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(Article begins on next page)

1 **Use of technology by people with dementia and informal carers during**
2 **COVID-19: a cross-country comparison**

3
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1 **Abstract**

2
3 **Objectives:** Considering the adverse outcomes of COVID-19, it is essential to provide
4 adequate support and care for people with dementia and informal carers. Technology can
5 reduce the distress associated with social distancing rules and the decreased access to in-person
6 services. This study aimed to explore the use of technology and its perceived effects across
7 different settings and countries.

8
9 **Methods:** The sample was composed of 127 informal carers and 15 people with dementia from
10 the UK, Italy, Australia and Poland. Semi-structured interviews explored participants'
11 experiences of using technology and their perceived effects. Transcripts were analysed by
12 researchers in each country using an inductive approach.

13
14 **Results:** Three overarching themes were developed: (1) Technology kept us alive during
15 COVID-19; (2) Remote care was anything but easy; (3) Perceived technology limitations.
16 Many similarities emerged between countries supporting the role of technology for being
17 socially engaged, having a routine, and staying active. However, the benefits of technology for
18 health and psychosocial care were more limited. Across countries, barriers to the access and
19 use of technology included lack of digital literacy, dementia severity, and lack of appropriate
20 digital environments. Help and supervision from carers were also necessary and sometimes
21 perceived as an additional burden.

22
23 **Conclusions:** Technology can effectively reduce the shrinking world that may be amplified by
24 the pandemic, thus preserving people with dementia's social skills and maintaining family
25 connections. However, for more extensive and well-adapted use of technology in dementia
26 care, actions should be taken to overcome the barriers to the access and use of technology by
27 older and vulnerable people globally.

28
29 *Keywords:* dementia; care; COVID-19; technology; social health; internet; digital divide;
30 caregivers

1 **Key points**

- 2
- 3 • During COVID-19 technology allowed people with dementia and informal carers to be
 - 4 socially engaged, have a routine, and stay active.
 - 5
 - 6 • Benefits of technology in dementia health and psychosocial care were limited.
 - 7
 - 8 • Barriers to the access and use of technology included lack of digital literacy, dementia
 - 9 severity, and lack of appropriate digital environments.
 - 10
 - 11 • The pandemic should prompt actions towards a more extensive and well-adapted use of
 - 12 technology in dementia care.
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1 **Introduction**

2 Over 55 million people live with dementia worldwide, and this number is expected to double
3 every 20 years¹. In the context of COVID-19, people with dementia have been required to
4 protect themselves by social distancing and maintaining prolonged periods of self-isolation,
5 given their high susceptibility to the virus. For home-dwelling people with dementia, social
6 distancing rules and the closure of social support services have been associated with faster
7 cognitive deterioration, worsening of behavioural and psychological symptoms, and higher
8 carer burden²⁻⁵. Bans on visits by families and friends along with restrictions on social
9 interactions and activities with fellow residents have led to increased psychological distress
10 and inactivity for people with dementia residing in care homes^{6,7}.

11 Given the adverse outcomes of COVID-19, supporting people with dementia and carers
12 to live well during the pandemic is a public health priority^{5,8}. Technology could effectively
13 compensate for the psychological distress associated with social distancing and the decreased
14 use of in-person services⁹. It has already been used in several fields of dementia care such as
15 support for independent living, care delivery, leisure and activities¹⁰. Benefits have been
16 documented¹¹⁻¹³, including reaching people living in rural/remote areas or with mobility
17 difficulties¹⁴. Furthermore, technology can improve daily functioning, quality of life and health
18 conditions for people with dementia, thus reducing health care costs, readmissions, and length
19 of hospital stays¹⁵. Telephone calls, chat apps, videoconferences, and remote therapies can
20 connect relatives, professionals and peers¹⁶⁻¹⁸. Monitoring technology can increase people
21 with dementia's safety and reduce the risk of accidents while preserving independence in
22 domestic and residential settings^{13,14}. Telepresence robots, multimedia and Apps can help with
23 daily activities and provide cognitive stimulation^{13,14}. Technology-based interventions, such
24 as reminiscence therapy, has been found to decrease people with dementia's depression while
25 improving their social skills^{19,20}. Interestingly, its adaptation in a digital format seems to
26 effectively respond to the person's desires and preferences according to a person-centred model
27 of care²⁰. Furthermore, telephone, video and computer-based interventions have shown
28 benefits on carer's burden, depression, and anxiety²¹.

