WHO Says Screens are Bad?! A Critical Review of the World Health Organization Guidelines on Screen Time for Children

**Abstract**

In April 2019, the World Health Organization published guidelines on screen time for preschool children that attracted considerable public attention. This article presents a critical review of the literature underlying these guidelines. Thirty-three studies were identified of which 31 had very low quality and 2 were proven to be irrelevant to the guidelines. Altogether, the 33 studies produced a wide range of mixed findings, including many counterfactual, positive and null results. A meta-analysis of all 33 studies revealed a negligible overall effect of screens on psychological development (Cohen’s *d* = 0.016) and a significant publication bias toward a moral panic over screens. A comparison of the current findings with updated studies and literature reviews suggests the direct effects of screen time alone are small and unreliable and that, to date, there is no convincing causal evidence that screen time impairs psychological development. Researchers are therefore advised to distinguish between normative and pathological use of screens, focus on deprived healthy daily behaviors, and investigate specific types of screen contents. Although parents are still advised to monitor their children's screen behaviors, they may let go of (some of) their constant guilt and allow themselves to enjoy the many benefits of screen use.

**Keywords.** Screen use, children, parents, psychological development, media panic

Parents of today face a great parenting challenge. Children are exposed to screen media from infancy and some scholars are concerned that this exposure might have a toll on their psychological development (Browne et al., 2020). Parents usually share this concern and make extensive efforts to limit their children's daily screen time, however, many of them struggle in keeping up with formal medical guidelines (Carson et al., 2014; Götz et al., 2020). In the busy atmosphere of modern society, many parents experience considerable guilt upon reading medical guidelines (e.g., the Canadian Sedentary Behavior Guidelines) (Carson et al., 2014) and most parents admit that they allow their children more screen time than is recommended by physicians (e.g., the American Academy of Pediatrics) (Trinh et al., 2020). The recent outbreak of the COVID-19 pandemic has even intensified the challenge. The long-standing lockdowns and the closing of the nursery and elementary schools forced parents to juggle between working from home and caring for their young children, and children's screen use has soared dramatically (Götz et al., 2020). Are these children indeed at risk? Is there convincing evidence that screen time impairs psychological development? Allegedly, according to the World Health Organization (WHO), the answer to both questions is: yes.

In April 2019, the WHO published comprehensive ‘guidelines on physical activity, sedentary behavior and sleep for children under 5 years of age’ (WHO, 2019). The guidelines were shaped with the full consensus of the Guideline Development Group (GDG) after a thorough scientific review of the available research. The rationale behind the guidelines was to provide policymakers, pediatricians and family nurses with practical recommendations on the amount of time that children should be: (1) physically active, (2) sleeping, and (3) spending on *sedentary activities*. Curiously, this last activity included watching screen-based entertainment. As shown in Figure 1, the guidelines include a statement that: “screen time is not recommended” for infants and for 1-year-old children. For older children aged 2–4 years, “screen time should be no more than 1 hour” and “less is better”. Inevitably, these official recommendations drew considerable public attention (e.g., Bowden, 2019; Euronews, 2019; Roberts, 2019; Turner, 2019), which might contribute to the maladaptive moral panic over screens and new media technologies (Goggin, 2010; Ingraham & Reeves, 2016; Orben, 2020).

The goal of the current article is to offer a balanced and scientifically-grounded perspective on the WHO guidelines on screen time. From a position of great respect toward the systematic work of the GDG, we offer a step-by-step critical review of the literature underlying the guidelines. Specifically in this review, we examine the scientific assumptions made by GDG and conduct a meta-analysis of the same empirical data that were available to the GDG on screen time and psychological development. Finally, we discuss the conclusions on screen time among preschool children in relation to contemporary studies and literature reviews and present three practical recommendations for further research.

**Method**

The following review consists of seven methodological steps: In the first step, we make a distinction between the overall framework of the WHO guidelines that target inactivity and obesity and the topic at hand (i.e., sedentary screen time). Then, in the second step, we discuss the quality of the 33 empirical studies that were collected by the GDG to address the specific topic of screen time. The following two steps are dedicated to an in-depth critical review of the validity and the relevance of the only two studies that were not marked (in the previous step) as studies with "very poor quality". In the fifth step, we challenge the assumption that the 33 studies on screen time form a consistent pattern regarding the psychological effects of screens. Finally, in the last to steps, we conduct a meta-analysis to assess the overall psychological effect of screens and to evaluate whether the collected studies suffer from a publication bias. Detailed description of each step is provided in the results.

