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## Stay home, stay safe, stay green: The role of gardening activities on mental health during the Covid-19 home confinement

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### ABSTRACT

Social distancing and home confinement during the first wave of Covid-19 have been essential to helping governments to flatten the infection curve but raised concerns on possible negative consequences such as prolonged isolation or sedentary lifestyles. In this scenario, gardening activities have been identified as a plausible tool to buffer the mental health consequences of forced home confinement. In this paper, we investigate the relation between gardening and psychopathological distress during the lockdown of the first wave of Covid-19 in Italy. It is hypothesized that engagement in gardening activities promotes psychological health, through a reduction of Covid-related stress. An online survey was administered through sharing using social media to N = 303 participants during the March-May 2020 lockdown in Italy, measuring Covid-19 related distress, psychopathological distress, engagement in gardening activities plus a series of socio-demographic and residential covariates. As expected, a mediation model tested using a bootstrapping procedure showed that gardening is related to lower psychopathological distress through decreased Covid-19 related distress. Interestingly, results also showed that psychopathological distress was higher for women and unmarried respondents, and negatively associated with age and square meters per person at home. The theoretical and practical implications for social policies contrasting the Covid-19 pandemic are discussed.

### 1. Introduction

The outbreak of the Covid-19 pandemic during 2020 caught the world off-guard. In the first months of 2020, the increase of patients needing medical assistance and, especially, intensive care, forced governments all over the world to take remedial actions to rapidly stop the spread of the disease. In particular, social distancing and home confinement were widely used to contrast the diffusion of the virus SARS-CoV-2. These measures efficiently helped governments to slow down the growth curve of the infections during the first wave of Covid-19 (Lau et al., 2020). While it is not excluded that they could be an indispensable instrument also during further waves and ongoing ones (some countries are currently affected by the second wave and others by the third wave), the data on the psychopathological consequences such as prolonged isolation (Killgore et al., 2020) and sedentary lifestyle (Zheng et al., 2020) started to get concern. In this scenario, it becomes essential to establish activities that can promote mental health during

home confinement. One of which is represented by gardening activities (Fullana et al., 2020).

Gardening activities are defined as a range of active interactions with nature that an individual may implement (Spano et al., 2020). These activities may include indoor and outdoor plant care and the collection of natural elements and their use (e.g., cooking). In the literature, it is well-known that individuals that engage in gardening activities report greater psychophysical and psychosocial health (Soga et al., 2017; Spano et al., 2020). Taking care of plants is a low expensive activity that can be easily implemented at home by a wide range of individuals, without particular expertise and tools. These important features become particularly relevant during quarantines and lockdowns. In this regard, different sources indicated that during the national lockdown in Italy, the selling of gardening supplies grew by 44 %, ranking as the third product category to experience substantial growth in the global sales (<http://sellics.com>). Estimates even report that three million Italians began to devote themselves to gardening precisely during the lockdown

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(Nomisma, 2020). Why it felt so important to so many people to start gardening during this burdensome period?

This paper aims at investigating the important role of gardening activities on psychopathological distress during the days of austere lockdown in Italy, in the course of the first wave of Covid-19. In particular, we hypothesized that the beneficial effect of the engagement in gardening activities on psychopathological health is exerted through diminished Covid-19 related stress.

### 1.1. Gardening and stress: the beneficial effect on psychological health

Gardening and horticultural therapy have been demonstrated to alleviate psychopathological symptoms in the case of schizophrenia (Oh et al., 2018), depression (Gonzalez et al., 2010), and anxiety disorders (Adevi and Mårtensson, 2013). Gardening activities have been also associated with diminished negative emotions and enhanced positive emotions (Soga et al., 2017; Van Den Berg and Custers, 2011). In this regard, the positive effect of gardening on psychopathology could be related to its beneficial effect in lowering psychological stress. Studies confirm that gardening has significant diminishing effects on important stress components as anxiety, tension, confusion, and fatigue (Clayton, 2007; Hayashi et al., 2008; Soga et al., 2017; Van Den Berg and Custers, 2011). This significant buffer effect was also detected through psychophysiological measures such as lowered heart rate and salivary cortisol levels (Van Den Berg and Custers, 2011; Wichrowski et al., 2005).

