


Digital affinity and cognitive reserve: Salience for resilient aging in pandemic

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Abstract

Objective: The study aimed to analyze the impact of technology in the older adults after acute pandemic regarding to the development of digital confidence. **Method:** A sample of $n = 56$ healthy older adults ($N = 22$ female, $N = 34$ male) aged 64 to 86 years ($M = 73.7$, $SD = 6.40$) participated in observational study. The sample was distributed in two groups: (a) pre-COVID and (b) post-COVID. Psychological battery was applied: Mini-Mental State Examination, Cognitive Reserve Index Questionnaire, Beck Depression Inventory-II, Affinity for Technology Interaction Scale, and then Digital Mastery Questionnaire. Descriptive and (M)ANOVA statistical analyses have been applied. **Results:** Our results confirmed the increase in technology usage among elders, the higher use of smart devices and then more confident digital daily living; then, the improving of digital affinity for technology and higher adherence in seniors than older. In sex effect, men seemed developing higher digital confidence for digital experience, for access and use of financial online services than women. In the process of improvement by massive digital experience in daily living the cognitive reserve had relevant influence: elders with high level of cognitive reserve appeared to enhance own competence in digital mastery and affinity for technology. **Conclusions:** Our study highlighted the higher cognitive reserve being protective in older adults favoring the efficacy to the changing in daily living as well the develop of adaptive behaviors in order to achieve high Quality of Life.

Keywords

COVID-19, technology, digital confidence, older adults, aging, resilience

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Introduction

The COVID-19 pandemic affected physical and mental health of population; particularly, the restrictive social measures as one of public health protection adopted by countries induced uneasiness and hardship (Vagnini et al., 2022). Several studies have highlighted the negative psychological effects by prolonged lockdown: increased perceived stress, anxiety, depression, and fear of death (Gauthier et al., 2022; Martins Van Jaarsveld, 2020; Murciano-Hueso et al., 2022; Rajkumar, 2020). Vulnerable population (= higher risk for poor health as a result of the barriers they experience to social, economic, political, and environmental resources) as well young generation, front-line health-care workers, and then general population showed compromised mental health outcome (The Lancet Psychiatry, 2021). Even older adults impacted negatively by pandemic: it is emphasized that social isolation among older adults is a “serious public health problem,” increasing

the risk of cardiovascular, autoimmune, neurocognitive, and mental health problems. Particularly, social isolation negative effects have been shown to be magnified in older adults. Social isolation often results in loneliness, which is a factor significantly associated with depression in older adults (Armitage & Nellums, 2020; Sayin Kasar & Karaman, 2021).

During pandemic, digital tools and internet surfing represented potent instrument to overcome social isolation; being physically distant, individuals could have social communication (relatives, friends, working) as

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well solving daily issues (pharmacy, medical care, primary shop) mitigating negative side effect of imposed restrictive measures in lockdown such as in prolonged isolation (Gauthier et al., 2022; Murciano-Hueso et al., 2022; Sen et al., 2022).

Digital technologies took rapid uptake as digital interaction as mental and physical need. The access to, as the ability to proficiently use technology sounded relevant to impact quickly and efficiently to the pandemic; unfortunately, that digital competence was lower in older adults than in youthhood, known as the digital divide (Di Giacomo et al., 2019; Friemel, 2016; Martins Van Jaarsveld, 2020; Paul & Stegbauer, 2005; Seifert et al., 2020; Xie et al., 2020).

Nevertheless, the elders who use technology is increasing significantly. Elders are progressively incorporating digital learning into their daily living. Moreover, literature detected the enhanced adoption of technology usage by older people even and more during pandemic (Sixsmith et al., 2022). The percentage of individuals 55 to 74 years old internet using was 71 in 2019, 75 in 2020, and 78 in 2021 (European Commission, 2022).

Considering the technological usage improvement in aging, present study aimed to highlight the impact of technology in COVID-19 era in the older adults regarding to the development of digital abilities. Our scope was to examine the changing of technology attitude over the time in healthy old population in pre and post pandemic by cohort study evaluating the impact of fast and massive digital solutions in daily life for own (physical and mental) needs.

Materials and Methods

Ethics Statement

The study has been approved by the Institutional Review Board (IRB) of the University of L'Aquila, Italy (Prot. No. 37590/2021). Informed consent was obtained from each participant, and the study adhered to the guidelines outlined in the Declaration of Helsinki (World Medical Association, 2008).