**Results**

1. **The binding of ‘sedentary behaviors’ with ‘sedentary screen time’ is misleading.**

The overall framework of the WHO guidelines, as described in its opening statements, is to promote healthy sleeping and physical behaviors and to reduce *physical inactivity* – a noteworthy risk factor for mortality and obesity. The term that was chosen to describe this problematic physical inactivity is “sedentary activities”. According to the WHO glossary of terms (p. Ⅳ), sedentary activities include two types of activities: *sedentary screen time*, which is the “time spent passively watching screen-based entertainment (TV, computer, mobile devices)” and other *sedentary behaviors* that are characterized by low levels of metabolic activity in a “sitting, reclining or lying posture”. The examples given for sedentary behaviors (without screens) include the time spent in a car seat or a stroller but also the time spent listening to a story. This equivalence between listening to a story and sitting restrained in a car seat is understood, assuming the overall framework of physical inactivity being linked to the problem of childhood obesity: Too much sitting without enough physical movement can lead to obesity, no matter the content of the sedentary activity.

From this general perspective of the guidelines (i.e., inactivity and obesity), the binding of sedentary behaviors with screen time in the recommendation section (Figure 1) is not trivial. Consider a familiar scenario in which a young child cries in his/her car seat during a long drive. According to the guidelines, is it alright for parents to play him/her children’s songs on YouTube? Ostensibly, the child is already sitting in a state of a sedentary behavior and the additional screen time would not add more risk for obesity. In other words, assuming that children are physically active and that their sleeping habits are decent, can parents expose them to screens? To answer this question, we should disregard the general framework of the guidelines and dive into the psychological outcomes of screen time.

The ‘summary of evidence’ section of the WHO guidelines (page 8) implies that screen time is a possible risk factor for both the physical and psychological development of children: the evidence on the negative *physical* effects of screens addresses adiposity and motor development, and the evidence on the *psychological* effects addresses children’s cognitive development and psychosocial health (page 8). Yet, in order to examine the unique consequences of screens beyond other forms of inactivity or sedentary behaviors, such as listening to a story, special attention should be given to the alleged cognitive and psychosocial implications. This is because there is no reason to assume that sedentary time with screens poses a greater risk for adiposity and motor development than sedentary time without screens (i.e., it is the physical inactivity that leads to adiposity, not the content of a TV show).

1. **The quality of evidence for negative psychological outcomes of screens is very poor.**

According to the authors of the WHO document, the suggested guidelines were formed based on a large number of empirical studies from high-quality systematic reviews published between 2017 and 2018 in six WHO languages. The scientific justification for the guidelines was provided in separate supplementary material named: [Web Annex Evidence Profiles](https://apps.who.int/iris/handle/10665/311663). The Web Annex includes 28 tables that summarize findings from a total of 251 references. However, only two tables address the empirical studies examining the psychosocial or cognitive outcomes of screen time. The evidence for the psychosocial consequences of screens (Web Annex Table 1.2.3) is based on 20 studies: two randomized trials, eleven longitudinal studies, and seven cross-sectional studies. The evidence for the cognitive consequences (Web Annex Table 1.2.4) is based on 29 studies: twelve longitudinal studies, one case-control, and sixteen cross-sectional studies. In light of the fact that some studies appear in both tables (i.e., they examined both cognitive and psychosocial associations) and the fact that four studies in Web Annex Table 1.2.4 (studies #87, #160, #173, and #174) did not examine screen time but other sedentary behaviors, the final number of relevant studies is 33.

The quality of all the studies in the Web Annex was rated by the GDG using a common approach for the Grading of Recommendations, Assessment, Development and Evaluations (GRADE; Guyatt et al., 2011). Remarkably, the first severe criticism of the validity of the guidelines has been generated by the GDG themselves, who summarized the recommendation section on sedentary time with the phrase: “strong recommendations, very low-quality evidence” (Figure 1). Overall, 31 of 33 studies received a GRADE score of a “very low quality”. This troubling information removes a first fundamental foundation from the scientific construction of the warnings against negative psychological outcomes of screens. Moreover, even the other two “moderate quality” studies are troublesome, as will be shown in the following two sections.

