



The mobile-born and the COVID-19 pandemic: opportunities, problems and the role of the telemedicine and e-health

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Introduction

The COVID-19 pandemic differentiated and is differentiating itself from previous pandemics in many aspects that are difficult to list and that are finding interest in many scientific studies. One of the aspects, however, that is completely evident, is that it is the first pandemic that was faced by the mobile-born. He or she is particularly familiar with mobile-technology communication tools, widely incremented in use during the pandemic. His or her role was important, helping to countenance the digital divide inside the families (for example the elderly) and to create familiar spontaneous telemedicine tools to sustain the fragile subjects. Probably studies currently under development will tell us how the mobile born, thanks to his or her resources, personally crossed the pandemic (especially the during the emergency phases). However, data analysis is showing that the time spent with mobile technology is increased for all of us. The risk of mobile-technology abuse, correlated to the time use, in the mobile-born is still a critical issue and is increased, with particular reference to (I) the text neck, a postural risk, and (II) the addiction, that can lead to communication and psychological problems. Telemedicine and e-health (TèH) have pivotal role in the fight of these risks. The commentary highlights these risks and for each one of them describes the possible role of the TèH support. The research question in the commentary is to investigate whether the pandemic (I) may have exacerbated these problems due to the increase in smartphone use and (II) how they can be of aid.

The commentary has been arranged into the following sections:

- (I) The COVID-19 pandemic and the mobile-born;
- (II) The COVID-19 pandemic and the new models of

interaction;

- (III) The TèH tools and the text neck;
- (IV) The TèH tools and the smartphone addiction;
- (V) Conclusions and opened questions.

The COVID-19 pandemic and the mobile-born

The COVID-19 pandemic has differentiated and is differentiating itself from previous pandemics in many aspects that are difficult to list and that are finding interest in many scientific studies.

One of the aspects, however, that is completely evident is that it is the first pandemic that was faced by the mobile-born. Mobile-borns are those subjects who were born during the boom in mobile technology which led to the spread of smartphones (in greater numbers) and tablets.

The mobile-born typically:

- (I) has a form of earliness in the use of mobile technologies and at the age of two he or she knows how to interact skillfully with a touch-screen, but, unlike previous generations, he or she cannot tie his shoes alone;
- (II) has developed and is developing new forms of communication, different from what we are used to. The correct circular communication model based on the three verbal, para-verbal and non-verbal components has often been replaced by a communication made up of electronic messages, chat, hashtag, or complete with all the elements.

The foregoing, shortly before the explosion of the COVID-19 pandemic, opened interesting scientific debates. There is no doubt that we are facing a new anthropological mutation with the mobile-born.

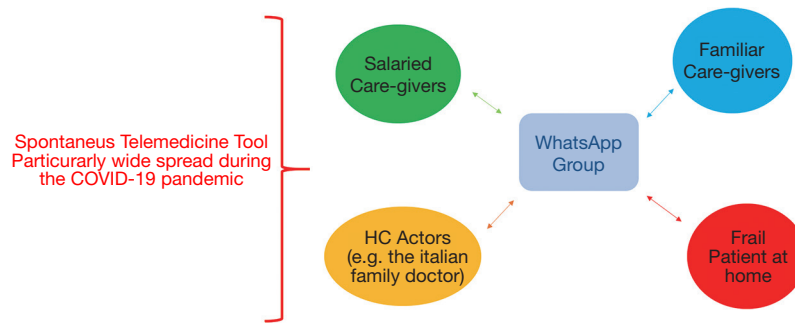


Figure 1 A spontaneous telemedicine group based on WhatsApp.

The COVID-19 pandemic and the new models of interaction

The smartphone abuse before the pandemic

Before the pandemic, interesting debates had opened on the emerging risks caused by the abuse of technology for the mobile-born; on the neurophysiological and psychocognitive (1-3) ones. Scholars showed that:

- (I) An abuse of mobile technology could lead to addiction and consequent psychological fragility;
- (II) An excessive use of these technologies could lead to serious postural problems generally named text neck syndrome. These problems could result into:
 - (i) Continuous headache;
 - (ii) Cervical problems;
 - (iii) Rigidity in the region between the two arms and the cervical area;
 - (iv) Cervical hernia.