Sample

A total of $N = 62$ eligible participants were enrolled; six participants dropped out: $N = 3$ lacking of time, $N = 3$ no interest to research program. A sample of $N = 56$ healthy old adults ($N = 22$ female, $N = 34$ male) aged 64 to 86 years ($M = 73.7$, $SD = 6.40$) participated in the study. The sample was distributed in two groups: (a) pre-COVID and (b) post-COVID. The participants were enrolled in middle Italy in two range time: pre-COVID group was composed of $N = 28$ subjects and enrolled in range time January to May 2019; post-COVID group was composed of $N = 28$ and enrolled in range time June to October 2022.

Cognitive decline screening had been applied to select healthy subject; the Mini Mental State Examination

(MMSE) (Folstein et al., 1975) test was applied for the cognitive decline screening (see below psychological measure paragraph).

The inclusion criteria were as follows: (a) age = 60 to 90 years, (b) MMSE score >23, (c) no sign of psychiatric or neurological diseases, (d) no alcohol or substance abuse, and (e) provision of informed consent.

Table 1 reported the demographic characteristics of the participants.

Measures

Sociodemographic variables. Demographic data were collected through participants' self-reports and stored in online database. They have been elaborated as categorical variables by descriptive analyses.

Psychological measures. The psychological battery was composed of three tests that measure emotional (depression) and cognitive characteristics, detailed as follows.

Mini-Mental State Examination (MMSE). The MMSE is a screening test that is used to detect cognitive decline in older adults (Folstein et al., 1975). It consists of 30 items and includes tests of orientation, attention, memory, language, and visual-spatial skills. Scoring can be used to assess the risk for dementia.

Cognitive Reserve Index Questionnaire (CRIq). The CRIq measures cognitive reserve by assessing information that pertains to adulthood (Nucci et al., 2012). The cognitive reserve is the mind's and brain's resistance to the aging decline. The questionnaire consists of 20 items and 3 sections: CRI-Education (years of education, training courses), CRI-Working Activity (occupation), and CRI-Leisure Time (hobbies and other activities). The CRIq scores are classified into the following five categories: low (<70), medium-low (70–84), medium (85–114), medium-high (115–130), and high (>130).

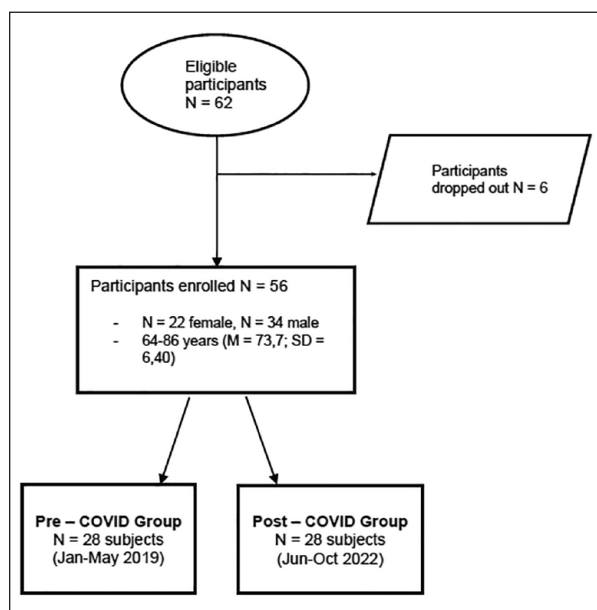
Beck Depression Inventory-II (BDI-II). The BDI measures the severity of depression (Beck et al., 2011). It consists of 21 multiple-choice questions. Higher total scores indicate more severe depressive symptoms. The standardized cutoffs used is based on four level: 0 to 13: minimal depression, 14 to 19: mild depression, 20 to 28: moderate depression, and 29 to 63: severe depression.

Technological measures. The battery was composed of two self-reports that measure technology interaction and ability to manage digital solutions, detailed as follows.

Affinity for Technology Interaction (ATI) Scale. This nine-item scale assesses a person's tendency to actively engage in or avoid intensive technology interaction (Franke et al., 2019). ATI can be regarded as a core personal resource that helps individuals use technology effectively.

Table 1. Demographic Characteristics of the Participants.

