean LS (p<0.05).

The accuracy of the LS was 0.68 (95% CI, 0.59–0.77) and the optimal LS cut-off for discrimination was 6.0. Consistently, female, disabled and unemployed individuals had higher odds of getting a high LS (≥ 6) compared to male, independent and employed (p<0.05). Odds of coming in contact with SARS-CoV-2 positive/presumed positive individuals was significantly reduced for one-unit increase in LS (0.74 (95% CI: 0.64–0.85)) and among individuals with high LS (0.37 (95% CI: 0.19–0.72)).

Only one subject among respondents declared to have been diagnosed with COVID19.

Conclusions MS patients, especially those with social unfavorable conditions, demonstrated good adherence to social distancing and use of protection equipment. Implementing domains, such as social assistance, may improve protection from infection. LS score is potentially able to identify subjects with behaviors at greater risk of infection, although it needs to be validated against MS population living in higher incidence areas.

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1. Introduction

Italy has been the second country after China to witness the outbreak of COVID19 epidemic and has been the first country in Europe to face the rapid diffusion of the infection (Lavezzo et al., 2020). In the absence of proven effective treatments or vaccines, Italian government tried to safeguard the population’s health by strict social distancing measures and imposing progressively more and more harsh restrictions to people’s movements (lockdown). Before lockdown measures were implemented, specific recommendations to not leave their houses were provided by the earliest nationwide government ruling (Decreto del Presidente del Consiglio dei Ministri, March 4th, 2020) to fragile individuals, such as immunosuppressed or elderly people, supposedly more at risk of complications from COVID19. Patients with Multiple Sclerosis (MS), although not specifically mentioned in the DPCM, are considered among people at major risk, considering their neurological disability, comorbidities and immunosuppressive treatments (Baker et al., 2020; Santangelo et al., 2019). All MS patients and their caregivers have therefore been advised by MS centres, patients’ association and the media to stay home and take all available measures of prevention from COVID19 infection, including the use of personal protective equipment (PPE) like face masks and gloves (MSIF, 2020). However, real adherence to these measures and its impact on the risk of infection still need to be explored in fragile selected populations (Paital et al., 2020). This is essential to evaluate the validity of social distancing in a population at risk and to better implement both sanitary and social protection strategies.

The aim of this study was to estimate through an anonymous survey the degree of adherence to social distancing measures among MS patients followed in a single MS center in the area of Rome and to explore the impact of demographic, clinical and social variables on adherence. Relationship between adherence and risk of being exposed to infection was also assessed considering a self-reported declaration of having been in contact with SARS-CoV-2 positive/presumed positive persons.

2. Patients and methods

2.1. Subjects

The MS center of Tor Vergata University hospital is a big facility for MS treatment assisting patients with MS and NMO living in a vast and densely populated area of Rome and its south east suburbs, with a majority of patients living in other Italian regions and abroad. The study involved exclusively patients with MS followed at the MS center of Tor Vergata University hospital.

Only patients whose personal email address was available and who had given consent to its use to receive information about initiatives taken by the MS center were contacted. They received an email inviting them to fill out a questionnaire exploring their habits and behaviors during the lockdown by clicking on the link provided. We reached out to 916 email addresses, receiving 645 filled questionnaires in total. Questionnaires were sent out on May 3rd to ascertain results over the entire period from March 9th to May 3rd, corresponding to stricter rules on social distancing restrictions Italy. The survey was kept open for 1 week up to May 10th. A reminder email was sent out on May 7th. Questionnaire was fully anonym and collected according to the general rules on data protection (GDPR); questions were structured in a manner that it was not possible to recognize responders’ identity from answers; responders were informed on the nature of the study and decided to freely take part to it. Respondents had to consent to the use of the information collected before filling in the survey, otherwise the system would not allow to continue.

2.2. Survey

A 35-item questionnaire was created using the Google Forms electronic survey. A combination of forced choice (yes/no) and multiple-choice questions was used. Original language of the survey was Italian. The full survey translated into English is included as supplementary material.