According to Pretty (2004), the mechanism through which gardening impacts stress is the result of three factors: (1) the view of a natural or semi-natural setting, which alone has been proved to represent a stress buffer; (2) the nature immersion, which enhances connectedness and relaxation, and (3) the active engagement in a natural setting, which allows for the effect of nature to be combined with the anti-stress effect of physical exercise. Different studies found that horticulture is mostly considered by gardeners as a way to distract themselves from negative emotions and achieve relaxation (Catanzaro and Ekanem, 2004; Clayton, 2007; Gonzalez et al., 2010). Following the same line, individuals who engaged in gardening activities reported enhanced restorativeness in terms of the experience of being away, meaning escaping from costly daily stressors while gardening (Gonzalez et al., 2010). In light of the abovementioned literature, we believe that gardening could exert an important role in stress during a highly stressful period such as prolonged home confinement resulting from the need to stop the spread of a pandemic as Covid-19.

### 1.2. Gardening during the Covid-19 pandemic and home confinement

It was estimated that by April 2020 half of the world population (3.9 billion persons) in more than 90 countries have been asked to stay at home by their governments (Sandford, 2020). Individuals found themselves without the possibility to exit their dwellings, constantly exposed to discouraging news on the spread of the pandemic and the excess load of the national health systems (Garfin et al., 2020). Particularly in Italy, the case fatality rate, which indicates the proportion of deaths on the total case detected, was one of the highest in the world (Johns Hopkins Coronavirus Resource Center, 2020). No doubt that the situation during this period was stressful and traumatic for most people. As confirmed by a study conducted on a representative sample of the Italian population, levels of negative affect, anxiety, and detachment (i.e., a condition characterized by depressive symptoms and interpersonal withdrawal) grew during the lockdown (Mazza et al., 2020).

Actually, the reasons to be stressed were several. Isolation and social distancing resulted in greater perceived loneliness (Li and Wang, 2020). Besides, studies reported that the fear to be infected or to have loved ones infected resulted in important implications as delayed access to health care (Lazzerini et al., 2020) and a higher incidence of suicide rates (Dsouza et al., 2020). Moreover, the economic depression consequent to the wide variety of containment measures resulted in high

economic stress and job insecurity (Wilson et al., 2020). These and other complex social and psychological consequences of the Covid-19 emergency may have contributed to the enhancement of Covid-19 related stress (Tan et al., 2020). In this regard, a recent meta-analysis highlighted that high levels of post-traumatic stress disorder symptoms were associated with the pandemic, suggesting that even 25% of adults would have needed mental health services during the first wave of the pandemic (Cooke et al., 2020).

In this scenario, it is important to identify those activities that can lower the traumatic impact of Covid-19 on psychological health. In this paper, we propose that the beneficial effect of gardening on psychological health may be especially important during home confinement. In particular, we hypothesize that there should be a positive effect of gardening activities on Covid-19 related stress which, in turn, should lower the psychopathological symptoms reported. We also predict that this effect would be significant over and above the effect of other important variables. The covariates considered are socio-demographic variables and variables related to the personal experience of the pandemic, namely smart working, the square meters per person in the place of residence, and the number of infections per region. To test our mediation hypothesis, we interviewed a wide sample of Italian residents during home confinement in the course of the first wave of the spread of the Covid-19 pandemic.

## 2. Method

### 2.1. Participants and procedures

A convenience sample was interviewed during the lockdown through an online survey shared through personal contacts, mailing lists, and social media such as Facebook, LinkedIn, Instagram, and WhatsApp. Individuals could complete the online survey by smartphone, personal computer, or tablet. Those who could not have access to such devices were unable to contribute to the research. Participants were assured anonymity and, to gain access to the survey, they needed to provide their informed consent to voluntarily take part in the study and declare that they were 18 or older. Thus, the refusal to give explicit consent to participate in the research and being younger than 18 constituted exclusion criteria.

The study was part of a wider research project aimed at investigating the psychopathological correlates during the Covid-19 pandemic in the whole Italian territory (Panno et al., 2020a). The data were collected from March to May 2020, namely during the strict lockdown in Italy (i.e., "phase one" of the containment measures). In that period the exponential curve in Italy was growing and the general level of restrictions was the same on the whole Italian territory, which means that people could move only for reasons of necessity (e.g., shopping for food, primary health care, work in activities functional to guarantee minimal essential services and those strictly linked to emergency management). Details of specific restrictions ongoing in Italy in that period are reported in Decreto del Presidente del Consiglio dei Ministri (2020a) and Decreto del Presidente del Consiglio dei Ministri (2020b).