	Sample (n. 56)		
	Pre-COVID (N. 28)	Post-COVID (N. 28)	Total (N. 56)
Age	72.8SD ± 6.08	74.5SD ± 6.70	73.7SD ± 6.40
Sex			
Female	11 (40%)	11 (40%)	22 (40%)
Male	17 (60%)	17 (60%)	34 (60%)
Education			
High school Non-graduates	28.6%	60.8%	44.7%
High school graduates	35.7%	21.4%	28.5%
Bachelor degree	35.7%	17.8%	26.8%
Relationship status			
Married/living with partner	71.4%	57.1%	64.2%
Divorced	7.1%	17.8%	12.5%
Widow	21.4%	25%	23.2%
Occupation			
Retired	3.6%	92.8%	48.2%
Employed	32.1%	3.6%	17.9%
Self-employed	64.3%	3.6%	33.9%

**Graphic 1.** Flowchart of recruitment.

Digital Mastery Questionnaire (DMQ; experimental test). The DMQ is an experimental self-report measure the ability to manage digital solutions in aging. The DMQ measures the use of technology in daily life (i.e., type of tools used, the extent of use, and the type of activities that one engages in). It consists of 20 items, which assess the following six dimensions: (a) daily usage time (i.e., the amount of time spent on technological devices daily); (b) perceived self-efficacy (i.e., confidence in using technological devices); (c) benefit for life (i.e., positive perceptions of the use of technological devices for online operations); (d) digital confidence (i.e., emotional reactions to the use of technological systems); (e) internet

surfing (i.e., the number of applications used on devices); and (f) digital tools (i.e., preferences for using certain technological devices such as a personal computer or smartphone). The DMQ was tested in a pilot study, which used a sample of individuals who were not included in this study. The internal reliability of this scale was good ($\alpha = .8$).

Procedure

Participation in this study was voluntary, and the written informed consent was mandatory. Recruitment was conducted in *n. 2* timing: pre-pandemic (January-May 2019) and post-acute pandemic (June-October 2022). The psychological evaluation was conducted in a quiet dedicated room lasting approximately 30 minutes. The tests were administered by trained psychologists, blinded to the objectives of the study. Independent clinical psychologists scored the tests. The data were collected anonymously (Graphic 1).

Study Design

In this cross-sectional study, the sample was composed by two groups: pre-COVID and post-COVID. Descriptive statistics were computed to examine their demographic and psychological characteristics. *t*-Test, one-way ANOVA, MANOVA, and then post hoc analyses (Tuckey test) were conducted to analyze the significant difference in technological using ability.

All statistical analyses were conducted using jamovi (The jamovi project, 2022); the significance level was set at $\alpha < .05$.

Results

The collected data were subjected to statistical analyses.

Table 2. Independent Sample *t*-Test Between Pre and Post-COVID Grouping.

		Statistic	<i>df</i>	<i>p</i>	Mean difference	SE difference		Effect size
Age	Student's <i>t</i>	1.024	54.0	0.310	1.7500	1.709	Cohen's <i>d</i>	0.2737
MMSE	Student's <i>t</i>	-0.145	54.0	0.885	-0.0746	0.514	Cohen's <i>d</i>	-0.0388

Table 3. Raw Score and ANOVA Analysis on Sample Performance.

Measures	Sample (N. 56)		ANOVA	
	Pre-COVID (N. 28)	Post-COVID (N. 28)	<i>F</i>	<i>p</i>
Psychological data				
MMSE	27.9 ± 1.74	27.8 ± 2.09	0.02	.88
Cognitive Reserve Index-q				
Education	114 ± 16.1	106 ± 16.4	3.11	.08
Leisure time	127 ± 17.5	110 ± 29	7.22	.01*
Working activity	115 ± 24.9	101 ± 30	3.75	.05
Tot	125 ± 19.4	107 ± 28	7.13	.01*
BDI-II	9.29 ± 7.46	13.6 ± 12.8	2.33	.13
Technology usage data				
Affinity for tech interaction	30.5 ± 7.94	31.5 ± 12.4	0.49	.48
Digital Mastery-q				
Daily usage time (minutes)	98.57 ± 78.68	139.29 ± 81.73	3.60	.06
Perceived self-efficacy	23.25 ± 4.17	26.14 ± 5.93	4.45	.04*
Benefit for life	27.93 ± 4.80	27.57 ± 7.06	0.04	.82
Digital confidence	29.43 ± 4.27	30.25 ± 6.45	0.31	.57
Internet surfing				
Low	17.8%	32.1%		
Medium	32.1%	10.7%		
High	50%	57.1%		
Digital tools				
PC	78.5%	35.7%		
Smartphone	21.4%	64.2%		

First, we analyzed the features of two groups (post COVID and pre COVID) by age, and Mini Mental State Examination (MMSE) distribution. *t*-Test analysis showed no significant difference between two groups (Table 2).