An important role that was highlighted in relation to these problems was the time of use. Time of use that during the pandemic is strongly increased. During the commentary we recalled and detailed these two postural and psychological problems, supporting them with the current scientific literature in relation to the step-by-step developments of the objectives of the commentary specifically in two dedicated sections in par. 3 and par. 4

The smartphone uses during the pandemic

There is no doubt that new interaction models were developed during the emergency phase. In our telemedicine sector we have seen how the need for social distancing has led to an unprecedented development of telemedicine (4), with the possibility of exploring new boundaries (5). We have also seen that this development will remain alive even

after the emergency phase (6).

Mobile technologies (6) played a major role, starting from the tele-mental support of pathologic subjects up to the support of the healthy ones (7,8). Messaging tools such as WhatsApp and video calling and virtual video meeting have had and are playing a strategic task. The possibility of interacting with family members by means of these technologies has, for example, made it possible to create straight lines of connection; on the one hand to relieve loneliness and on the other hand to keep in contact with fragile (as for example the elderly) relatives, through what we can call, spontaneous telemedicine tools, based, for example on WhatsApp groups (9).

Figure 1 shows an example of a spontaneous telemedicine network that became more widespread during the COVID-19 pandemic.

The young, mobile-born have often helped the elderly to familiarize with these forms of spontaneous telemedicine tools through support networks based on WhatsApp (or other similar) messaging tools and to limit the impact of the digital divide.

One thing is certain.

New communication models, from the tele-vision, up to the e-learning and the new forms of sociality emerged during the emergency phase, will continue in the following phases and after the pandemic.

Certainly, some advantages that have emerged will ensure that the use of mobile technologies by everyone, and in particular the mobile-born one, will settle at higher levels than before the COVID-19 pandemic.

The increasing of the emerging risks of smartphone abuse

During the emergency phase of the pandemic, at the Istituto Superiore di Sanità (the Italian National Institute of

9. Smartphone use before the lock down (1= min; 6= max)*						
	1	2	3	4	5	6
Voice call	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Use of the social networks	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Use of the Apps for messsging (es. Whats App)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Ebook	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Web browsing	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Video call	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
10. Smartphone use after the lock down (1= min; 6= max)*						
	1	2	3	4	5	6
Voice call	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Use of the social networks	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Use of the Apps for messsging (es. Whats App)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Ebook	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Web browsing	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Video call	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Figure 2 The Likerts with the questions on smartphone application use before and after the pandemic.

health) we developed a survey to investigate the supporting role of mobile technologies during the pandemic explosion also in the creation of spontaneous telemedicine tools.

This survey (e-survey) was electronically submitted a week after the starting of the Italian lock-down on March, 9, 2020 and accompanied by a SAS anxiety test [ZUNG SAS (10,11)] and a Smartphone Addiction Scale Short Version (SAS-SV) test on the mobile technology addiction [SAS-SV (12,13)]. The 91% of the interviewed answered during the first 48 hours. It clearly emerges in young subjects (minimum age 14 y, maximum age; 144 females, average age 16.2; 151 males, average age 15.9) a 43.4% (std-dev 11.3%; $P < 0,01$, student t -test) a mean value increase in the use of the mobile technology tools during the emergency phase when analyzing the answers to the questions 9.2, 9.3, 9.5,

10.2, 10.3, 10.5 [the most related to the risk of addiction and to the text neck described in the following (1-3,14)] in the Likerts reported in *Figure 2*.

The investigation is still continuing in the further lockdown/restriction periods. The data-mining will be performed on all the sample. It is hoped that the data-mining of this study and of other similar ongoing ones will give interesting answers to the many emerged questions on the role of technology and in particular the impact of the pandemic on mobile-born.

The use of mobile technologies has therefore grown during the emergency and has remained above the values of before the emergency even after.