Participants were 303, of which 207 (68.3 %) were women and 96 (31.7 %) were men. Age ranged from 18 to 74 ( $M = 39.88$ ,  $SD = 13.44$ ). Of the total sample, 165 (54.5 %) were married or living together and 138 (45.5 %) were unmarried. Regarding the educational qualification, 111 (36.6 %) held a high school diploma, whereas 192 (63.4 %) held a bachelor's degree or higher qualification. Regarding the employment status, 223 (73.6 %) were workers, 37 (12.2 %) were students, 27 (8.9 %) were unemployed, 7 (2.3 %) were retired, 4 (1.3 %) were homemakers, and 5 (1.7 %) reported other statuses. Approximately half of the sample (162, 53.5 %) was smart working during the lockdown. The major part of the sample (175, 57.8 %) was living in the central regions of Italy, 66 (21.8 %) in the northern regions, while 62 (20.5 %) in the southern regions. The study has been approved by the European University of Rome's ethics committee (Prot. N.004/20) and was held

according to the Helsinki declaration standards.

## 2.2. Measures

### 2.2.1. Covid-19 related distress

To measure the Covid-19 related distress, we used the Italian adaptation of the 22-item Impact of Event Scale-Revised (IES-R; Craparo et al., 2013; Weiss and Marmar, 1997), a widely used measure of post-traumatic stress disorder symptoms in relation to specific events. Specifically, in the instructions, it was asked to directly refer to the emergency related to the spread of Covid-19 while responding to the items. An example of an item is “Any reminders brought back feelings about it”. Responses ranged from 0 (not at all) to 4 (extremely). The scale is composed of three sub-dimensions, namely intrusion, avoidance, and hyper-arousal. In this study, we used the total sum score, with higher ratings indicating more severe symptoms. The mean was 22.24 (SD = 11.64) and Cronbach’s alpha was 0.87.

### 2.2.2. Psychopathological distress

To assess the psychopathological symptoms, we used the Italian version of the 9-item Symptom-Checklist-K-9 (SCL-K-9; Imperatori et al., 2020a; Klaghofer and Brähler, 2001). It is the shortest version of the popular Symptom Checklist-90-Revised (SCL- 90-R; Derogatis, 1977), composed of 90 items. Each of the nine items assesses symptoms reported over the previous week through nine psychopathological domains: somatization, interpersonal sensitivity, obsessive-compulsive, anxiety, depression, hostility, phobic anxiety, paranoid ideation, and psychoticism. The total mean score is a unidimensional indicator of psychopathological distress, with higher scores indicating higher distress. Responses ranged from 0 (not at all) to 4 (extremely). In our sample, the mean was 0.96 (SD = 0.73) and Cronbach’s alpha was 0.87.

### 2.2.3. Other measures

We asked participants whether they engaged in gardening activities during the lockdown. Of the total sample, 98 (32.3 %) reported having engaged in gardening activities and 205 (67.7 %) reported having had not engaged in such activities. We also asked questions related to the place of residence in which the individuals spent confinement, which could give us elements on the personal experience during the lockdown. Several studies reported how living space is an important indicator of housing quality and, in particular, of psychological health (Eurofound, 2016; Evans et al., 1989). Space could be even more important during confinement. In this regard, we measured the square meters per person. It was computed as the quotient of square meters of the place of residence during confinement divided by the number of inhabitants. In our sample, the average square meters per person at disposal in one’s dwelling was 35.30 (SD = 15.60). Lastly, we matched each participant with the number of infections of the previous day in the specific Italian

region where the participant spent the period of lockdown, using the data provided by the Italian Ministry of Health (Ministero della Salute, 2020).

## 3. Results

In Table 1, the descriptive statistics and the correlations among variables are reported. Interestingly, having engaged in gardening activities was negatively associated with Covid-19 related distress and psychopathological distress and positively related to age and square meters per person. Covid-19 related distress was positively related to psychopathological distress and was higher for women. It was negatively related to age, educational qualification, and marital status. Psychopathological distress was higher for women and was negatively related to age, marital status, and square meters per person.