29 However, there are challenges to using technology by people with dementia. Difficulties
30 include barriers to access to the internet and digital devices, usability, and accessibility, which
31 is not only specific to people living with the condition²²⁻²⁴. Despite these challenges,
32 technology may support people with dementia and carers during pandemic times by providing
33 continuity of care and social connectedness while decreasing exposure to risk and the pressure
34 on health and care systems¹³.

35 This international study aimed to explore the use of technology in dementia care and
36 perceived effects across different care settings and countries (UK, Italy, Australia, Poland). It
37 is crucial to understand if and how technology can provide support and care to vulnerable
38 people during exceptional public health emergencies^{8,10}. Furthermore, cross-country
39 comparisons can identify similar and different technological solutions and perceived impacts
40 across countries to be implemented for integrated and improved dementia care provision during
41 pandemic and non-pandemic times.

42 **Methods**

43 **Participants and recruitment**

44 Participants were people with dementia living in the community or residential facilities and
45 informal carers (i.e., family members) caring for someone with dementia in the United
46 Kingdom (UK), Italy, Australia, and Poland, aged 18 years and older.

47 Participants were recruited through third sector and social support organisations, local
48 daycare centres, clinical practice, social media, and snowball sampling. Internal newsletters
49 provided information about the study for potentially interested participants. In addition, social
50

1 support organisations contacted potential participants via telephone or email, thus sharing
2 information about the study and asking whether they wanted to be involved.

3 Ethical approval was obtained from the University of Liverpool Ethics Committee (UK)
4 [Ref: 7626], the Ethics Committee of the University of Bologna (Italy) [Ref: 41453], Human
5 Research Ethics Committee at the Griffith University (Australia) [GU Ref No: 2020/488], and
6 from the Wroclaw Medical University Ethics Committee (Poland) [Ref: KB-366/220].
7

8 **Data collection**

9 The semi-structured interview guide was developed with a person with dementia, three
10 informal carers and social support service providers in the UK. It was adapted culturally and
11 translated into Polish and Italian.

12 In the UK, data were collected in April 2020, when a national lockdown took place and
13 safeguarding older and vulnerable adults was the priority. In Italy, data collection took place
14 between November 2020 and March 2021, when each region had been differentiated using
15 three colours corresponding to a specific epidemiological risk scenario with its containment
16 measures. In Australia, data collection occurred between August and October 2020, when
17 restrictions started being eased in most states. Finally, in Poland, data were collected between
18 June and August 2020, when restrictions were eased after the first COVID-19 wave, thus
19 partially allowing daycare centres to resume.

20 At the beginning of the interview, participants provided verbal informed consent for their
21 interviews to be audio-recorded and for data to be used in this study. The researcher assessed
22 mental capacity over the telephone, asking the person with dementia to tell what the study was
23 about, and make sure that s/he understood that s/he was able to withdraw at any point and that
24 the study was completely voluntary. Due to social distancing rules, interviews were carried out
25 by telephone or via Zoom and video chat platforms. They were recorded and subsequently
26 transcribed verbatim.
27

28 **Data analysis**

29 In each country, transcripts were identified with different ID codes, with the ID coding and
30 anonymising process starting at ID01. Two researchers experienced in qualitative data analysis
31 carried out the coding process. We employed inductive thematic analysis²⁵ to generate codes
32 and themes, first individually, as they emerged from the data without any predefined concepts,
33 and then within each country group. Once data saturation was achieved and all the transcripts
34 were coded, highlighted codes were discussed amongst country teams, and repetitive codes
35 were gathered into themes. Open dialogue and discussion within each country group ensured
36 that the researcher's potential biases did not affect data analysis. Then, virtual team meetings
37 were conducted across countries to discuss the findings jointly. The UK and Australian
38 transcripts were coded in English, while Polish and Italian transcripts were coded in the original
39 language, with specific quotes translated into English after joint analysis.
40