1. **One of the two “moderate quality” studies is irrelevant to the recommendations.**

The GDG judged two out of the 33 studies to have moderate scientific quality; however, one of these studies, Study #157, is irrelevant to the final recommendations. In Study #157, Kostyrka-Allchorne et al. (Kostyrka-Allchorne et al., 2017) investigated the effects of fast versus slow videos (measured in the frequency of camera cuts per minute) on preschool children. They created two versions of the ‘Snail and the Whale’ children’s story, one that simulated fast videos (28.2 cuts per minute) and one that simulated slower videos (6.2 cuts). The results of this experiment suggested that children who are exposed to fast‐paced videos may switch toys more frequently than children who watch slower paced videos.

This is an intriguing experiment; however, two characteristics of this study prevent it from being relevant to the WHO recommendations on screen time. First, this study does *not* address or examine sedentary screen time per se, because *both**groups* participated in sedentary screen time behaviors. Second, the artificially enhanced video in the experimental group does not simulate typical children’s movies. As Kostyrka-Allchorne and collegues illustrated in their article (Figure 2), the frequency of the cuts in the fast video is comparable to extremely energetic videos that do not address, and are not appropriate for, preschool children. The samples provided by the authors are the music videos by Taylor Swift (‘Blank Space’, 32 cuts per minute) and Mark Ronson (‘Uptown Funk,’ 37.5 cuts per minute). On the contrary, the slow video actually resembles a popular children’s TV program (‘Sooty’, 7.6 cuts per minute). Therefore, an alternative and more accurate recommendation for parents from this study may be to *control the content* of the screens. In other words, the study suggests a problem with fast-moving content that is inappropriate for young children; it does not explore whether there is a problem with sedentary screen time.

1. **The other “moderate quality” study has significant methodological flaws.**

Allegedly, Study #101 (Yilmaz et al., 2015) that was also judged to be of moderate quality provides the holy grail. In Study #101, Yilmaz and colleagues conducted a randomized controlled trial (RCT) to assess the outcome of a designated intervention for reducing screen time among preschool children. Unfortunately, even this RCT suffers from significant methodological weaknesses that challenge its fit to the WHO guidelines. We outline four critiques below in regards to this research. First, the main finding of the study, in which the authors show a significant reduction in screen time among children in the intervention group, is irrelevant to the WHO guidelines. Indeed, children in the intervention group started the research with a screen time average of 86.03 (*SD* = 20.46) minutes per day and completed it after nine months with only 21.15 (*SD* = 6.12) minutes, but these numbers are essentially a straightforward manipulation check that ensures that the designated intervention actually works. The only implication of this finding is that reducing screen time is possible. Although some parents may be encouraged by this finding, it has nothing to do with the outcome of the screen time.

Second, the body mass index (BMI) scores did not differ between children in the intervention and control groups. This non-finding is especially interesting in light of the scientific strength of the examined variable; BMI is an objective assessment that is not susceptible to subjective impressions or to research biases. Considering the experimental design of the study (RCT) and the validity of the examined variable, this non-finding actually challenges the general framework of the guidelines that focus on physical outcomes of sedentary activities.

Third, the analysis of psychosocial outcomes was not conducted correctly. Yilmaz and colleagues claimed that children in the intervention group displayed less aggressive and delinquent behaviors compared with children in the control group. They support this claim on the fact that the two negative behaviors were not statistically different between the groups before the intervention and that fact that they were statistically different after the intervention. After nine months from the intervention, the average aggressive score in the control group was 3.85 (*SD* = 1.38) compared with 3.35 (*SD* = 1.46) in the intervention group. The average delinquent behaviors score in the control group was 3.83 (*SD* = 0.95) compared with 3.45 (*SD* = 1.56) in the intervention group; however, these analyses were based on *between-group t-tests for independent samples*, which are not appropriate for this type of experimental design and therefore should be cautiously interpreted.

