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Original Research

Challenge your Brain. Blogging during the COVID Lockdown as a Way to Enhance Well-Being and Cognitive Reserve in an Older Population

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Abstract

Background: The lockdown linked with COVID-19 restrictions has been reported to have severe consequences at an emotional and cognitive level, this was especially true for vulnerable populations, such as the older adults. This study aims at exploring the effect of a blog-based intervention implemented during COVID lockdown to increase the perceived well-being and cognitive reserve (CR) of a sample of American older adults. **Methods**: Forty-one participants (63% female), age range from 64 to 83, participated in a blog-based 5-week intervention. Their level of well-being as well as cognitive reserve were assessed before and after the intervention with specific scales. Participants were matched by age, gender and education level to a quasi-equivalent control group living in the same area who was tested on the same variables. **Results**: Results showed a significant increase in both perceived well-being and CR in the intervention group. A significant difference was also found when comparing the intervention group to the matched controls.

Keywords: blogging; cognitive reserve; COVID-19; older adults; well-being

1. Introduction

The 2019 coronavirus pandemic (COVID-19) has had, and still has, a relevant effect on several aspects of people's everyday life. Researchers have agreed on the fact that, since the pandemic began negative effects on both physical and psychological well-being, following full or partial lockdown periods, have been reported [1]. Moreover, some populations, such as immigrants, people with low socioeconomic status, homeless, older adults or people with chronic illness [2,3], were considered more vulnerable than others.

Older people have been the primary target of most of the social distancing policies and regulations, mainly because they have a higher risk of presenting complications from COVID-19. Thus, they have often experienced and/or are still experiencing permanent isolation for several months, having limited social activities and thus usually perceiving greater feelings of loneliness [4]. This feeling of loneliness and boredom [5,6] and relative physical inactivity [7] may have dramatic effects on individual physical and psychological well-being, as well as an increased risk of psychiatric disorders such as anxiety and depression [6] and an overall decline in cognitive functioning [8].

Interestingly, some studies have shown that cognitive reserve (CR), defined as the accumulation of brain resources during the entire lifespan [9,10], can moderate the negative association between social isolation and cognitive decline [8]. This might also apply to the possible decrease in perceived psychological well-being [11]. More specifically, CR, according to different authors, denotes a cumulative improvement in neural resources due to the interaction of genetic and environmental variables that, in turn, might mitigate the effects of the neural decline caused by physiological aging or age-related diseases [10,12]. This happens because the CR would allow people to optimize their performances through more adaptable functional brain processes [13], such as differential recruitment of brain networks (i.e., different brain areas or networks and interconnections) or alternative cognitive strategies [9,14,15]. Moreover, a direct relationship between these processes and healthy aging has been reported: the higher the CR, the better overall mental health an individual will achieve [13]. Several key factors influence the level of CR, including education, social networks, occupational history, number and type of leisure activities [12,16]. Creativity has also been proved to be positively associated with CR and it hence can be considered a proxy for this construct [17,18].

Starting from this evidence, it has been hypothesized that offering online-intervention activities connected to CR might not only increase participants' CR itself, but also increase their overall well-being and decrease the feeling of social isolation of the older adults in a safe and fun way. In the present study we implemented the intervention by using a blog, designed to support participants' collaboration and interactions. According to some studies, blogs might facilitate self-expression and self-reflection by promoting metacognition, because they allow participants to

share knowledge and perspectives, to receive feedback, and to derive social support from each other [19,20].

The aim of the present study was therefore to implement these theoretical premises by offering an online, blog-based, training to increase CR of a group of healthy aging people during the first lockdown period of COVID-19. We hypothesized that the training would have a positive effect on the participants, by increasing both their perceived well-being as well as their cognitive reserve level.

2. Materials and Methods

2.1 Participants and Procedures

Participants were recruited by asking local senior centers to share information about the initiative with their members. A description of the proposed intervention has been shared with senior centers and their associates though e-mail in April 2020. The researchers involved in the project were available for any further information regarding the intervention via e-mail or video-call.

An a priori Power analysis was computed using the software G*Power [21]. The analysis reported that to achieve a power of 0.85 with $\alpha = 0.05$ for our main analyses, a sample size of 38 participants needed to be recruited. Forty-one participants joined the intervention group (F = 63%), age between 64 and 83 (M = 69.90 y.; SD = 4.88).