One thing is certain. As it was already evident and how it emerges from the electronic survey (e-survey)

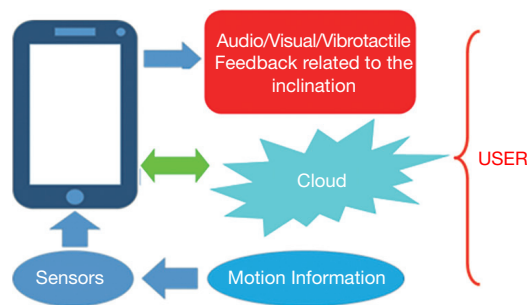


Figure 3 The smartphone as a tutor against the text neck.

the interaction with the smartphone (which was already worrying before the pandemic) has greatly increased.

This means that the emerging risks that were present before the COVID-19 pandemic (from abuse of technology and related to exposure time) are current, alive and present.

Among these risks we find that those with the highest incidence are (1-3,14):

- (I) The postural risks, with greater impact on the cervical vertebrae, currently named the text neck syndrome;
- (II) Addiction risks with their impact on the communicative and psychological sphere.

The telemedicine and e-health tools and the text neck

The text neck

The text neck is a definition used in these recent years to describe repeated stress injuries and neck pain resulting from excessive vision or from texting (typing) on mobile devices used for an excessive period of time. The main cause of this syndrome is the maintenance of the neck tilted for too long during use of the smartphone, with angles between 15° and 60° (1,2,14) which results in an increase of load at the level of the cervical vertebrae, that can reach up 264 N at 60° !

The text neck can give rise to various symptoms, above anticipated.

Experts of the text neck, to relieve stress due to posture, suggest simple changes in lifestyle.

Among the many tips, it is suggested to keep the devices in front of the face or at eye level while watching the display and use both hands and the two thumbs to create a more

symmetrical and comfortable position for the spine.

The role of the TeH

A practical and easy TeH support can come from the mobile technology. Indeed, these systems, in particular smartphones, are equipped with very complex and heterogeneous sensors; among the different types of sensors, they are highlighted those of movement such as accelerometers and gyroscopes. By means of the accelerometer, sensitive to the acceleration of gravity it is, for example, possible to measure the angle of the smartphone with respect to the terrestrial vertical; (it is precisely this sensor that is indeed used for the common “wheel display” function, when turning the smartphone from vertical to horizontal). The general idea is to use the smartphone itself, as “a tutor who protects us from the text neck” proding us to hold the phone in front of the face. *Figure 3* illustrates how the smartphone thanks to the accelerometer (used as an inclinometer) can return an alignment with respect to the terrestrial vertical and therefore pushes the user to take the device to eye level and to assume a correct posture. Instead, an inclination with respect to the terrestrial vertical forces the user to bend the neck and assume one incorrect posture by increasing the load on the cervical vertebrae.

This “virtual level function” can be mapped with a visual, sound or vibrotactile biofeedback, and gives back to the user, in real time an information related to the inclination. A symbol with a red color (as for the commercial App Head-Up: protect your neck) can for example indicate a smartphone inclination associated with incorrect posture, a green symbol may indicate a correct smartphone inclination, other colors can be used to indicate a gradation of the inclinations that lead to incorrect postures.

The specific role of the TeH here can be:

- (I) The monitor of the effectiveness and quality of the yet available Apps for the self-awareness;
- (II) To design self-awareness Apps and related clouds for dedicated studies on the text neck;
- (III) To design specific studies based on wearable sensors affixed in the body segments (14,15) starting from the head, to assess the head-trunk kinematics during the activities with the smartphone and (I) with and (II) without the use of the App for the self-awareness.

The telemedicine and e-health tools and the smartphone addiction

The smartphone addiction

Several tests have been proposed with regards to the smartphone addiction. We can focus to the test SAS-SV (12,13). This is a psychological test based on a specific questionnaire self-administered and used to identify the risk level of smartphone addiction. It allows the categorization in three groups of risk in adolescents and young adults. The test includes ten statements.