41 **Findings**

42 **Sample description**

43 A total of 142 participants were involved across four countries (50 in the UK; 48 in Italy; 26
44 in Poland; 18 in Australia). These included 127 informal carers and 15 people with dementia.
45 Most carers were female (n=98, 77.2%), adult children (n=85, 66.9%), and did not cohabit with
46 their relative with dementia (n=78, 61.4%). They were on average 59 (+/-10.1) years old
47 [Range 30-91].

48 People with dementia were mostly female (n = 9; 60%) and were on average 69 (+/-8.9)
49 years old [Range 50-87]. Dementia subtypes amongst people with dementia and the people
50 carers cared for were mostly Alzheimer's disease (n=59, 41.6%), followed by mixed and

1 vascular dementia (13.4%; 12.7%), and other rarer forms such as frontotemporal dementia and
 2 Lewy Body dementia (32.3%). Furthermore, at the time of data collection, most people with
 3 dementia and the people carers cared for lived in the community (n=108, 76%), while lower
 4 numbers were residing in care homes (n=34, 24%).

5
 6 **Qualitative findings**

7 Thematic analysis identified three overarching themes across the interviews (Table 1): (1)
 8 Technology kept us alive during COVID-19 (two subthemes); (2) Remote care was anything
 9 but easy (two subthemes); (3) Perceived technology limitations (three subthemes). Each theme
 10 is described below, with exemplar verbatim extracts of participants' interviews.

11
 12 **Table 1.** Themes and sub-themes from interviews

13

Themes	Sub-Themes
1. Technology kept us alive during COVID-19	Staying in touch with the world and facilities What a discovery, lots of things can be done online
2. Remote care was anything but easy	Little use and satisfaction with telemedicine Remote psychosocial care: something is better than nothing
3. Perceived technology limitations	Age can matter Dementia severity and need for human contact Lack of appropriate digital home and residential environments

14
 15
 16 **Theme 1: Technology kept us alive during COVID-19**

17
 18 **Staying in touch with the world and facilities**

19 During the COVID-19 restrictions, technology was considered a helpline where it was
 20 accessible. Across countries, technology was used by people with dementia and their informal
 21 carers to liaise with friends and families remotely. It allowed participants to maintain social
 22 relationships while decreasing their isolation and loneliness.

23
 24 *“Well, we are trying to mitigate the effect of missing our friends, we all stay in touch either on
 25 the telephone, on what's app ehm by getting up, speaking to other carers. I think that's nice, it
 26 shows that we are all thinking of each other.”* **UK, ID22, Female carer, spouse**

27
 28 *“Undoubtedly some social media or some platforms that allow you to contact and see another
 29 person, because it is the human face that is powerful, it is important. It is a form that may not
 30 be perfect, but it is good enough to be used.”* **Poland, ID16, Female carer, daughter**

31
 32 Across countries, due to the closure of face-to-face support services, community-
 33 dwelling people with dementia and their informal carers were in touch with care staff by
 34 telephone and video calls. Similarly, emails, telephone calls and videoconferences were used
 35 by informal carers to communicate with care home staff, as well as with their family members

1 during the restrictions. As highlighted in Italy, technology represented the only way informal
2 carers knew about their family members residing in care homes. However, this did not always
3 happen as some care homes did not allow contact with residents nor kept the families up to
4 date about their family members or current facility status (i.e., about the lockdown), as
5 experienced in Australia. Some Australian carers did express their concerns that protecting the
6 residential aged care facility (RACF) budget and prestige was more important than keeping
7 them informed and facilitating contact with their family members (via technology or by
8 allowing visits). Therefore, their restrictions in visiting policies were not updated/lifted as soon
9 as the local health advice was changing.