Because of COVID related restrictions it was not possible to recruit a concurrent control group (the Institutional IRB argued that it wouldn't be ethical not to offer the intervention immediately). However, to have a partial control over the effect of time, we recruited a group of 41 participants that could be matched to our intervention group by age, gender and level of education. We selected participants that were living in the same geographical area as the intervention group (hence following the same lockdown restrictions) and we asked them to fill out the same surveys as our control group at Time 2. Participants to be included in the control group were also recruited through local senior centers via email starting around the same date (April 2020) but specifying that they would be asked to fill out the surveys after a few weeks (in order to properly match the timing with the Intervention group).

Table 1 reports basic info regarding the matching variables between our intervention group and the control group at Time 2.

Table 1. Demographic information for intervention and control groups.

	Intervention (N = 41)	Control (N = 41)	*p*
Gender	F = 26	F = 26	ns
Age (years)	M = 69.90; SD = 4.88 (range 64–83)	M = 70.51; SD = 4.47 (range 64–82)	ns
Education (years)	M = 16.56; SD = 2.07 (range 10–19)	M = 16.54; SD = 2.59 (range 10–20)	ns

Each participant filled out an online informed consent form through Qualtrics, and the rest of the self-report data and questionnaires was collected there as well.

2.2 Materials

Participants in the intervention group performed a pre- (Time 1) and post- (Time 2) assessment in which they filled out two on-line surveys through Qualtrics. Participants in the control group filled out the same surveys at Time 2.

The Cognitive Reserve Test - CoRe-T [17]: this test has been created to assess individuals' Cognitive Reserve level in a comprehensive way. It includes two main sections: self-report and fluidity of thoughts tasks. Self-report data include information about education (years of completed education, including vocational training), type and frequency of leisure activities, and occupation history (type of occupations and the number of years they have been working in each position). Moreover, two tasks are used to assess fluidity of thought/creativity: the "Acronyms" task, where participants are given 5 minutes to list all the terms that can fit into the three given acronyms (OMG, TGIF, SOS—the new acronyms have to make sense), and the "Alternative use task" where participants, in 5 minutes, are asked to list as many different, interesting or unusual usages for an empty plastic bottle (other than recycling) as they can. Answers to the flexibility tasks are scored according to fluency (i.e., number of valid answers) and originality (i.e., number of unique, original answers). The CoRe-T returns a comprehensive CR score (given by the cumulative score of years of education, frequency of leisure activities and total score for flexibility of thought/creativity). Subscores (e.g., total scores for leisure activities or creativity) can also be used for comparison. For more information about the scoring of the CoRe-T, please refer to Colombo *et al.* [17].

The Warwick-Edinburgh Mental Well-being Scale-WEMWBS [22] is a measure of mental well-being focusing entirely on positive aspects of mental health. As a short (14 items) and psychometrically robust scale, it has been reported to efficiently assess wellbeing. Participants rate each item on a 5-point Likert scale defined as follows: 1—none of the time; 2—rarely; 3—some of the time; 4—often; 5—all of the time. Example items are the following: "I've been feeling optimistic about the future", "I've been feeling useful", "I've been feeling relaxed", etc. The questionnaire returns a general mental well-being score as the sum of the responses.

2.3 Intervention

The intervention consisted of weekly challenges linked to CR, for a 5-weeks period. Challenges were posted on a blog and participants were asked, but not be required (to promote a free and motivated participation) to comment and exchange ideas, opinions, and thoughts on the blog about their progress with the challenges. Participants were constantly engaged through comments and blog posts: each

participant ended up posting or commenting at least twice a week. Researchers were daily involved in responding to participants to stimulate participation in the challenges and to ensure full participation of the intervention group over the weeks. Researchers also were available by email to answer any questions that participants might have and offer technical support as needed. Weekly emails, with a synopsis of what had bene done the week before, and highlights of the new weeks were also sent to all participants.

The challenges were easy and fun activities that have been reported in the literature to increase the CR. These activities were described each week together with the rationale for their choice and their anticipated benefits. Moreover, cognitive challenges that usually required divergent thinking or creative problem-solving, were included in each week blog posts to stimulate creative thinking and therefore CR (see **Supplementary Materials** to read the details of the intervention).