Well-designed RCTs that include two groups (experimental and control) as well as repeated measures (before and after the manipulation/intervention) should incorporate *mixed-design analyses* (a split-plot analysis of variance) that address the differences *between* the independent groups, while considering the changes that occur *within* each group. This is because the main research interest in RCTs is in the difference between the changes that occurred in the intervention group and the changes that occurred in the control group. This mixed analysis is especially required in the research at hand in light of its peculiar findings. On the one hand, the average scores of delinquent behaviors *increased*, both in the control group (3.02 → 3.83) and in the intervention group (3.02 → 3.45), despite the reduction in screen time, which should have led to less delinquent behaviors. On the other hand, there was a sizable decrease in aggressive behaviorin both groups. As expected, the scores in the intervention group decreased from an average of 6.94 (*SD* = 1.66) to 3.35 (*SD* = 1.46) but unexpectedly, a similar trend also occurred in the control group. The average aggressive behavior scores in the control group decreased from 7.17 (*SD* = 1.52) to 3.85 (*SD* = 1.38). This reduction in both groups (3.32 and 3.59) seems significantly larger that the difference between the changes (0.27) that occurred in each group, nine months after the intervention. The large reduction in both groups may actually imply that the principle cause for the reduction in aggressive behavior has nothing to do with screen time.

Fourth, even if the appropriate analyses were applied, the conclusions regarding harmful effects of screens cannot be deduced, because of a specific shortcoming in the methodology of the experiment. Whereas families allocated to the intervention group were exposed to four sets of materials and counseling sessions in which they were taught the “harmful effects of TV, video, and computer games”, families in the control group “were not aware of (the) counselling interventions” (p. 444). As the authors themselves acknowledge, unlike parents in the control group, “the parents’ reports of aggressive behaviors (in the intervention group) are likely to be biased” (p. 448) as they were fully aware of the research goals. These parents were exposed to the *demand characteristics* of the study; they understood what was expected from them and knew what the “right” answers were. In contrast with the objective BMI scores, parents could provide biased responses to the subjective psychosocial questionnaires. This bias might have even occurred without the parents’ awareness. Moreover, the participants in the intervention group were subjected to a relatively strong *placebo effect*; they went through a persuasion campaign that emphasized the harmful effects of screens and the beneficial effects of the active reduction of screen time. Therefore, even if the parents’ reports are genuine, the design of the research does not allow the differentiation between the placebo effect and the active ingredient of reducing screen time.

1. **The 33 studies on psychological outcomes do not converge into a consistent pattern.**

Having established that the WHO guidelines are based on a very poor-quality research, one might claim that, together, the 33 studies form a critical mass that tells a consistent troubling story. Regrettably, this is also not true. In order to extract an overall impression from the entire set of studies, we revisited each one of the 33 articles assembled by the GDG (Tables 1.2.3 and 1.2.4 in the Web Annex) and mapped the various findings to ‘good’, ‘bad’, or ‘null’ effects of screens. Altogether, including the two experimental yet problematic studies from above (see steps 3 and 4), we counted a total of 66 psychological effects of screens.

The first impression that arises from this aggregation is that the 33 studies examine a very wide range of psychosocial and cognitive variables. Speech disorders, classroom behaviors, attention difficulties, and victimization of bullying are only few examples. Therefore, the claim that a consistent pattern can be seen from the 33 studies relies on a problematic logical leap – that all of the studies address similar psychological effects. The assumption that the studies can be aggregated into one unified effect of screen time is, in our opinion, a far-reaching logical step. The second impression from this aggregation is that most of the studies (*N* = 21) also reported *null results* in some of the variables that were examined. Taking into account the valid suspicion of publication bias – the scientific tendency not to publish non-results (see step 7), it is possible that additional studies with null results ended up not being published. The third and somewhat surprising impression is that a few studies (*N* = 5) have actually documented favorable associations with screen use. These favorable associations mean that screen time has also been documented to be associated with positive psychological outcomes, such as improved social skills and cognitive functions. Taking together these three impressions, we conclude that the 33 studies do not share a common and clear (negative) scientific ground and that, in some cases, researchers tend to ignore counterfactual null/positive findings.