10
11 *“We received an email from the facility saying they're in complete lockdown and we were only
12 given a few hours' notice.”* **Australia, ID13, Female carer, daughter**

13 *“When I saw my mother in video call, she was able to recognize me and to say hi. This let me
14 understand that she was fine and properly looked after by staff members. This was helpful to
15 calm me down.”* **Italy, ID47, Female carer, daughter**

16 17 **What a discovery, lots of things can be done online**

18 Across countries, technology played a vital role in helping participants manage their daily lives
19 better, have a routine and stay active during the pandemic. Indeed, technology was integrated
20 into everyday life and unexpectedly used for a wide range of daily activities, such as working,
21 shopping for groceries, staying timely informed about the pandemic and available support,
22 following remote courses etc. Across countries, people with dementia, under carer supervision,
23 increasingly adapted themselves to the use of technology, thus following leisure activities such
24 as watching favourite TV programs, listening to preferred music and joining old and new online
25 groups to keep themselves active. For people with dementia and informal carers, although
26 mainly for the latter, telephone/Zoom/Skype meetings limited their travel and the hassle related
27 to travelling, thus saving time and managing their daily lives better, as mentioned in Australia.

28
29 *“My work hasn't stopped. I'm doing a lot of work online on the telephone. I sit on a lot of
30 advisory committees and other committees. Most of them have gone online, so I'm very busy. I
31 miss the contact, but I don't miss having to travel and organise myself to get there.”* **Australia,
32 ID2, Person with dementia, female**

33
34 *“Chester Zoo were live streaming various animals and their keeps during the day on Facebook,
35 so I sat her in front of as I said she likes animals and watching things, so I sat her in front of
36 the computer and played her all the different bits.”* **UK, ID03, Female carer, daughter**

37 38 **Theme 2: Remote care was anything but easy**

39 **Little use and satisfaction with telemedicine**

40 The use of technology to access healthcare was discussed in Poland and Australia, though it
41 was insufficient to meet the needs of many participants. Polish community-dwelling people
42 with dementia and informal carers emphasized telemedicine since, before the COVID-19
43 pandemic, they referred to the use of technology when accessing medical help through
44 teleconsultations or private outpatient clinics with an online reservation system. However,
45 during the pandemic, participants from Poland reported that obtaining teleconsultations was
46 difficult and caused frustration due to busy lines, waiting line queues and redirection of the
47 healthcare system to COVID-19 patients. Furthermore, satisfaction with teleconsultations
48 varied depending on the personnel dedication and individual clinic's solutions. Overall, people
49 with dementia expect personal contact and a direct medical examination. A medical visit was

1 considered a time that someone spent with them and a meeting with someone who cared for
2 them and listened to their concerns. This was even more important when neuropsychological
3 examinations were needed since digitalised questionnaires measuring cognitive impairment are
4 not widely used in Poland.

5 *“And this telemedicine doesn't quite meet my expectations. Actually, they are mine and my
6 husband's. For example, when we have a cold, we want the doctor to see us, we want him to
7 listen, to examine our throats, to take care of the patient.”* **Poland, ID5, Person with
8 dementia, female**

9
10 In Australia, during the pandemic, some medical or allied appointments (e.g.,
11 geriatricians and speech pathologists) took place via Zoom. However, in the carers' view,
12 technology in healthcare would not be appropriate for their relatives with dementia who rely
13 on non-verbal communication, especially at the advanced stages of the disease.

14
15 *“I know the doctor well and it was only the two of us that wasn't too bad, but I keep on thinking
16 that if I had dementia and I had to talk to somebody on the screen or on the phone it would be
17 very hard for the doctor to pick up non-verbal cues.”* **Australia, ID14, Female former carer**

18 **Remote psychosocial care: something is better than nothing**

19 Across countries, due to COVID-19 social distancing and lockdown measures, social support
20 services adapted support to remote service delivery. Specifically, this occurred through
21 different modalities: a) pen-and-paper cognitive tasks by email (Italy, Poland); b) pre-recorded
22 videos or live sessions of cognitive, low-impact exercises and music therapy on Whatsapp
23 (Italy); and c) small patient/carer support groups on Whatsapp, Skype, Zoom (UK, Italy,
24 Australia, Poland) or Facebook (Australia). Overall, remote psychosocial activities provided
25 people with dementia and informal carers with emotional and psychological support, which
26 was vital to address dementia daily challenges, which COVID-19 even amplified. However,
27 all remote activities appeared to be grass-root initiatives of specific community service/day-
28 care facilities staff or more active informal carers rather than a system solution.