3. Results

Analyses were run using IBM-SPSS 28 (Chicago, IL, USA) statistical package.

We first compared results from our intervention group (pre-post intervention), and then we proceeded to compare the scores of the Intervention group at Time 2 with the scores from our control group (who filled out the surveys at that time).

3.1 Effects of the Online Intervention on Well-Being

We run a paired-samples *t*-test to compare the WEMWBS scores at Time 1 and 2 for our intervention group.

Results show a significant increase between Time 1 and Time 2 in the self-reported levels of wellbeing (M_{T1} = 50.88; SD_{T1} = 6.61; M_{T2} = 58.61; SD_{T2} = 2.96; t_{40} = –7.62, $p < 0.001$).

We then run an independent-samples *t*-test to compare intervention and control groups at Time 2, using the WEMWBS scores as dependent variables. The intervention group reported significantly higher levels of well-being when compared to an equivalent group of peers living in the same area (M_{Int} = 58.61; SD_{Int} = 2.96; M_{Contr} = 51.70; SD_{Contr} = 5.62; t_{80} = –6.95, $p < 0.001$).

3.2 Effects of the Online Intervention on the Cognitive Reserve

As a second step, we focused on the effects of the intervention on participants' CR level.

We run a paired-samples *t*-test to compare the scores from the CoRe-T at Time 1 and Time 2 for our intervention group. Results showed a significant increase between Time 1 and Time 2 in the overall CR scores (M_{T1} = 93.42; SD_{T1} = 13.55; M_{T2} = 106.51; SD_{T2} =15.30; t_{39} = –13.49; $p < 0.001$; $d = 0.89$).

To assess changes in specific components of the CR that could have been affected differently by the intervention, we run a second paired-samples t-test to compare the scores of individual CR components (leisure activities and creativity, which are the dynamic components of CR as measured by Core-T) at Time 1 and Time 2 for our Intervention group (see Table 2 for mean scores and SD). The analysis returned a significant difference between Time 1 and Time 2 for both Leisure activities (t_{39} = –10.05, $p < 0.001$; $d = 0.63$) and Creativity (t_{40} = –10.57, $p < 0.001$; $d = 0.63$).

Table 2. Mean scores and standard deviations for main cognitive reserve (CR) sub-components.

	Time 1 (pre-test)	Time 2 (post-test)
Leisure activities	51.67 (9.02)	56.95 (7.63)

We then run an independent-samples *t*-test to compare intervention and control groups at Time 2, using the CoRe-T scores as dependent variables. The intervention group reported and gets significantly higher levels of cognitive reserve when compared to the quasi-equivalent group of peers living in the same area (M_{Int} = 106.51; SD_{Int} = 15.30; M_{Contr} = 93.54; SD_{Contr} = 13.15; t_{80} = –4.14, $p < 0.001$; $d = 0.91$).

Finally, we ran another independent-samples *t*-test to examine more in depth where specific differences within the CR components that could have been affected by the intervention occurred. Distribution scores are reported in Fig. 1.

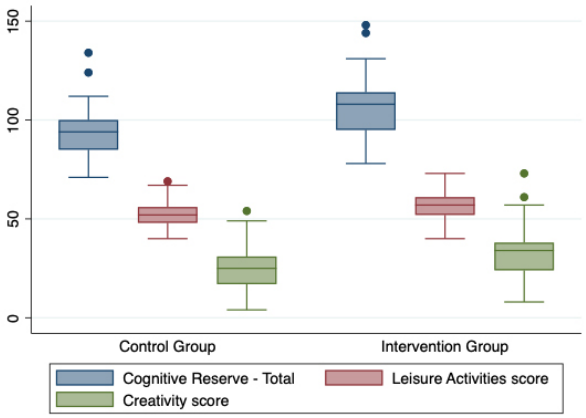

Fig. 1. Box Plots of Cognitive Reserve Test (CoRe-T) scores for the Control and Intervention groups at Time 2.

Both the leisure activities component (t_{80} = –3.11; $p < 0.001$; $d = 0.69$) and the creativity component (t_{80} = –2.90; $p = 0.002$; $d = 0.64$) of the CR were significantly different between the intervention and the control group.

4. Discussion

Our main hypothesis, which led us to expect an increase in both perceived well-being and CR levels in a sample of healthy older people, after a 5-weeks of online blogging, was confirmed.

