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Understanding of user needs and problems: A rapid evidence review of age assurance and parental controls in everyday life (D2.4a)

WP2: Existing Methods, User Needs and Requirements

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1. Executive summary

How can children's experiences in a digital world be made age-appropriate? A range of child protection measures is designed to mitigate the content, contact, conduct and contract risks children encounter online. Such measures are developed as a matter of responsible business practice or to meet regulatory requirements (whether legislation, co- or self-regulation). The effectiveness of these measures in protecting children while also respecting children's other rights depends on technical, regulatory, business and domestic practices and their interdependencies.

This report examines families' domestic practices, while also recognising their structural and cultural contexts. It presents findings from a rapid evidence review focused on parents' and children's everyday actions, views and experiences of two child online protection measures: age assurance (service-level means of verifying the age of users with various degrees of certainty) and parental control tools (end user tools for parents to support the safety and privacy of their children online).

The aim is to understand the outcomes of families' engagement with these measures and to formulate evidence-based, child rights-respecting recommendations for the future development of age assurance and parental control tools.

The evidence review involved a systematic search of academic databases (social sciences, human–computer interaction and related fields), supplementary searches and consultation with experts. The resulting 1,736 studies were screened for relevance, generating a sample of 61 studies that were analysed for this report.

Findings: The use of age assurance in digital contexts

- **Mechanisms for age assurance are rarely implemented for the sale of age-restricted goods.** The evidence on the sale of age-restricted goods shows that age assurance is rarely implemented at the point of sale or on the delivery of goods and services (e.g., for alcohol or pornography). This ineffectiveness is due to non-compliance with legal requirements and/or failure to follow established procedures, as well as poorly designed measures that can be easily bypassed, for example by making a wrong self-declaration of age.

- **Existing barriers to accessing age-restricted content, goods and services are mostly ineffective.** A range of age assurance measures is commonly used in relation to children's access to goods, services and content in the digital environment, but they all have limitations. Self-declaration tools that require the user to only enter their birthdate or to tick a box that asks if they meet the 'age required' criteria are most commonly used as they are easy and cheap to implement. However, such measures are only a token

gesture to age assurance as they are easily circumvented and do little to protect children in high-risk contexts.

- **Children can use workaround strategies to challenge the age assurance system.** For example, some children were found to use parents' IDs or gift cards to purchase age-restricted goods. In most cases the system was so easy to bypass that no sophisticated means were required to find a workaround.

- **Some measures can pose risks to children's safety or privacy.** Third party age assurance (especially age verification mechanisms where the user's age is verified by identity confirmation providers, e.g., via digital IDs, background checks or tokenised age checking) is more effective in protecting children but is more expensive and it may raise safety or privacy concerns (e.g., in relation to online fraud or data minimisation). We did not find evidence on uses of multifactor authentication techniques or privacy-by-design and default mechanisms that could resolve some of these issues.

- **Accessing restricted goods became easier during COVID-19 lockdowns.** As online purchasing increased and social distancing measures reduced in-person contact, children found it easier to access restricted goods. For example, deliveries in person were replaced by deliveries at the doorstep and age was often not verified.

- **Parents want flexibility in deciding when a service may be appropriate.** Parents sometimes help children override age requirements by allowing them to use age-restricted services or to access content for older children. Parents want to be able to make the final decision about what content and services their children can access based on their judgement of what is suitable for their child, rather than on general age restrictions.

- **Age ratings are seen as informative by parents but not necessarily relevant to their specific circumstances.** Age ratings of digital and media content used to determine access in both physical (e.g. cinemas, rental stores, in-home) and virtual spaces are often seen as advisory rather than mandatory by parents.

Findings: The use of parental control tools for online safety

- **Children value having control over their internet use.** They recognise the positive aspects of available measures and occasionally install apps themselves to assist with self-discipline and boundary negotiation with parents.

- **Parental control tools can respond to the anxieties of digital parenting.** The research demonstrated that for parents and carers, parental control mechanisms could reduce anxiety and worry over children's digital lives and the online risks they encounter. Such measures, often focused on content, may create a false sense of security while other risks relating to data processing and commercial surveillance remain.

- **Parenting control measures are insufficient on their own; they work best when used to facilitate enabling mediation.** The evidence shows that the use of technical controls without active and positive involvement in children's digital lives is likely to harm parent-–child relations, resulting in more conflict over media use, less sharing about online experiences and poorer family communication.

- **Fostering communication and trust between parents and children is crucial.** The importance of open communication, mutual learning from digital experiences, negotiation of access and use and the involvement of children in digital mediation decisions emerged from the findings as important for family life and child protection.