The questionnaire collected data regarding the lockdown period about different areas of interests including several items (Boateng et al., 2018):

- Demographic information (age, sex, marital status, country and province of residency during lockdown, household, number of co-habitants)
- Employment (employment status, job description, work arrangements, working arrangements of cohabitants)
- Social distancing measures (number of times they left their house) and use of PPE
- Shopping habits (who took care of routinary shopping needs)
- MS clinical characteristics (disease duration, disability, type of treatment, access to visits and drug dispensation modality)
- COVID infection data (symptoms of infection, Sars-COV-2 serological status, Sars-COV-2 test, contact with infected persons or suspects)

Further questions were related to the patients’ opinion on how MS patients could have been better supported during pandemic.

2.3. Scoring

In order to estimate adherence to protection advices, an overall ‘Lockdown Score’ (LS) on 0–10 scale - where 0 indicates no adherence and 10 full adherence- was created analyzing four main domains (Working, Social distancing and PPE use, Assistance for shopping needs, Residency). The score has been balanced on the assumption that behaviors (items listed in the questions) would impact differently on protection from COVID19. Each domain, in fact, contributes differently to the final score and, within each of the domains, every item corresponds to a different value. In particular, Working domain, analyzing information about working agreements and behavior of respondents and cohabitants, was assigned a 0 – 4 subscore; Social distancing and PPE use domain, analyzing information about the number of times respondents left the house and the kind of PPE used, was assigned a 0 – 4 subscore; Assistance for shopping needs, analyzing information about who was going out for shopping needs - i.e. for food or drugs-, was assigned a 0 – 2 subscore; Residency domain, analyzing information about the location of respondents during lockdown taking into account COVID19 incidence in the living area, was assigned a −2 – 0 subscore penalty. See Table 1 for details of LS scale.

2.4. Statistical analysis

Categorical variables were presented as N (%). Mean LS values (± standard deviation) were calculated for each category and domain, in addition to overall LS.

Differences among categorical variables groups were calculated using ANOVA or non-parametric Kruskal-Wallis test, as appropriate. A multi-variable model was fitted to assess the association of Sex, Age, Mobility and Employment with LS mean. A logistic regression model was used to evaluate the risk of getting in contact with SARS-CoV-2 positive (or presumed positive) individuals on the basis of the LS as a continuous term, also adjusting for possible confounders (Sex, Age, Mobility, Employment). To evaluate the accuracy of LS in discriminating people who had come in contact with positive/presumed positive individuals we calculated the area under the receiver-operator characteristic curve (AUC) and we determined the optimal cut-off value minimizing the distance to the corner function \(\sqrt{(1 - Sensitivity)^2 + (1 - Specificity)^2}\). On the basis of this cut-off, LS was dichotomized as low/high LS; characteristics of subjects with high/low LS were presented as N (%); logistic regression models were used to identify characteristics associated with high LS and to evaluate the risk of getting in contact with SARS-CoV-2...
The number of cohabitants who left home for working reasons (11%), in contributions to the score; specifically, missing values consisted in and complete one and excluded the other. The final sample of ques two times by mistake, we considered only the most recent identical or almost identical answers. Supposing that people had filled the questionnaire. We identified 32 pairs of questionnaires providing respondents who went to work regularly (≥ 5–6 times/week) regularly. 

Social distancing and PPE use (0–4)

| Respondent | Wearing FFP2/FFP3* | Wearing glasses | Wearing gloves | Wearing surgical face masks | Other (e.g. scarfs) |
|------------|--------------------|----------------|---------------|---------------------------|-------------------|
| Respondent | 1                  | 0.5            | 0.5           | 0.25                      | 0                 |

**Assistance for shopping needs (0–2)**

| Respondent | Other | Cooperator | Respondent |
|------------|-------|------------|------------|
| Respondent | 2     | 1          | 0          |

**Residency (−2 · 0)**

| Respondent | Low incidence province | High incidence region | High incidence province |
|------------|------------------------|-----------------------|-------------------------|
| Respondent | 0                      | −1                    | −2                      |

*PPE and FFP stands respectively for Personal Protection Equipments and Filtering Facepiece type 2 and 3.

positive/presumed positive individuals on the basis of the LS profile (high vs low LS) also adjusting for Sex, Age, Mobility and Employment. In case of missing values (unanswered questions) about cohabitant’s working habits, we assumed that half the cohabitants were employed regularly; when data about protection equipment were not reported, it was assumed that no protection equipment was used; when data about the area of residency during lockdown were not provided, it was assumed that respondents were living in a low COVID19 incidence area. A two-sided a less than 0.05 was considered statistically significant.