The intervention group reported significantly higher levels of well-being and got a higher score on CoRe-T after participating in the CR intervention. This difference emerged both when comparing the intervention group's scores at Time 1 and 2, and when comparing the Intervention's group's scores with a quasi-equivalent control group matched by age, gender and education level. Previous research [23] reported how blogging appears to be helpful in meeting psychological and social needs for older adults, by providing a medium for this specific population to engage in activities linked to the well-being, like to focus on self-expression [24], engage in social and cognitive activities [25], and perceive to be part of a community [26].

Yet, we cannot forget how the role of CR for healthy aging has been considered a crucial variable in the field of aging neuroscience. The CR has been linked to a better quality of life [27], less cognitive decline [28] and lower incidence of psychiatric symptoms [29], so that interventions that target proxies of CR are highly recommended [27]. The blog-based intervention presented here addressed this specific issue by proposing different challenges inspired by CR proxies (see **Supplementary Table 1**); it was also unique because it was designed to specifically target creativity and divergent thinking, which are components linked to CR [17,18] but, to our knowledge, have not been directly addressed in a CR intervention before.

It is also essential to stress the need to replicate these findings with different research paradigms (e.g., randomized controlled trials) and possibly longitudinal designs, to prove the effectiveness of online, blog-based interventions that focus on increasing participants' CR.

Despite having statistically significant findings, there are some limitations that needs to be addressed. These limitations are mainly linked to a lack of a concurrent active control group (part of the effects can be ascribed to the activity of blogging per se), and a possible learning effect for the creativity items in the CoRe-T.

Regarding the lack of the control group, we tried to compensate by recruiting a group of individuals at Time 2, which has been living in the same area as the intervention group, hence sharing the same COVID-related restrictions. We matched them for age, gender and also educational level (which many times is considered a CR indicator by itself), assuming that this would allow us to make a relevant comparison about well-being and CR at Time 2, with most of the basic confounders that could have affected changes on the intervention group accounted for. Moreover, the intervention was relatively short in time, so that could also support our assumption that time related changes in the control group were most likely very minor This is not an ideal solution, and future studies should replicate our findings using a concurrent control group.

As for the learning effect for the creativity items of the Core-T test, we tried to compensate by accounting for the leisure activity component, which is not affected by a learning component, and should hence help having a more balanced post-test score. Finally, our analyses considered different subfactors of the more general flexibility of thought, and if the changes were always significant, the specific changes in each subfactor were different: meaning that either the learning effect was not so widespread or not all the components were affected.

5. Conclusions

The significant effect of an online blog-based intervention on both participants' CR and perceived well-being reported in this paper has two main implications. On the one hand, it shows how even a short and relatively easy web-based intervention might have a significant impact on perceived well-being and CR, and, in turn might have positive effects on cognition and mental health of older people. This finding is in line with and support other recent researches that reported evidence of effectiveness of different types of tele-neuro-rehabilitation interventions [30,31], also for older subjects [30]. On the other hand, our results highlight the potentiality of online training to reach, in both preventive and rehabilitative perspective, a large audience of participants (such as those who cannot access rehabilitation centers or other centralized healthcare services), not only during the COVID period, but also due to physical or economical restraints. These types of interventions are indeed generally considered promising healthcare tool, as they guarantee continuity of care over time and in space (from hospitals to patients' home) and allow to increase the frequency and intensity of rehabilitation programs [32].

Author Contributions

BC and SC designed the research study. BC, GF and SP performed the research. BC analyzed the data. BC and GF write the main parts of the manuscript. All Authors contributed to write the manuscript and approved the final manuscript.

Ethics Approval and Consent to Participate

Protocols and procedures for this research were approved by Champlain College's IRB (COA IRB000173). Protocols and procedures were conducted according to the Declaration of Helsinki.

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Conflict of Interest

The authors declare no conflict of interest. BC is serving as the Guest Editor for this special issue named "COVID-19 Related Restriction Measures and Their Impact on Cognition". We declare that BC had no involvement in the peer review of this article and has no access to information regarding its peer review. Full responsibility for the editorial process for this article was delegated to CM.

Supplementary Material

Supplementary material associated with this article can be found, in the online version, at https://doi.org/10.31083/j.jin2104114.

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