Then, we wanted to analyze the difference among psychological performance (see Table 3). One-way ANOVA analysis was conducted comparing COVID groups (pre-COVID and post-COVID) in psychological and technological measures. Statistical analyses showed higher performance in post-COVID group regarding to the perceived self-efficacy (DMQ) ($p = .04$), and even lower cognitive Reserve Index (CRIq) ($p = .01$) and leisure time (CRI-q Leisure Time) ($p = .01$) than pre-COVID group.

Then we analyzed the BDI-II testing outcome: even no significance emerged by statistical analysis, our finding highlighted the increasing of affective as mild mood disturbance in post-COVID group.

Regarding technological measures, the groups reported the improving of digital use (internet surfing: pre-COVID group 50%, post-COVID group 57.1%) and the changing of device preference: personal computers

in pre-COVID group (78.5%) versus smartphones in post-COVID group (64.2%).

Then, we analyzed the aging and pre-post COVID effect on psychological performance. MANOVA analysis ($2 \times 2 \times 3$) was conducted between groups (2) (pre- and post-COVID), age groups (2) (old and senior by median age = 74.0 years old), and psychological tests (3) (BDI-II, ATI, DMQ). Multivariate analyses highlighted a significant effect on pre- and post-COVID group; no difference by aging and no interaction COVID and aging groups. Univariate analyses showed a significant effect by aging on DMQ ($F(1, 52) = 4.64$; $p = .03$), and then significant interaction between COVID and aging groups in ATI ($F(1, 52) = 6.51$; $p = .01$); no interactions between age groups and COVID in depression scale and digital ability (see Figure 1).

Then, we verified the sex effect: we conducted the MANOVA analysis ($2 \times 2 \times 3$) comparing COVID-19 groups (2), Sex (2; male, female), and psychological tests (3) (BDI-II, ATI, DMQ). As expected, results showed a significant difference in depression ($F(52,$

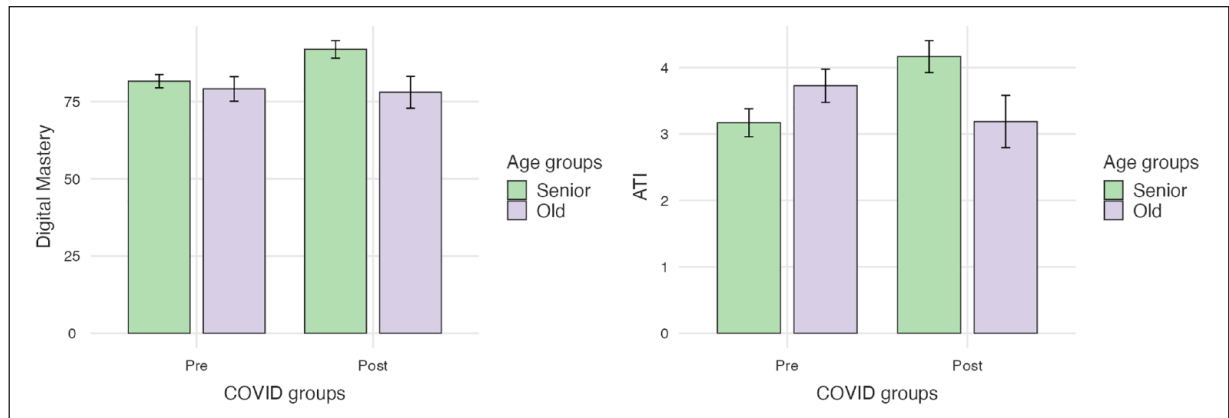


Figure 1. Representation of technological performance by COVID and aging groups.