1. **Meta-analysis reveals negligible summary effects of screens.**

Even if we take the far-reaching logical step of aggregating the 66 effects from all 33 studies into one unified conclusion regarding the psychosocial effects of screens, an objective–mathematical method can be applied to estimate the overall effect. To examine the overall effect of screens, we conducted a meta-analysis that combines the 66 effects from all 33 studies and extracts an overall estimate for the actual effect of screens (Littell et al., 2008). For the purpose of this meta-analysis, we accepted the inclusion of all 33 studies’ data that were available to the GDG, despite our reservations about some of these studies and about the general aggregation assumption. For the application of the meta-analysis, we used R version 3.5.0 ([www.r-project.org](http://www.r-project.org)).

Prior to the meta-analysis, we collected all of the relevant effects on psychosocial and cognitive variables from all 33 studies and transformed them into a unified parameter of Pearson’s correlation coefficient (*r*). We used the R package ‘Psych’ (version 1.8.12; <https://personality-project.org/r/psych>) to transform the effect sizes from their original modes (e.g., Cohen’s d, odds ratio) into Pearson’s *r*. In cases where the authors did not provide a value for the effect size, we computed the Pearson’s *r* from the reported means and standard deviations and from the given test statistics (i.e., *T*, *F* or *χ2*). In cases where multiple regression was conducted, we transformed the standardized beta coefficients to Pearson’s *r* using a conventional formula: *r* = *β* + 0.5γ, whereby γ equals 1 when *β* is positive and zero when *β* is negative (Peterson & Brown, 2005). Only one study lacked standardized beta coefficients or other interpretable statistics (Mistry et al., 2007) and therefore could not be included in the meta-analysis.

After the collection and transformation of all the effect sizes, we standardized the total of 66 Pearson’s coefficients into a set of Fischer *z* scores and conducted the meta-analysis, using the statistical package, Metafor (version 2.1-0; [www.metafor-project.org](http://www.metafor-project.org)). To ensure the validity of the results, we applied both conventional statistical models: the random effects model and the fixed model (Figure 3). We present here the results from the more lenient random effects model, which allows the assumption that studies are not functionally identical (Borenstein et al., 2011).

The image that arises from the entire meta-analysis is illustrated in a forest plot (Figure 3). Allegedly, the results indicate that screen time is positively related with psychosocial and cognitive variables (*r* = 0.08, *p* < 0.01; 95% CI [0.06, 0 .11]). Two additional meta-analyses, which were performed separately for each cluster of variables, provided similar results, for the psychosocial (*r* = 0.08, *p* < 0.01; 95% CI [0.05, 0 .11]) and cognitive variables (*r* = 0.08, *p* < 0.01; 95% CI [0.05, 0.12]); however, although significant, the summary effect value (*r* = 0.08) and the confidence intervals that approached zero (0.06) imply that screen time has a very low effect on a child’s psychological development (Cohen, 2013). De facto, the summary effect value (0.08) explains only 1.6% of the variance in the child’s psychosocial development. Thus, even if we accept all of the assumptions made in the WHO guidelines, the actual effect of screens is negligible.

1. **Meta-analysis shows a significant publication bias toward favoring negative effects.**

As implied in step 5, one of the inherent problems in the publication process of scientific research is the tendency of both editors and authors to favor studies that yield significant findings (i.e., that reject the null hypothesis). Empirical studies that do not result in statistically significant effects are usually not even considered for publication, unless they are based on a particularly large data set or on a very strong experimental design. Poor-quality cross-sectional studies with small to medium samples, such as the ones used to form the guidelines, are therefore especially vulnerable to this bias. Those poor-quality studies that are ‘lucky’ enough to find an effect are likely to be published, whereas those that do not find significant effects would not.

If a publication bias exists in a given field, then it would skew the entire meta-analysis (Borenstein et al., 2011). To estimate whether the collected studies underlying the meta-analysis suffer from a publication bias, we conducted a funnel plot. The funnel plot method relies on the simple notion that if a phenomenon exists in reality (e.g., that screen time has a negative effect on psychological development) then the studies that try to measure this phenomenon should show a relatively symmetric pattern. If, for example, the ‘real’ correlation between screen time and psychological variables is around 0.3, then some studies would have lower values (e.g., 0.1, 0.2) and others would have higher values (e.g., 0.4, 0.5), but they all should form a somewhat symmetric pattern that revolves around the center point. Worryingly, the funnel plot of all the 66 effects included in the meta-analysis showed a severely asymmetric pattern (Figure 4). Moreover, the Egger’s regression test for funnel plot asymmetry showed a significant effect of publication bias (*z* = 3.656, *p* < 0.001). The clustering of effect sizes plotted in the lower part of the funnel, especially on the right side of the line, serves as a strong indication that the literature on screen time and its negative effects on the psychological development of the child suffers from significant publication bias.