### 3.1. Mediation model

To test our hypothesis that engaging in gardening activities is related to lower psychopathological distress through decreased Covid-19 related distress, we tested a mediation model using the Model 4 of the SPSS Macro Process (Hayes, 2018) with 5000 bootstrap samples. We also considered the following covariates: gender, age, educational qualification (0 = no bachelor’s degree and 1 = bachelor’s degree), marital status (1 = unmarried and 2 = married), smart working (0 = no and 1 = yes), square meters per person, and number of infections per region. According to Baron and Kenny (1986), we obtained the results from three models. In the first model, we obtained the total effect of gardening activities on psychopathological distress (path *c*). In the second model, we obtained the path *a* of mediation, namely the effect of gardening activities on the Covid-19 related distress. In the third and last model, we obtained the path *b*, namely the effect of Covid-19 related distress on psychopathological distress controlling for gardening activities, and the path *c’*, namely the direct effect of gardening activities on psychopathological distress.

Results of the three models are reported in Table 2. In particular, the total effect was negative and significant, indicating that having engaged in gardening activities was associated with lower psychopathological distress. Moreover, the effect of gardening activities on Covid-19 related distress was negative and significant. Thus, having engaged in gardening activities was associated with lower Covid-19 related distress. In turn, Covid-19 related distress was positively related to psychopathological distress. Lastly, the indirect effect was significant  $\beta = -.16$ ,  $SE = .07$ , [95 % CI =  $-.31, -.03$ ], ultimately confirming our mediation hypothesis. Interestingly, when Covid-19 related distress was taken into account, the direct effect of gardening activities on psychopathological distress was no longer significant. This latter finding suggests that the totality of the effect of gardening on psychopathological distress passed through the

**Table 1**  
Correlations among variables of interest.

	1	2	3	4	5	6	7	8	9	10
1. Gardening activities	1									
2. Covid-19 related distress	-.18**	1								
3. Psychopathological distress	-.23***	.63***	1							
4. Gender	-.09	.27***	.28***	1						
5. Age	.24***	-.15**	-.28***	-.17**	1					
6. Educational qualification	.03	-.13*	-.04	-.01	.01	1				
7. Marital status	.12*	-.12*	-.15*	-.04	.46***	-.06	1			
8. Smart working	.01	-.05	.01	.04	.11	.21***	.05	1		
9. Square meters per person	.21***	-.10	-.13*	-.04	.14*	.14*	-.16**	.01	1	
10. Number of infections per region	-.17**	-.02	.03	.10	-.01	-.03	.11	.10	-.08	1

Note. Gardening activities: 0 = no and 1 = yes, Gender: 1 = male and 2 = female, Educational qualification: 0 = no bachelor’s degree and 1 = bachelor’s degree; Marital status: 1 = unmarried and 2 = married; Smart working: 0 = no and 1 = yes.

\*  $p < .05$ .

\*\*  $p < .01$ .

\*\*\*  $p < .001$ .

**Table 2**  
Results of the three mediation models.

	Psychopathological distress						Covid-19 related distress		
	Model 1			Model 3			Model 2		
	$\beta$	SE	95 % CI	$\beta$	SE	95 % CI	$\beta$	SE	95 % CI
Intercept	.11	.07	[-.02, .24]	.05	.05	[-.05, .16]	.09	.07	[-.04, .23]
Gardening activities	-.33**	.12	[-.56, -.09]	-.16	.10	[-.36, .03]	-.29*	.12	[-.53, -.05]
Covid-19 related distress	-	-	-	.57***	.05	[.48, .66]	-	-	-
Gender	.23***	.05	[.12, .34]	.09	.05	[.01, .18]	.26***	.06	[.15, .37]
Age	-.18**	.06	[-.30, -.05]	-.16**	.05	[-.26, -.06]	-.02	.06	[-.15, .10]
Educational qualification	-.04	.06	[-.15, .07]	.03	.05	[-.06, .12]	-.12*	.06	[-.23, -.01]
Marital status	-.05	.06	[-.18, .07]	.01	.05	[-.10, .10]	-.09	.06	[-.22, .03]
Smart working	.03	.06	[-.07, .14]	.05	.05	[-.04, .14]	-.02	.06	[-.13, .09]
Square meters per person	-.07	.06	[-.19, .04]	-.04	.05	[-.13, .05]	-.06	.06	[-.17, .06]
Number of infections per region	-.02	.05	[-.13, .09]	.01	.04	[-.08, .10]	-.06	.06	[-.17, .05]
R <sup>2</sup>	.17***			.45***			.13***		

Note. Gardening activities: 0 = no and 1 = yes, Gender: 1 = male and 2 = female, Educational qualification: 0 = no bachelor's degree and 1 = bachelor's degree; Marital status: 1 = unmarried and 2 = married; Smart working: 0 = no and 1 = yes.