Statistical analyses were performed using the SAS software (version 9.4).

### 3. Results

#### 3.1. Respondents

We have received 645 anonymous answers; 29 persons did not fill the questionnaire. We identified 32 pairs of questionnaires providing identical or almost identical answers. Supposing that people had filled the survey two times by mistake, we considered only the most recent and complete one and excluded the other. The final sample of questionnaires for the analysis included 551 answers.

Almost all the individuals (86%) completed the 100% of the questions contributing to the score; specifically, missing values consisted in the number of cohabitants who left home for working reasons (11%), in the protection equipment used (N = 1) and in the province of residency during lockdown (N = 4).

#### 3.2. Subjects’ characteristics

Characteristics of the study population are shown in Table 2 and details about drugs taken by respondents are shown in Table 3. The sample was mainly constituted by females (68%) and age ranged between 18 and 79 years, averaging 44.67 years (SD = 11.43). Most of the subjects were living with a partner (78%), in a flat with more than 2 rooms (60%), preferably in a city or a town (92%), received a high school education (53%) and were employed (65%) (Table 2). Concerning MS, the majority of responders were not disabled (77%), took immunosuppressive drugs (57%) and had received MS diagnosis more than 15 years before (46%) (Table 2). The most frequently used immunomodulatory drug was Dimethyl Fumarate (19%) while the most frequently used immunosuppressive treatments were Natalizumab (17%) and fingolimod (15%) (Table 3).

### 3.3. Lockdown scoring

Respondents had a mean (± SD) overall LS of 6.52 ± 2.11 (Working 3.16 ± 1.19, Social distancing and PPE use 2.69 ± 1.33, Assistance 0.66 ± 0.62, Residency penalty applied in 4 cases).

The AUC of the LS was 0.68 (95% CI, 0.59–0.77) (Fig. 1). The optimal cut-off to discriminate MS people coming in contact with COVID19 positive/presumed positive individuals was 6.0 according to the corner distance function. LS ≥ 6 was considered high (high LS) and LS ≤ 6 low (low LS).

Mean LS as well as Individual Working and Social Distance and PPE domains scores were significantly higher among females (Table 2 and 4). However, including working habits of cohabitants in the working domain score, females advantage in Working domain disappeared and males reached higher ranks (Table 2). No significant differences in LS were found among age groups both treating LS as continuous and as dichotomized variable. Although not significant, mean LS and subdomains scores were found to be higher among older people (Table 2) and a greater percentage of older individuals was observed among subjects with high LS (Table 4). Disabled individuals obtained significantly higher scores in all the subdomains except for the Working Domain which considers cohabitants’ behavior (Table 2). Being disabled was also found to be associated with having a high LS (p < 0.0001) (Table 4).

Patients treated with immunosuppressive drugs had higher score in Assistance domain, meaning that they received better social assistance (Table 2). Working Domain score was significantly higher among less educated individuals; in fact, only 33% of individuals with low education, declared to be employed. No significant differences in score means and high/low LS were found while comparing disease duration, type of living place and dimension of the house (Table 2 and 4). While fitting the multiple model to study associations between subjects’ characteristics and LS as continuous, score means remained significantly higher among female (p = 0.01), disabled (p < 0.001) and unemployed subjects (p = 0.02) and similarly female and disabled individuals were found to be more inclined to get a high LS when multivariable logistic regression model was fitted (Table 4).

Considering working behavior, 51% of the subjects obtained the maximum mark but many were penalized due to cohabitants working behavior (individually, subjects did better, reaching the percentage of 88%). Among individuals working remotely, 77 individuals (60%) started this working modality as soon as the Prime Minister Law Decree of March, 8th 2020 entered into force or even before that date. Among individuals keeping regular working modalities, 161 subjects have jobs concerning Social Distance and PPE Domain, 81% of individuals went out for reasons different from work less than twice a week; among those who provided details (538) on protection equipment, 521 (97%) individuals used face masks, 183 (34%) wore FFP2/3 face masks while 375 (70%) used surgical masks; 392 (73%) used gloves.