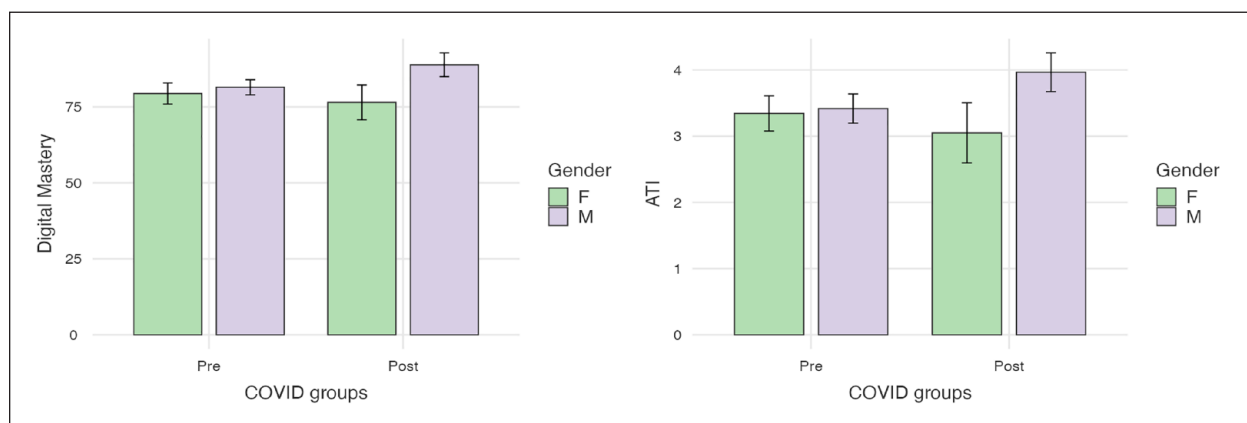


Figure 2. Representation of technological performance by COVID and sex groups.

1)=6.00; $p = .01$): women evidenced higher depression than men (see Figure 2).

Regarding the influence of cognitive reserve in psychological and technological outcome, we examined the CRI level effect. MANOVA analysis ($2 \times 2 \times 3$) was conducted between COVID-19 groups (2), cognitive reserve levels (high and low CRI indexes) (2), and psychological tests (3) (BDI-II, ATI, DMQ). Multivariate analysis evidenced significant effect for CRI ($F(50, 3) = 6.73$; $p = .001$) and interaction COVID groups and CRI levels ($F(50, 3) = 3.61$; $p = .01$). Univariate analyses showed the significant impact of CRI on BDI ($F(52, 1) = 15.46$; $p = .001$), ATI ($F(52, 1) = 12.61$; $p = .001$), and DMQ ($F(52, 1) = 9.13$; $p = .004$); the interaction COVID groups and CRI levels evidenced the significant effect on ATI performance ($F(52, 1) = 10.90$; $p = .002$) and DMQ ($F(52, 1) = 6.89$; $p = .01$) (see Figure 3).

Discussion and Conclusion

Aim of the study was to analyze the impact of the digital massive adoption in public emergency as pandemic on older adults in terms of digital confidence. We elaborated a cohort study by pre- and post-COVID acute

emergency to investigate the outcome of massive exposition to the digital daily living to overcome social restrictive measure as protective action for public health.

According to the literature, our findings confirmed the increase in technology usage among elders, the higher use of smart devices and then more confident digital daily living.

We examined the role of individual aspects, as age, sex, cognitive reserve could influence the adoption and confidence in digital living: our finding highlighted the improving of digital affinity for technology and higher adherence in seniors than older. In sex effect, men seemed develop higher digital confidence for digital experience, for access and use of financial online services than women. In the process of improvement by massive digital experience in daily living the cognitive reserve had relevant influence: elders with high level of cognitive reserve appeared to enhance own competence in digital mastery and affinity for technology and apply that improving the psychological dimensions making all actions based on digital solutions: spending long time on digital resources, using several apps for smartphone (i.e., bank account, supermarket, pharmacy, ecc), browsing the web, exploiting social media, videogames, smart games.