29
30
31 *“They didn't do anything. I had proposed an online forum but they didn't follow through...so
32 I don't know... nothing happened with that.”* **Australia, ID9, Female carer, daughter**

33 *“Dealing with Alzheimer's locked in a house was really intense; groups of carers were a
34 resource to exchange opinions among us and, especially in the harshest time, it was of
35 fundamental psychological support.”* **Italy, ID13, Female carer, daughter**

36 Psychosocial activities were quickly adapted for virtual settings, consisting of smaller
37 groups of people with dementia that were easier to manage by professionals. They also required
38 the presence of a caregiver to help the person with dementia with videoconferences or
39 execution of cognitive tasks. However, some barriers in accessing online carer support groups
40 emerged, for example, when informal carers had no one taking care of their relatives, or they
41 did not feel comfortable participating due to the presence of their being left home alone, as
42 occurred in Australia and Italy.

43
44 *“You can't do stuff online on your own and leave her alone. Every time is an issue.”* **Italy,
45 ID5, Female carer, daughter**

46
47 *“We've set up a Zoom thing and we get a time slot and there was one of the coordinators that
48 took everybody out on the trips (21.04) and there was 1, 2 other people that were in Ken's*

1 *group. I think she felt that if there was the whole 12 of them it would be just completely*
2 *overwhelming.” UK, ID13, Female carer, spouse*

3

4 **Theme 3: Perceived technology limitations**

5 **Age can matter**

6 Several barriers to accessing and using technology were identified across countries, including
7 a lack of digital literacy. Many people with dementia were unfamiliar with and, therefore, did
8 not know how to use or manipulate digital devices except the telephone. As such, help in setting
9 up remote meetings, for example, and supervision by carers were necessary and sometimes
10 perceived as additional carer burden.. Furthermore, even those digitally competent carers
11 sometimes found it challenging to adapt to the rapid technology changes, as mentioned in
12 Australia.

13

14 *“It doesn't work when you get older. It's hard. Technology changes rapidly that it's hard to*
15 *stay current with it. Time to figure out what it means. It's hard to navigate your way through,*
16 *so I think it's an age thing rather than just a generational thing.” Australia, ID4, Female*
17 *carer, daughter*

18

19 *“Our seniors are not digital. They are ‘analog’. I know that some people try, but it would be*
20 *difficult to connect to our residents online.” Poland, ID16, Female carer, daughter*

21

22 **Dementia severity and need for human contact**

23 Dementia deficits represented an obstacle for communication through digital tools. Indeed, the
24 interactions were unsuccessful across countries when people with dementia were highly
25 compromised, i.e., had severe vision/hearing/orientation problems. Overall, technological tools
26 did not compensate, across countries, for the need for human contact experienced by people
27 with dementia. Indeed, online activities somehow led to more tiredness and less involvement
28 of people with dementia than face-to-face activities, especially for physical and cognitive
29 exercises, as mentioned in Italy.

30

31 *“What is missing is the human contact. Through a phone’s screen, you can’t involve people as*
32 *well as in person. Staff members are experienced but without human contact my mother could*
33 *not focus for too long.” Italy, ID1, Female carer, daughter*

34

35 *“Trevor can’t engage in video conferencing or anything like that, he doesn’t partly because of*
36 *the vision issues of Posterior Cortical Atrophy, he doesn’t really see the screen or anything*
37 *like that, and he doesn’t give you eye contact when he’s talking to you. So, it’s quite difficult*
38 *if you’re on the other end of a video conference to know whether Trevor is even engaging with*
39 *the audio.” UK, ID31, Female carer, spouse*

40

41 **Lack of appropriate digital home and residential environments**

42 Across countries, at the very beginning of the pandemic, not every participant was digitally
43 connected (i.e., they had no Wi-Fi at home). For example, in Italy and Poland, people with
44 dementia mainly had used telephones with no access to other technologies until supplied in
45 some cases by relatives to enable online communications. Furthermore, some devices/websites
46 were not easy to use by people with dementia or less digitally competent carers. For example,
47 in Italy, although smartphones mainly were used, tablets or personal computers were
48 recognised as the most appropriate device for people with dementia due to their larger screen.