Only for the 9% of the subjects neither the patient nor cohabitants went out to get supplies, while 42% got the worst social assistance rank because the patient himself left home for personal needs. Specifically,
only for 22% of individuals, drugs for MS were directly delivered at home, while 28% of the subjects directly went to the MS center for treatment infusion. When patients were asked to give some advices to the MS center in order to improve assistance, the 41% suggested to potentiate domiciliary sanitary services.

3.4. SARS-CoV-2 infection

Among respondents, subjects who were exposed to positive or presumed positive subjects were respectively 10 (2%) and 31 (6%). Comparing individuals who differ for one-unit in the LS, the odd of those who have the highest score is 0.74 times the odd of the others (95% CI: 0.64–0.85) and the odd of those who got high LS is 0.37 times the odd of those with a low score (95% CI: 0.19–0.72) (Table 5). After adjustment for possible confounders results remained consistent (Table 5).

Based on the AUC cut-off (=6), among the 10 individuals who came in contact with confirmed COVID19 positive subjects, all of them but one would have been correctly classified.

Among respondents only one subject resulted positive at the COVID19 swab. Swab tests were performed in the 3.27% of individuals and the percentage of positive swabs was thus 5.56% (0.18% of the sample).

The subject with COVID19 infection got an individual LS of 5.75 (below the estimated cut-off), getting a poor mark (0.75) for Social Distance and PPE principally due to the high number of times she left home and to poor PPE use, a mark of 3 in the Working Domain (Individual rank of 4 excluding cohabitants) and the highest mark for
Assistance (2). In addition, this subject came in contact with a SARS-CoV-2 positive subject (cohabitant).

4. Discussion and conclusions

The results of our survey showed generally good adherence of MS patients to lockdown and an extensive use of protection devices, as measured by the LS.

Recently, data collected by the Italian Institute of Statistics among the general Italian population (samples size 3088 individuals reached by phone) have demonstrated high responsiveness to lockdown (89,1% of people declared that they used face masks going out, 72% did not leave home and 92,4% said that the interindividual distance of at least one meter was respected when outside homes). (ISTAT, 2020) Among the ones that left home once (22,7%) or at least twice (5,2%), reasons

![Fig. 1. Receiver Operating Characteristic (ROC) Curve and area under the ROC curve (AUC). Prediction of coming in contact with positive/presumed positive individuals on the basis of the Lockdown Score (LS).](image)