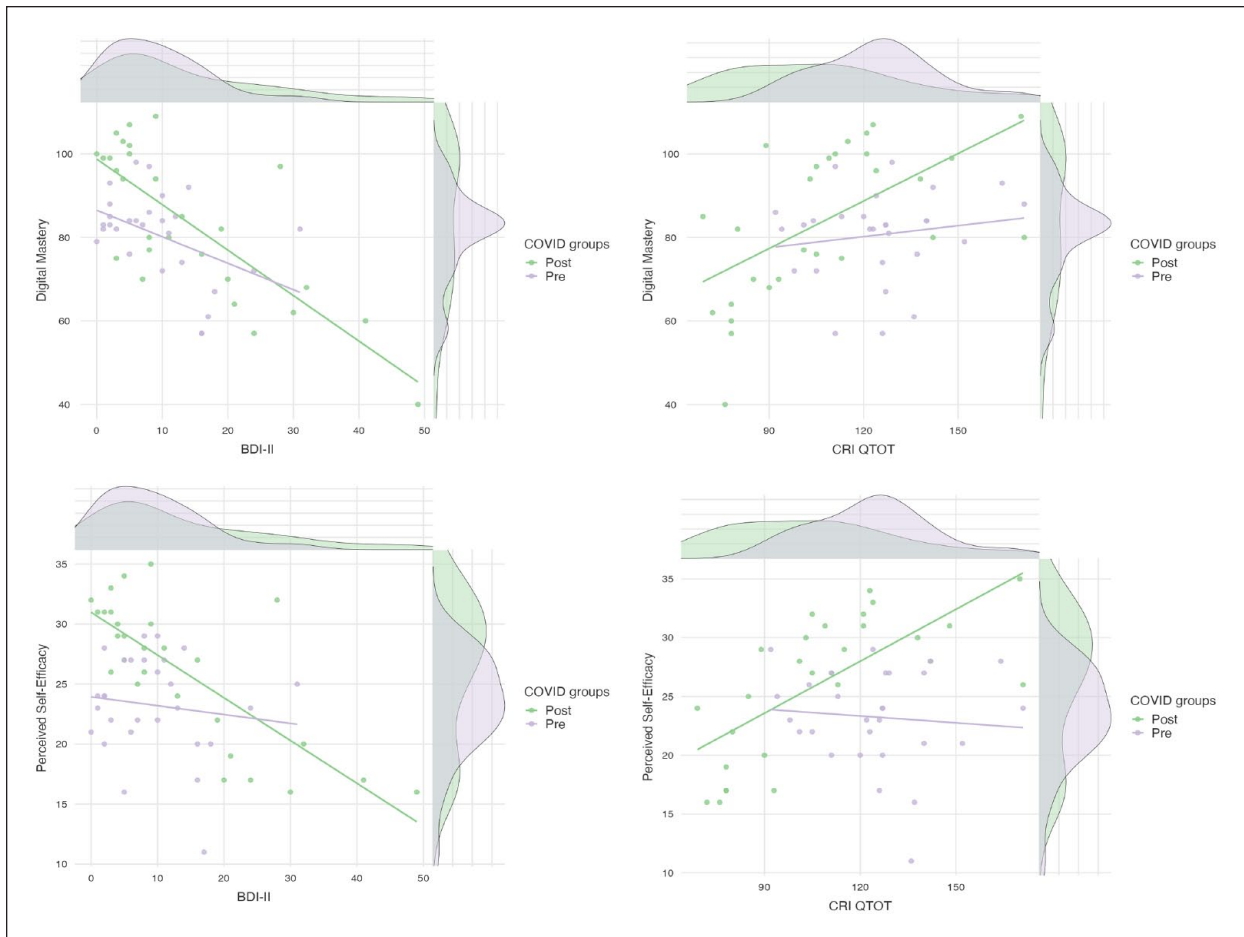


Figure 3. Representation of digital performance of COVID groups in BDI and CRI test.

Taking into account our previous study (Ranieri et al., 2021), in pre-pandemic the technology could be considered a beneficial recourse for active lifestyle as well improved and easy daily living. After massive and fast adoption of technological solutions to innovate the reduced living by public emergency, digital confidence is become a need for skilled living reinforcing the independency and the autonomy in elderly. Our finding showed the higher cognitive reserve being protective in older adults favoring the efficacy to the changing in daily living as well the develop of adaptive behaviors to achieve high positive psychological outcomes.

Moreover, the learned lesson from pandemic is related to the anxiety in older adults could have approaching technology (Di Giacomo et al., 2019) after the massive adoption for own physical and mental health, could be considered in a reduced effect. The cognitive reserve is a focal point for better life in late living because is favoring the adaptive changing in daily habits and beliefs. Technological confidence could improve that cognitive ability exploiting the personal growing impacting positively the self-esteem, autonomy, intimacy, and confidence in own individual resources.

Lately, some studies is going to investigate the neuropsychological abilities of superagers (= explicitly defined as adults over the age of 80 with excellent episodic memory ability) by sectorial approach (Cook Maher et al., 2017, 2022): our study verified the need to deal with the higher cognitive ability of older people by person-centered approach and taking care of global functioning as well how the technological environment could be reinforce the aging stimulating the maintenance of active intellectual activation. The focal point of our findings is the relevance of cognitive reserve during older adulthood as a key factor that should be examined in investigations on successful aging and more in superagers; this is more interesting within the context of analyses on the impact of technology on aging and digital living.

Limitations of the study are about the sample size, and larger psychological evaluations measuring in-depth the cognitive abilities. Our study was based on sample representative, but we could improve the frequency of sample size in order to detect consistency.

Declaration of Conflicting Interests

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