Unfortunately, there is no way to offer an accurate estimation of the number of null results that ended up not being published. Moreover, in light of the significant publication bias and in light of the moral panic of media, we speculate that the 21 null effects and the 5 favorable effects that did infiltrate the current meta-analysis were only possible because many of the studies examined multiple negative effects of screens, of which at least one negative effect was found to be significant. The current meta-analysis suggests that there are additional empirical studies that did not find any effects of screens but due to this publication bias, they were not brought to the scientific community and therefore not brought to the public discourse.

**Discussion**

Despite the thorough scientific work completed by the GDG, the current article critically challenges the scientific validity of the WHO guidelines on screen time. In step 1, we made a clear distinction between the overall framework of the guidelines (i.e., inactivity and obesity) and the topic at hand (i.e., sedentary screen time). Then, in step 2, we illustrated the GDG’s major reservation that summarized the section on screens with the phrase: “strong recommendations, very low-quality evidence”. In steps 3 and 4, we delved into the two “moderate quality” studies and showed that they suffered from troubling methodological issues and that they were not relevant to the WHO guidelines. In light of the fact that the 33 studies examined a wide range of outcomes, of which many resulted in null or even favorable outcomes of screens, step 5 emphasized researchers' tendency to ignore counterfactual findings and challenged the assumption that a consistent pattern can be extracted to begin with. Finally, the meta-analysis conducted in step 6 showed that the overall psychological effect of screens is negligible, and step 7 lends evidence that the entire field suffers from a publication bias. Altogether, these seven steps undermine the scientific evidence of the WHO guidelines.

Unfortunately, the observed phenomenon, according to which conclusive conclusions are formulated without sufficient evidence, is not exceptional in the research on children's screen use (Orben & Przybylski, 2019). Updated critiques revealed that several recent studies formed concerning conclusions regarding the risks of screen use, based on problematic methodological assumptions, dismissal of counterfactual results, and over-reliance on small correlational effects (Ophir, Lipshits-Braziler, et al., 2019; Ophir, Tikochinski, et al., 2019; Ophir et al., 2020). Some might argue that small effects could develop into large effects over time (Browne et al., 2020) but this could only be the case if the observed effects are distinctive and reliable.

In many cases, the (small) negative effects of screens are not accurate and disguise the more complex relationships between screen use and psychological development (Orben & Przybylski, 2020). A new study for example, which was not covered in the WHO guidelines, raised a troubling concern that toddlers who watch television/videos are at risk to develop symptoms of Autism Spectrum Disorder (ASD) (Heffler et al., 2020). Inevitably, this warning received considerable attention from the popular media, even though the actual effect that was observed in the study was partial, small, and unreliable. Alongside a very small association between TV/video viewing at 12 months and a continuous measure of ASD-like symptoms at 24 months, Heffler et al. also noticed that screen use at 18 months does *not* predict ASD-like symptoms at 24 months, and more importantly, that the effect of TV/video viewing on the primary outcome of the study – the original dichotomic measure of ASD risk – is *not* significant (Heffler et al., 2020). Moreover, even the reported small effect on the continuous measure of ASD-like symptoms cannot be interpreted due to insufficient information (i.e., a cut-off point for ASD and average scores for users and non-users of screens). In fact, the vast majority of the children who watched TV/video in this study received a total score of 0 or of 1 point, out of 20 potential points, in the continuous ASD scale.