| Table 4 | Subjects’ characteristics associated with high/low LS (univariable and multivariable logistic regression models). |
|---------|-----------------------------------------------------------------------------------------------------------|
|         | High LS (LS >= 6.0)) | Low LS (LS < 6.0) | Univariable | Multivariable |
|         | N(%) | N(%) | OR (95% CI) | p-value | OR (95% CI) | p-value |
| Sex | | | | | | |
| Female | 231(71%) | 141(62%) | 0.67 (0.47–0.96) | 0.03 | 0.65 (0.44–0.94) | 0.02 |
| Male | 94(29%) | 85(38%) | 1.00 (ref) | — | 1.00 (ref) | — |
| Age | | | | | | |
| < 40 years | 115 (35%) | 82 (36%) | 0.97(0.67–1.40) | 0.42 | — | — |
| 40–60 years | 170 (52%) | 124 (55%) | 1.00 (ref) | — | — | — |
| > 60 | 40 (12%) | 20 (9%) | 0.68 (0.38–1.23) | 0.20 | — | — |
| Mobility | | | | | | |
| Independent | 227 (70%) | 196 (87%) | 1.00 (ref) | — | — | — |
| Need Support | 98 (30%) | 30 (13%) | 0.35 (0.22–0.55) | <0.0001 | 0.37 (0.23–0.61) | <0.0001 |
| MS drugs | | | | | | |
| Immunomodulatory | 121 (43%) | 89 (44%) | 1.00 (ref) | — | — | — |
| Immunosuppressive | 161 (57%) | 112 (56%) | 0.94 (0.65–1.36) | 0.76 | — | — |
| Diagnosis Date | | | | | | |
| 0–10 years | 81 (25%) | 60 (27%) | 0.93 (0.61–1.42) | 0.48 | — | — |
| 10–15 years | 101 (31%) | 53 (23%) | 0.66 (0.43–1.00) | 0.05 | — | — |
| > 15 years | 143 (44%) | 113 (50%) | 1.00 (ref) | — | — | — |
| Marital Status* | | | | | | |
| Not living with a partner | 72 (22%) | 55 (24%) | 1.00 (ref) | — | — | — |
| Living with a partner | 253 (78%) | 171 (76%) | 0.88 (0.59–1.32) | 0.54 | — | — |
| Education | | | | | | |
| Middle School/Below | 47 (14%) | 28 (12%) | 0.80 (0.47–1.36) | 0.51 | — | — |
| High School | 168 (52%) | 124 (55%) | 1.00 (ref) | — | — | — |
| University/ PhD | 110 (34%) | 74 (33%) | 0.91 (0.62–1.32) | 0.94 | — | — |
| Living Place | | | | | | |
| < 2 rooms flat | 38 (12%) | 35 (16%) | 1.00 (ref) | — | — | — |
| >= 2 rooms flat | 199 (62%) | 130 (58%) | 0.70(0.42–1.18) | 0.22 | — | — |
| House | 83 (26%) | 60 (27%) | 0.78(0.44–1.36) | 0.74 | — | — |
| Employment | | | | | | |
| Employed | 193 (59%) | 163 (72%) | 1.00 (ref) | — | — | — |
| Not Employed | 132 (41%) | 63 (28%) | 0.56 (0.39–0.81) | <0.01 | 0.76 (0.51–1.13) | 0.17 |
| Lockdown Place | | | | | | |
| City | 160 (50%) | 96 (43%) | 0.72 (0.37–1.37) | 0.16 | — | — |
| Town | 135 (42%) | 105 (48%) | 0.93 (0.48–1.78) | 0.64 | — | — |
| Village | 24 (8%) | 20 (9%) | 1.00 (ref) | — | — | — |

*Living with a partner includes partnered/de facto/religious; not living with a partner includes single/separated/divorced/widow.

| Table 5 | Association of LS (continuous LS and high vs low LS) with SARS-CoV-2 positive/presumed positive person contact. Univariable logistic regression and multivariable logistic regression adjusted for sex, age, mobility and employment. |
|---------|-----------------------------------------------------------------------------------------------------------|
|         | Univariable | Multivariable |
|         | OR (95% CI) | p-value | OR (95% CI) | p-value |
| LS (continuous) | 0.74 (0.64–0.85) | <0.0001 | 0.78 (0.67–0.90) | <0.001 |
| High vs Low LS | 0.37(0.19–0.72) | <0.01 | 0.42(0.21–0.84) | 0.01 |
for going out were identified with working or supplying food or medicines. Among employed people, 4 out of 10 left home and only 2 out of 10 did among those unemployed. However, the survey considered only a short time interval (April 5–21, 2020) and did not measure how such measures impacted on protection from infection; moreover, details about the medical history of the cohort were not provided.

In our work, while searching for specific characteristics determining higher or lower adherence to lockdown, hence more effective protection strategies, we found that female, older, disabled and unemployed persons had higher LS, suggesting that social unfavorable conditions in case of pandemic is beneficial in terms of protection.

Interestingly, we did not find differences in the score among people treated with immunomodulators, immunosuppressants or untreated, as well as among people with short or long disease duration. Although the recommendations of the MS International Foundation and of the MS study group of the Italian Society of Neurology for people with MS were differentiated based on treatments’ mechanism of action (MSIF, 2020) and a protective role of some commonly used drugs has been even suggested (i.e. beta-interferons) (Pandey et al., 2020), it is possible that the very diagnosis of MS had a greater impact on patients’ behavior.