- **Measures need to account for the child's evolving capacities in a way that enables learning and development.** Approaches to parental control tools change with the child's age and development. For example, younger teenagers are subjected to more mediation and monitoring by parents and carers while older teenagers experience less restriction. If parental control tools do not provide options that are appropriate for children of different ages, they may introduce a problematic degree of parental surveillance that can be harmful to children.

- **Family diversity matters to how age assurance is used.** The nature and need of technical mediation differ depending on family circumstances, parenting practices and cultural norms. Those findings reinforce the importance of flexibility as a core principle for development in terms of design recommendations. We found very little research on marginalised or disadvantaged children and families, so the degree to which existing measures tend to exclude or discriminate against certain groups is unknown, which is a cause for concern.

- **Measures often demand technical skills that some parents lack.** Existing measures often require technical proficiencies of parents and knowledge about the measures if they are to be applied competently and effectively. While some parents might lack the digital competence to take advantage of the existing measures, others might use them as a 'quick fix' to

make up for their lower digital skills, making the measures potentially counter-productive.

- **Restricting children's internet use reduces opportunities, digital skills and learning.** The evidence shows that restrictive mediation comes at a cost for young people as it undermines their capacity to cope with online risks and build resilience, their growing knowledge about the complexity of the online environment and their capacity to take advantage of digital opportunities.

- **Restricting access does not necessarily limit the online risk of harm.** Parental control measures are often implemented with the intent of protecting children from harmful experiences. The evidence suggests that parental control tools are somewhat effective in reducing online risk by limiting young people's access to the internet. However, they may also have adverse effects, for example by making prohibited behaviours or content more appealing, leading to poorer judgements and victimisation. In addition, exposure to some degree of risk, carefully managed, can help children build resilience and learn about online safety. Recognition of these findings should be part of technology design.

- **There is a risk of exacerbating existing vulnerabilities or compounding disadvantage.** There is evidence that parental control tools sometimes exacerbate existing vulnerabilities. For example, restrictions are more often applied in households where the child 'feels a lack of family support' (Martínez et al., 2020, p. 72), thus potentially exacerbating problems for children who already lack a supportive environment. Furthermore, not all children have an engaged adult present or a parent who is able to support their safe internet use. These children are at risk of being left out, even though they are most likely to benefit from such tools.

- **Children find unjustified restrictions frustrating.** Children express negative views about poor app functionalities as well as overall frustration, dislike and even anger in relation to uses of parental control tools and mediation practices, especially when they are primarily restrictive or exercised with little warmth or open communication. Parents most often complain when the measures are malfunctioning, there are flaws in the design functionality or the costs are high.

Implications for child rights

- **Children's right to protection is prioritised over their other rights.** Most age assurance measures prioritise children's online safety, sometimes at the expense of other rights, such as participation or learning or privacy. It is imperative that the measures developed to protect children from harm in

relation to digital technologies should be effective and proportionate, respecting the full range of children's rights.

- **Measures do little to enable children's right to be heard.** They tend to be developed from the viewpoint of industry's or parents' interests, and rarely consider children's needs or voices. Children are rarely consulted at any stage of the design, implementation or application process. Built-in mechanisms that enable children to have control or express opinion, for example in-app 'Consult the child' features, are also lacking.

- **Children's increasing capacity to make their own choices remains largely unsupported.** We found little evidence that the available measures take into consideration children's developing capacities and possess the granularity that can support these changing needs.

- **Many age assurance measures do not respect children's rights to privacy or autonomy.** Such measures can sometimes enable an inappropriate or undesirable degree of parental surveillance. Privacy-by-default or -design is rarely implemented. Some children were very vocal in the research studies saying they were unhappy with the way in which parental control measures adversely affected their privacy and socialising. The lack of transparency about the monitoring mechanisms or about 'behind the scene' datafication processes can also harm child rights.

- **It is possible that such measures might discriminate some children.** Designs that assume the presence of an engaged adult might discriminate against children whose circumstances are different. It is also unclear how other vulnerable groups might be affected, for example disabled children. We did not find established approaches to conducting a child rights impact assessment to verify how such measures might affect child rights.

- **There appears to have been little attention to how child protection measures can have a positive effect on child rights.** Rather than only being a means to limit children's access to the digital environment, age assurance can also serve to create a richer and more diverse digital ecology that caters for children's rights and interests as a user group. We have witnessed very little such effort so far.