Uncareful interpretations of small effects may also overlook the straightforward role of potential covariates, such as socio-demographic variables (Ophir, Lipshits-Braziler, et al., 2019). Multiple studies that investigated children's use of screens revealed that small effects tend to diminish, and in some cases even disappear, once essential covariates are controlled (Hutton, Dudley, & Horowitz-Kraus, 2020; Linebarger, 2015; Madigan et al., 2019; Twenge et al., 2017). For example, a recent study on preschool children, which was not covered in the WHO guidelines, found that the negative correlation between screen time and literacy skills disappears when household income is controlled (Hutton, Dudley, Horowitz-Kraus, et al., 2020). In fact, even larger negative effects of screens can prove to be no longer significant, once background variables are properly considered. Blankson et al. (2015) for example, revealed that the association between TV viewing and vocabulary and/or executive functioning among preschool children (e.g., *r* = -0.28) becomes non-significant, once sociodemographic variables, home learning environment, and parental styles are controlled. In other words, the potential risk for a reduction in cognitive performance is not necessarily linked to screen time but to other, no less important, environmental conditions.

In contrast to the assumption made in the WHO document, the accumulating studies on children's screen use do not lend sufficient support to the notion that screen time alone increases the risk for psychological impairments. Based on (1) the current meta-analysis, as well as on (2) an exhaustive review on screen use and ADHD-related behaviors (Beyens et al., 2018) and (3) an updated meta-analysis on screen use and language skills (Madigan et al., 2020), the current state of the literature seems to support the opposite argument, according to which the overall negative effect of screen time per se is small and unreliable. The existing literature, as shown here and as documented in Madigan et al.'s meta-analysis (2020), is highly heterogenous (i.e., it includes positive, negative, mixed, and non-significant effects) and is characterized by a significant publication bias (i.e., favoring research that emphasizes the negative aspects of screens). Further research is therefore needed, in order to form scientifically valid guidelines for parents. Instead of focusing on direct relationships, researchers are encouraged to search for mediating variables, such as personality traits or specific types of usages and contents, which could shed more light on the complex relationships between screen use and psychological outcomes (Beyens et al., 2018; Frost & Rickwood, 2017). With great respect to the work that was conducted by the WHO so far, we suggest three practical avenues for researchers who wish to provide scientifically sound (and in our view, more balanced) guidelines on screen use for children.

1. **Distinguish between normative use and pathological overuse of screens.** While pure screen time has not been proven to have negative psychological outcomes, pathological overuse of screens may definitely be dangerous (Elhai et al., 2017), as is the case in most human behaviors (e.g., eating, working, and even exercising). Different terms are mentioned in the literature to describe this pathological overuse (i.e., addiction, dependency, compulsive, and problematic use) (Kardefelt-Winther, 2014) but they all share a common ground: Children (and adults) engaging in pathological overuse of screens experience a compulsory need to use the screen-technology and experience painful withdrawal symptoms when they are deprived from it. Researchers are therefore recommended to distinguish between normative and pathological overuse of screens and examine the unique impacts of each types of screen use.
2. **Focus on deprived healthy daily behaviors.** Aside from dependency, the overuse of screens may have an indirect negative effect on children's development through an important third mediator – a substantial reduction in positive and constructive daily behaviors, such as exercising, sleeping, or interacting with friends (Ophir, Lipshits-Braziler, et al., 2019). Researchers are therefore advised to direct their efforts to analyze the mediating role of these positive behaviors. This recommendation actually corresponds with the general framework of the WHO guidelines that focuses on sleeping and physical activities (WHO, ‎2019). Similar to the previous point on pathological overuse, it is possible that screen time will prove to be maladaptive, mainly in cases where it happens at the expense of healthy daily habits.
3. **Investigate the effects of specific types of contents.** As illustrated in step 3 of the current critique, the content presented on the screens matters (Kostyrka-Allchorne et al., 2017). Whereas inappropriate, violent (Anderson et al., 2019) or hyper-sexual (Owens et al., 2012) contents can be harmful, educational contents, such as math exercises (Zaranis et al., 2013) and literacy-oriented games (Dezuanni et al., 2015) can be beneficial for children's development. Researchers are therefore advised to track the diverse effects of the different types of screen contents that are being consumed by children today (Greitemeyer & Mügge, 2014). This recommendation corroborates with the findings of the meta-analysis on screen time and language skills, which was cited above: While “background television” was found to have negative effects on children's language skills (*r* = -0.19), educational programs (*r* = 0.13) and co-viewing (*r* = 0.16) were found to have positive outcomes (Madigan et al., 2020).