\*  $p < .05$ .  
 \*\*  $p < .01$ .  
 \*\*\*  $p < .001$ .

Covid-19 related distress. See Fig. 1 for a graphical representation of the mediation model.

**4. Discussion**

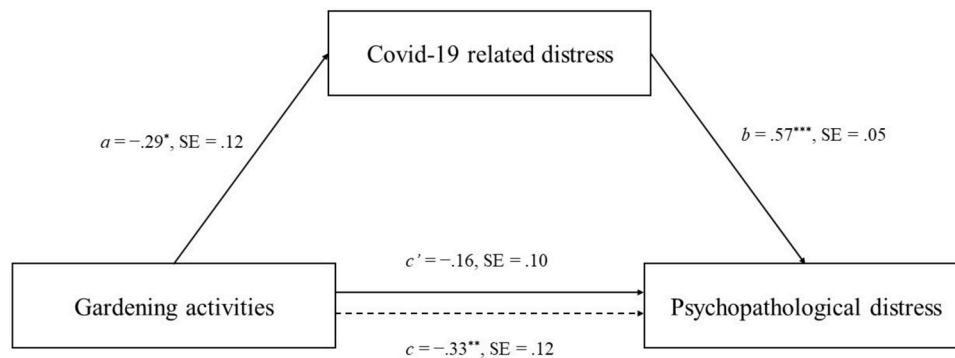
The psychological traumatic consequences of Covid-19 and related containment measures spread worldwide. Numerous studies have been conducted and are still currently being designed by researchers to find solutions to contrast this massive phenomenon, especially considering the high number of on-going quarantines and possible future lockdowns. In this study, we investigated the role of gardening in diminishing the psychopathological consequences of containment measures. Specifically, we hypothesized that the beneficial effect of gardening activities on psychopathological distress passes through a lowered Covid-19 related distress. Moreover, we expected this effect to be significant over and above the effect of important covariates. To test our hypothesis, we interviewed a sample of Italian residents during the period of strict lockdown in Italy.

Results attested, as expected, that engaging in gardening activities was associated with lower psychopathological distress during the lockdown. Moreover, importantly, this effect was mediated by Covid-19 related distress. While the effect of gardening on psychological health and stress is widely recognized by numerous studies, the innovative findings of this study are related to the test of these beneficial effects during a lockdown. Notably, this effect held over and above the effect of crucial covariates as gender, age, educational qualification, marital status, smart working, square meters per person in the dwelling, and the

number of infections per Italian region.

Regarding the covariates, still significant in both models with the psychopathological distress as the outcome was the effect of age, with younger people reporting more symptoms. Interestingly, this effect was also found in other studies conducted during the pandemic (Li and Wang, 2020; Palgi et al., 2020). This result was interpreted as higher resilience and more effective emotion regulation by older individuals. Besides, younger individuals may experience greater loneliness (especially if unmarried) and economic stress during this period (Knepple Carney et al., 2020; Li and Wang, 2020). In the model with Covid-19 related stress as the outcome, the effect of educational qualification was significant, indicating that higher educational level was associated with lower distress related to the pandemic. As we can speculate from the correlations observed, this result may be related to the fact that people with (vs. without) a degree may have been less exposed to the risk of losing their job. Indeed, they are more likely to work for companies that could recur to the smart working solution. Moreover, these individuals seem to have more space at their disposal in their place of residence. These two factors, in turn, may have sustained psychological health. These conjectures would highlight social and economic inequality in the experience of the lockdown. However, this hypothesis is just speculation and still needs to be tested.