1 Australian participants highlighted that, before COVID-19, websites mainly were designed for
2 digitally competent people. Therefore, older people or those with lower digital literacy may
3 struggle to use them with hardly any alternative to websites. Moreover, at the onset of the
4 pandemic, not all facilities were provided with an adequate internet connection, thus leading to
5 low quality video calls, and facilities had only a few telephones per nursing home floor which
6 made communication sometimes difficult, as reported in Italy and Australia.

7 *“In the first months, the internet connection was awful. Apparently, the facility did not own a*
8 *Wi-fi connection; they were using a low-quality mobile connection. Recently, the stability of*
9 *connection has improved.” Italy, ID46, female carer, daughter*

10

11 *“Setting up a Zoom meeting but that became difficult because 25% of the people in my group*
12 *haven't got internet. They're not connected.” Australia, ID14, Female former carer*

13

14 **Discussion**

15 This international study shows how technology allowed connectedness and social support
16 across four high-income countries (UK, Italy, Australia, Poland), thus reducing people’s
17 feelings of isolation and loneliness. Indeed, within a context of closed social support services
18 and severe restrictions into care homes, smartphones, tablets, and computers were the only
19 means to enable the continuity of social relationships. This was vital since there is extensive
20 literature about the detrimental effects of social isolation and loneliness on cognition, mental
21 health and well-being, in general, and vulnerable populations^{26,27}.

22 Beyond telecommunications, our findings show the potential of technology for several
23 purposes, such as informative, recreational, and educational ones. Across countries, in the
24 absence of usual outdoor activities and habits, technology helped participants cope with
25 everyday life, where face-to-face activities were converted to distance activities²⁸. This also
26 allowed participants to discover the advantages of using technology in everyday life, thus
27 providing them with a routine and consistency in their lives during pandemic times.
28 Maintaining a daily routine is also beneficial to control the behavioral and psychological
29 symptoms of dementia that, if not managed appropriately, are associated with increased carer
30 burden²⁹.

31 Technology allowed, at least to some extent, the continuity of psychosocial care with
32 some differences across countries, which depended on community services ability and daycare
33 facilities to introduce and manage online activities shortly after the onset of the pandemic.
34 Specifically, while online patient/support groups were common across countries, some
35 rehabilitation specialist activities, such as cognitive and physical therapies, were solely
36 delivered digitally in Italy. In Poland, emphasis was given to telemedicine whilst online
37 psychosocial support was not the norm, and when provided, often described as poor. In the
38 UK, Italy and Australia, delivery online was variable and subject to the vagaries of the digital
39 divide (skills, affordability, variable content utility).

40 Online groups were beneficial as they provided participants with social opportunities and
41 psychological support to deal with everyday difficulties associated with dementia that was
42 exacerbated by the pandemic. However, concerns about the insufficient number of online
43 activities and the need for carer supervision emerged across countries. Due to the lack of human
44 contact, virtual activities, especially the more structured ones, were less involving and more
45 stressful for people with dementia than face-to-face activities. Furthermore, access to carer
46 online support groups was complex for those concerned about privacy and/or had no one to
47 look after their relatives at home.

48 When designing online activities whose benefits must be maximized to meet participants’
49 needs, these aspects should be carefully considered. The pandemic indeed could represent an

1 additional stressor even for informal carers^{30,31}, who already provide most of the care during
2 non-pandemic times^{32,33}.