Each subject must assign a graded assessment at six levels; the first level corresponds to the lowest rating, i.e., the minimum assignable score (strongly disagree); while level 6 corresponds to the highest rating, i.e., the maximum score assignable (strongly in agreement). The scores obtained on each individual question are then added together. The value obtained identifies belonging to the risk class. The risk classes identified by the test are different based to sex.

Males are considered technology dependent with a score above 31, with high risk of dependence with a score between 22 and 31.

Females are considered technology-dependent with a score higher than 33, with high risk of addiction with scores between 22 and 33.

The role of the TeH

TeH can be of aid surely (16,17) using the cyber-psychology approach redesigning the tests electronically (e-tests) and wide spreading them inside the frame of an e-survey using the tools commonly used by the young subjects (e.g., the social networks).

The SAS-SV electronically can become as it follows: <https://forms.office.com/Pages/ResponsePage.aspx?id=DQSIkWsW0yxEjajBLZtrQAAAAAAAAAAAAZAAOUXdFhURVpWTVhFTDBRUEFOUFYzSIVXWEsyWjJaMC4u>

The specific role of the TeH here can be consequently:

- (I) The design of specific e-survey for the Self Assessment of the Smartphone addiction (17) using e-tests;
- (II) Activate some self-awareness procedures embedded in the e-survey depending on the outcome of the e-tests (for example suggesting to contact professionals, to the subjects with an outcome showing a high risk); or alternatively activate some monitor/contact procedures with the respect of the privacy (directly get the test result and contact the

subject with a high risk);

- (III) Investigate the use of Apps for limiting the time use (indirectly useful also for the text neck).

Conclusions and opened questions

The COVID-19 pandemic was the first to be addressed by mobile-born.

Before the pandemic there had been a lot of debate on (I) the problems emerging in the mobile born caused by an abuse of mobile technology and (II) in relation to possible technological solutions.

During the pandemic, mobile technology played an important role. Its use has increased and, even after the pandemic, it will remain at levels above the previous ones. It was also shown, with a high significance by means of properly submitted e-surveys. Many questions have arisen in relation to how the “mobile borns”, familiar with the technology, faced the emergency phases of the pandemic and the role they played in eliminating the digital divide inside to the families. Certainly, however, the high use of mobile technologies by these subjects, which, during and after the emergency phases of the pandemic has further increased, [which was already worrying before the pandemic (14,18)] involves risks. Among these risks, the emerging ones of text neck and addiction were highlighted in the commentary.

TeH can intervene with various technological solutions that are illustrated in the commentary starting with tools of self-awareness and telemonitoring that can give a concrete answer to these problems.

The role of the training of the mobile-born in the use of these TeH solutions is also important. At the ISS, for example, we have proposed a training package for the young subjects of the secondary schools on these aspects with the objective also to allow them to diffuse the information inside to their school (19).

From a practical and theoretical point of view, the study highlights:

- (I) An increase in the use of mobile technology during the pandemic in terms of usage time and non-voice use of applications;
- (II) This in the pre-pandemic period was correlated to an increased postural and addiction risk and therefore is worthy of attention;
- (III) The TeH that did so much during the pandemic (20-23) to support us could support us, with dedicated applications illustrated in the study also

to combat these risks.

Regarding significance, the study has important added values:

- (I) Having posed and faced the problem of increasing the risk of the text neck and addiction in the pandemic era;
- (II) Having proposed a survey that in some passages addressed the problems related to the increase in risk;
- (III) Having reported an overview of the possible solutions of TeH.

The limitation of the study is that inherent in the commentary which on the one hand has the merit of addressing and proposing new themes during evolution and worthy of further study, on the other it certainly has the limit of leaving more targeted studies having to face the implications. Targeted studies could, for example, address the wide-ranging impact of the solutions proposed in minimizing risk, deepen with specific studies the psychological implications of the increase in the use of mobile technology, both in terms of dependence and defence against anxiety problems. and depression in the period.

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