This study has some limitations. First, the cross-sectional design cannot ascertain causality and the direction of the relationships observed. Nevertheless, we are confident in future studies that may specifically overcome this limitation with experimental designs. Moreover, future longitudinal studies may inform us of the intraindividual



**Fig. 1.** Graphical representation of the results from the mediation model. Note. Please note that the reported estimates were obtained controlling for the covariates gender, age, educational qualification, marital status, smart working, square meters per person, and number of infections per region. The estimates correspond to standardized effects.



dynamic involved in the generation of stress and psychopathological symptoms during home confinement. Second, although we interviewed a sample of Italian residents distributed throughout different regions, the limited number of participants does not allow for proper generalizability to the Italian population. Third, our measure of psychological distress is widely used albeit composed of only nine items. Future studies should consider using more detailed instruments of this complex construct, such as the longer version of the SCL-K-9, namely the Symptom Checklist-90-Revised. In this way, the specific effects on each indicator could be also considered.

Another limitation is that we cannot be sure that gardening activities were performed outdoor or indoor. This could lead to differences in the strength of the effects on stress and health as attested by past research (Hawkins et al., 2011). Thus, future research could focus on the typology of gardening activities and its relations with stress and health during quarantines or national lockdowns. Lastly, individual characteristics may be involved in the relationship between gardening and mental health as they can enhance or impede the possibility, for instance, to appreciate nature immersion (Panno et al., 2020b). Future research directions could investigate their role during home confinement.

Despite these limitations, these findings suggest that gardening has been an important activity during the pandemic for our sample. We believe that the effects we found are crucial especially in light of the high rate of future home confinement the world population may experience during the future waves of Covid-19. In particular, we believe that the importance of these findings is related to the specific features of gardening activities, which may make it a feasible and significant instrument for contrasting the negative psychopathological consequences of measures such as isolation and home confinement. More in general, the contact with nature would seem to assume a particular relevance during summers with very high temperatures and, accordingly, it should be supported as well as guaranteed in such periods (Panno et al., 2017).

First, gardening can guarantee a feeling of connectedness with nature when there can be lowered occasions to spend time in natural settings (e.g., urban parks and community gardens were closed during lockdowns in most cities in Italy or going in these places was discouraged; Azevedo et al., 2020; Carrus et al., 2020; Ugolini et al., 2020). Second, gardening may also partially contrast the problem of a sedentary lifestyle during home confinement. Third, we believe it is a versatile tool that can be easily performed during lockdowns. The activity could be implemented in groups of people that may discuss their plants and flowers growing through virtual meetings or blogs. In this way, the social aspect of gardening, which proved to contribute to psychological health, may be also included. Fourth, the Covid-19 pandemic did not affect all the population with the same gravity, sharpening social inequalities. In this scenario, relevant to less wealthy individuals seem to be the economic benefits of growing their food (Catanzaro and Ekanem, 2004). Fifth, we believe that gardening is a low-cost activity that is affordable for most people despite social and economic disparities. Lastly, in those cases where direct access to a garden is not possible, exposure to virtual gardens using virtual reality may be considered (Imperatori et al., 2020b; Riva et al., 2020).

In conclusion, the picture returned by our data suggests that some sub-populations, more than others, might be more exposed to psychopathological distress, especially during home confinement. In particular, young people, women, and unmarried individuals showed less psychological adaptation. Policymakers could consider giving priority and tailoring interventions to these groups that are more at risk, especially in those situations in which the efforts needed for responding to the pandemic are limited. In this regard, our study points to the promotion of an active engagement with nature as a possible intervention. Apart from gardening, strengthening psychological resources such as coping strategies could be a further successful tactic. For instance, the emotion regulation strategy cognitive reappraisal has been proved to be associated with lower stress during home confinement due to the Covid-19 pandemic (Pérez et al., 2020; Xu et al., 2020).

All in all, we are confident that our results may be useful to professionals and policymakers in the fight against the Covid-19 pandemic and the related significant psychopathological consequences.

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## CRediT authorship contribution statement

**Annalisa Theodorou:** Methodology, Formal analysis, Data curation, Writing - original draft, Writing - review & editing. **Angelo Panno:** Conceptualization, Methodology, Formal analysis, Investigation, Writing - review & editing, Supervision, Project administration, Funding acquisition. **Giuseppe Carrus:** Funding acquisition, Supervision. **Giuseppe Alessio Carbone:** Conceptualization, Investigation, Data curation, Methodology. **Chiara Massullo:** Investigation, Data curation, Writing - review & editing. **Claudio Imperatori:** Investigation, Project administration, Resources, Writing - review & editing, Supervision.

## Declaration of Competing Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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