3 Whilst there are several studies on the efficacy of psychosocial interventions³⁴⁻³⁶, there
4 is emerging evidence supporting its use in a digital format^{20,21}. However, broader research is
5 needed to precisely establish what online activities work, for which populations and conditions,
6 taking account of equity and quality. This would be important to guarantee high-quality care
7 during exceptional times such as pandemics before decisions are made to become the standard
8 'cost-effective alternative' care approach as 'post-pandemic digital drive innovations'³⁷. Our
9 study shows that specialist support is required to help participants cope with symptoms,
10 pandemic-related changes, and support quality of life. Furthermore, benefits associated with
11 technology need to be adapted and integrated into everyday care to improve care quality and
12 enlarge the chance of access for people with mobility difficulties and/or living in remote or
13 rural areas, for example. This would also help to overcome the often fragmented or completely
14 lacking care pathways that exist internationally^{38,39}.

15 Social distancing rules imposed by the pandemic interrupted access to routine healthcare
16 for those vulnerable people at an increased risk of virus infection, morbidity and mortality. In
17 such a context, evidence on the use of technology in healthcare emerged in Poland and in
18 Australia^{40,41} only. However, based on our findings, difficulties with remote healthcare arose,
19 and teleconsultations, specifically, seem not to work for people with dementia who prefer
20 physical contact and rely on non-verbal communication, especially when their cognition is
21 seriously compromised. Initial evidence suggests that teleconsultations, to be effective, should
22 be structured around needs and be adjusted to provide tailored advice, by replacing non-verbal
23 prompts when necessary⁴². Furthermore, practitioners need to ensure that people with dementia
24 are engaged in remote healthcare consultations to guarantee person-centred care while
25 evaluating when it is more appropriate to see people in person⁴³.

26 This may be achieved in different ways^{42,43}. Before starting the remote consultation, for
27 example, practitioners could ask the person with dementia (if possible) what he/she wants to
28 get out of it. Wherever appropriate, people with dementia or carers may prepare (in advance) a
29 list of issues to be covered during remote consultations. To ensure optimal technical set up,
30 practitioners could say something like 'can you hear me?', 'can you see me?', and show people
31 with dementia their interest and attentiveness through eye contact and facial expressions during
32 the consultation. Practitioners are also recommended to speak in short, straightforward
33 sentences and, at the end of the consultation, to summarise key points and asking people with
34 dementia if they need anything clarified. Despite the potential of technology to mitigate the
35 effects of COVID-19, several barriers to their access and use emerged across countries. First,
36 participants had to acquire gradually and/or improve their digital skills. It is well-known how
37 older adults, compared to younger people, start using technology later in their lives, and issues
38 related to privacy and security could lead to a worrying attitude towards technology²⁴.
39 Similarly, age-related impairments can make it challenging to acquire digital skills⁴⁴.
40 Therefore, it is important to provide training and support to reduce the risk for social inequity
41 and injustice for already vulnerable populations⁴⁵. Training from friends, family, classes, and
42 peer tutors can improve older adults' skills and their attitude towards technology (i.e., less
43 anxiety, increased interest, usefulness, and self-efficacy)^{24,28}.

44 Based on our findings, people with dementia who were severely impaired could not
45 benefit from the use of technology. Other barriers included a lack of digital resources, such as
46 the internet connection. Current estimates report that only 54% of the global population is
47 connected today, with people living in poorer and/or remote regions less likely to be connected
48 and women and older people^{46,47}. Actions should be prompted by appropriate policies,
49 programs and funding by building internet infrastructure quickly .

1 These initiatives should be carried out in public and private spaces. Our findings show
2 that, across countries, not all care homes were provided with an internet connection at the
3 beginning of the pandemic, and time was required to achieve a good connection. However,
4 where available, the internet connection was a lifeline to maintain meaningful relationships and
5 reassure informal carers about their relatives' health. This was important considering the high
6 number of deaths caused by COVID-19 in already underfunded and overstretched care
7 homes^{48,49}. Technology can also give those residents cognitively able the chance to read news,
8 play card games or e-mail families, thus keeping people involved in life⁵⁰.