Selecting single domains, we noticed that the mean score of the individual Working domain was close to the upper limit, meaning that the majority of people did not leave the house to go to work and remote working was agreed to the majority of them, in line with government’s indications for fragile populations. Nevertheless, including cohabitants reduced the Working domain score suggesting that, in order to achieve higher protection, homeworking indications should have been extended to patients’ close social contacts and cohabitants. This aspect is corroborated by the analysis of the answers given by the only individual that got infected among respondents. Although financial and other social issues are critical in making this sustainable (Maharaj and Kleckowski, 2012), considering the risks for fragile people there is an indication for shifting cohabitants’ work arrangements toward remote work. Looking at Social Distance and PPE use domain and Assistance domain, we found that the majority of patients reached intermediate scores, especially for assistance. This suggests that people were not leaving their homes for reasons related to work while they did for shopping or treatments. Conversely, there was high adherence to the use of PPE. Although effort has been put to implement home delivery of drugs for MS and in replacing visits with phone calls or telemedicine, this represents a critical issue to comply with in order to better protect our patients. Moccia and Lanzillo, 2020 Taking into account the personal opinion of patients, it is worth noticing that the majority of them asked to potentiate home assistance for healthcare and other needs.

Implementing strategies to improve LS in fragile patients is relevant in terms of protection from infection. Interestingly, we found that a decrease of only 1 point in the LS was associated with a higher odds ratio of coming in contact with infected people or suspects, underlining the need of respecting all advices in order to get full protection from infection. The accuracy of the score was close to 0.7, meaning that the score has sufficient discriminative capacity in the identification of individuals coming in contact with positive subjects. A cut-off of 6.0 has been identified as the minimum value to reach in order to get protected.

Unfortunately, we could not calculate the risk of actual infection depending on score values, as in our sample there was only one respondent positive for SARS-CoV-2. Low infection incidence was not unexpected as our sample is almost entirely (92%) constituted by individuals who live in the Rome area (COVID19 incidence 0.12%, similar to the one found in our sample), with only 4 subjects living in high COVID19 incidence areas. (Goumenou et al., 2020)

It was not possible to compare the incidence of COVID19 infection in this MS population with the general Italian MS population as data are not available yet, although a study investigating COVID-19 infection among Italian MS patients is ongoing. (Sormani, 2020)

Our study has several limitations. The use of a web-based survey restricts the capacity to reach persons with no access to internet and navigation devices. Adhesion to the survey was on a voluntary basis and patients were not selected in advance to be representative of the general MS population, nevertheless the high number of respondents guarantees the generalizability of our results. However, looking at the characteristics of the respondents, the distribution among demographic and clinical categories was similar to the general MS population, with the exception of therapies in use.

Moreover, due to the intrinsic nature of the survey, data were collected in an anonymous way, therefore clarification of ambiguous data was not possible.

Finally, we only evaluated patients followed up in a single MS center located in a low risk area, therefore we were not able to verify the performance of the score in other MS populations living in regions with high incidence of COVID19. This aspect might be addressed in additional studies.

Notwithstanding these limits, we believe that this study underlines the importance of strict adherence to lockdown measures and use of protective devices by persons with MS and their cohabitants in preventing unwarranted exposure to infected individuals or suspects. Although the validity of our score needs to be confirmed in larger and independent populations it may represent a useful tool to measure adherence to lockdown in fragile people.

CRediT authorship contribution statement

Doriana Landi: Conceptualization, Data curation, Investigation, Methodology, Writing - original draft. Marta Ponzano: Conceptualization, Data curation, Methodology, Formal analysis, Writing - original draft. Carolina Gabri Nicoletti: Investigation, Methodology, Writing - original draft. Gianluca Cecchi: Investigation, Data curation. Gaia Cola: Investigation, Data curation. Giorgia Mataluni: Conceptualization, Writing - review & editing, Conceptualization, Writing - review & editing. Nicola Biagio Mercuri: Methodology, Writing - review & editing. Maria Pia Sormani: Conceptualization, Formal analysis, Supervision, Writing - review & editing. Girolama Alessandra Marfia: Conceptualization, Supervision, Writing - review & editing.

Declaration on Competing Interest

Landi D has no interests to disclose; Ponzano M has no interests to disclose; Nicoletti CG has no interests to disclose; Cecchi G has no interests to disclose; Gol A has no interests to disclose; Mataluni G has no interests to disclose; Mercuri NB has no interests to disclose; Sormani MP has no interests to disclose; Marfia GA has no interests to disclose.

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Supplementary materials

Supplementary material associated with this article can be found, in the online version, at doi:10.1016/j.msard.2020.102359.

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