Altogether, the above list of recommended research directions may result in a more accurate, more balanced, and most importantly less terrifying, recommendations for parents. Although we agree that parents cannot always wait for scientists to settle contemporary debates (Browne et al., 2020), we also believe that scientists cannot make unfounded statements, and as shown in this article, the available scientific evidence does not support the WHO guidelines on screens. Not only is voicing such a stance ethically problematic; it may also contribute to the prevailing guilt that parents already experience (Carson et al., 2014).

Even before the outburst of the COVID crisis that required parents to extend their children's screen time (Götz et al., 2020), millions of parents (in north America) allowed their children more screen time than was recommended by the WHO (Carson et al., 2014; Trinh et al., 2020). These parents are consistently exposed to allegedly scientific warnings about the lasting consequences of screens for their children's brain and mental health (e.g., Park, 2019, Heid, 2018) and many of them experience an unsettling cognitive dissonance, which brings much tension and conflicts into their family unit (Götz et al., 2020). We therefore believe that it is our duty, as scientists, to provide these parents with the most accurate and the most informative picture on the effects of screen use, even if this picture is somewhat controversial and is yet to be further researched and enriched.

Indeed, the new era of screen technologies raises complicated parenting challenges. Yet, the present review and meta-analysis on preschool children suggest that many of the allegedly scientific warnings are not properly founded and may even reflect a bias towards a media panic (Ingraham & Reeves, 2016; Orben, 2020). The actual direct effects of screen time are small and unreliable and to date, there is no convincing causal evidence that (non-pathological) screen time alone impairs psychological development. This of course does not mean that parents can be off guard. They still need to watch for inappropriate contents, ensure that their children's healthy daily practices are not compensated, and help them develop safe and balanced screen use habits. However, they can let go of (some) of their constant self-blame and allow themselves to enjoy the many benefits of screen use. Just like other sedentary behaviors that involve positive activities such as 'listening to a story', screen time can be leveraged by parents for educational purposes, quality co-viewing time with their children, and, perhaps even some quite quality time for themselves and their spouses.

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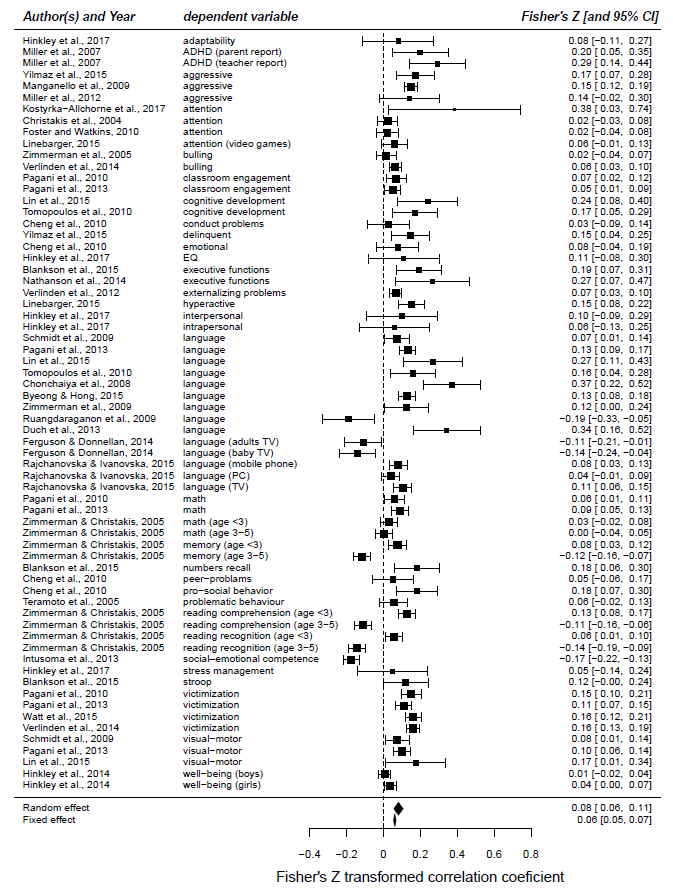
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*Figure 3 – Forest plot of the meta-analysis*



*Figure 4 – Funnel plot indicates a significant publication bias.*