9 Our study highlighted some other barriers to the access and use of technology, consisting
10 of the lack of appropriate devices/websites that sometimes seemed neither user-friendly nor fit
11 the purpose of supporting people with dementia and informal carers. Specifically, devices such
12 as smartphones with small screens or not easy-to-use software/websites made it difficult for
13 participants to use and benefit from technology. Consequently, these need to be designed and
14 selected considering factors such as people's age, cognitive ability and physical functioning²³.
15 In addition, training programs should be provided to informal carers and practitioners to ensure
16 good practice¹³. Interestingly, emerging evidence shows that people with dementia can provide
17 accurate feedback and should be involved throughout the development process²².

18 In developing technologies, user's personal concerns, needs, preferences and
19 sustainability across all stages of aging and dementia need to be highly considered to deliver
20 high-value, needs-based, person-centred care²³. Similarly, issues related to the acceptability
21 and ease of use of technology are relevant. People with dementia can become very frustrated
22 and anxious if they forget passwords or get locked out of account. Not receiving assistance and
23 support undoes any advantage that technology might offer. Before that, as a rule, every person
24 with dementia must agree to terms and conditions regarding their privacy associated with the
25 use of technology.

26 Overall, our study revealed that, despite some benefits of using technology, it was not
27 enough to compensate for the lack of in-person social interactions. Human contact is vital for
28 people with dementia, thus increasing their well-being as well as reducing their behavioural
29 and psychological symptoms⁵¹. Consequently, benefits associated with remote activities,
30 instead of replacing human interactions, should be maximised and integrated in usual care.

31 **Strengths, limitations, and future directions**

32 This sizable multi-country representative study provides a timely comparison of the use of
33 technology in four high-income countries (UK, Italy, Australia, Poland). However, we
34 acknowledge that people with dementia were underrepresented compared to an adequate
35 number of carers. Nevertheless, many similarities emerged between countries supporting the
36 pivotal role of technology for maintaining social relationships and enjoying life during
37 pandemic and non-pandemic times. We noted regional differences in psychosocial
38 interventions offered after the pandemic outbreak. However, these seemed to depend on the
39 differences among services within countries rather than between them, except for Poland,
40 where some emphasis was given to telemedicine. Our findings also provided useful information
41 about adjustments required to enable older adults and those with dementia to benefit from
42 technology. Similarly, some gaps in the use of technology in dementia care, for example, in
43 healthcare, were highlighted.

44 Overall, we expect that data from low-income countries would be quite different due to
45 the role of socio-economic factors in enabling the access and use of technology. It is also
46 important to note that, although data were collected from different time points of the pandemic,
47 restrictions were at different levels in all countries. It would be interesting to investigate if
48 digital literacy has increased and the benefits of technology-based interventions after nearly
49 two years of the pandemic. Similarly, research needs to be expanded on technology to develop
50

1 effective interventions while considering organizational barriers and users' characteristics,
2 needs and preferences.

3 **Conclusions**

5 This international study shows how technology was vitally important since it allowed
6 participants to be socially engaged, have a routine and stay active. The pandemic can prompt
7 actions to overcome main barriers to the access and use of technology by older and vulnerable
8 people. These actions should allow more extensive and well-adapted use of technology in
9 dementia care and its adoption by policy and practice. Using technology in non-pandemic times
10 could reach indeed those who live in remote and rural areas or are physically impaired. More
11 extensive adoption of technology could also reinforce and improve geriatric care and, more
12 generally, it would preserve people with dementia's ability to engage with communities during
13 potential future pandemics as well.

14 **Conflicts of interest**

15 None.

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31 **Contributorship**

32 CG led the study and designed the study in the UK with MG and HT and oversaw the project.
33 IC collected data in Italy, analysed data with RC and GO, and wrote drafts of the manuscript.
34 CG, KL, DS, AS, MM collected data in their respective countries and led the data analysis in
35 their country teams. All team members IC, CG, KL, MM, RC, MC, MG, WM, AP, JR, AS,
36 DS, HT, ET, MV, GO, contributed to data analysis and critically commented on drafts of the
37 manuscript and approved the final manuscript.

38 **Data sharing statement**

39 No additional data is available.

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