Design considerations

Age assurance

- **Mechanisms should be effective, proportionate and follow the principle of data minimisation.** A technique to consider is multifactor identification. To support the exercise of agency while mitigating

workarounds, the authenticating factors could combine human inputs (e.g., PIN code or password or self-declare age) with technical authentication, such as posturing and profiling (of the devices used to access the service) and hard ID. Seeking effective measures might involve looking beyond the scope of age assurance, drawing from existing digital identification technologies already deployed in other sectors, such as banking and computer or network security.

- Such measures need to be **one tool among a wide repertoire of practices** that enable children's positive engagement with digital technologies. The design of such measures needs to take into account the limitations and actively promote user awareness.

- It is imperative that the measures developed to protect children from harm in relation to digital technologies should be **effective and proportionate**, respecting the full range of children's rights. This can be done through robust evaluations, participatory design methods and conducting a child rights impact assessment.

- There are strong grounds for **age assurance as a norm to go hand-in-hand with privacy and safety-by-design**. This can provide children with age-appropriate digital opportunities as well as protections. It is important that service providers do not defer responsibility onto parents (via controls). Even though parental control tools are an easier and cheaper solution than implementing robust age assurance, as this evidence review has found, there are many problems with parental control tools in relation to child rights and overly restrictive measures.

- Service providers can use age assurance not only to protect against harmful content but also to identify child users so they can **promote a safer and more diverse digital environment in which children can flourish.**

- The lack of enforcement of existing regulations and the use of inefficient technical measures is a considerable concern that requires further consideration. This might involve **exploring how standards can be harnessed** to encourage the selection and adoption of age assurance technology to improve the efficacy of age-restricting mechanisms and to encourage further innovation. Other options to deliberate might involve **combining standards with certification schemes** and exploring how the use of certified age assurance technologies as a statutory requirement for providing age-restricted content might promote enforcement and effectiveness.

- The empirical evidence on the use of age assurance mechanisms in everyday family life is limited, leaving important gaps. This is especially true for access

to digital content and services. More evidence is available on parental control tools and consent measures, which embed age-gating mechanisms, but the studies mainly discuss parental control tools generally rather than the particular mechanisms that they employ. Hence, design teams need to **initiate user engagement in product development and commission independent research evaluations** that can create a comprehensive knowledge base about the benefits and limitations of such measures, as well as their outcomes in relation to children's wellbeing, resilience, equality and rights.

Parental control tools

- Some parental control measures showed promise in the existing research evidence. **Features that enable negotiation and boundary re-drawing** within families are valued and seem more effective. A possible consideration here is how the computing systems that mediate parent–child negotiation over levels, aspects, scope and scale of parental control tools could involve constructive communication between parents and children, rather than a techno-centric command-control approach.

- Applying the principle of negotiability through adding user control functions that support negotiation across parents, children and the mediating computing systems can be **managed in a child-friendly way**.

- **Features that support children's agency**, for example through enabling communication, also show promise in some experimental research. They encourage children to engage actively and positively with parental control mechanisms rather than resenting them or seeking to bypass them.

- The design should seek ways to **ensure flexibility and build trust**. The level of child autonomy can be designed to respect and respond to the evolving capacities of the child, also enabling trust-building opportunities for parents and children, making supervision visible and, under certain circumstances, override-able by the child.

- To be effective, measures need to be able to **address the learning needs of children and families**, including in relation to online safety, privacy and effective parental support. Efforts are needed to ensure that parents are supported to learn about the benefits of such measures and how to apply them to maximise beneficial outcomes for their children.

- Designs should consider adding **options for less tech-savvy parents,** possibly starting with delegating control over to the automated or default parental control setting and **gradually building the competence of both**

parents and children. It is important to consider how parents can be supported to make the best decisions for their child's circumstances, for example by designing an **interactive system** that prompts questions for parents to choose aspects, scope and scale of control over their child's internet and device use and to configure the parental control tools accordingly.

Contribution to the euCONSENT project

This work is part of an EU-funded project euCONSENT that aims to put into live operation a pan-European open system for age verification and parental consent that is secure, certified and interoperable, and proposes measures that respect, protect and remedy children's rights in the digital age (UN, 2021). The purpose of this report within the euCONSENT project is to understand the current context of everyday use of age assurance and parental control tools by children and families to inform recommendations for the principles (collated in D2.4: *Understanding of user needs and problems*) that the euCONSENT technical partners should follow as they design the measures, which will be the foundation for D2.5: *System features and user requirements*.

The full report unfolds as follows: it introduces the context and reasoning behind age assurance and parental control tools. This is followed by a brief methodological discussion and a commentary on the kinds of evidence available as well as presenting the key findings from the rapid review of the evidence, organised by approaches to age assurance and parental control tools. The report concludes with a discussion of the implications and challenges for child online protection measures.

2. Acknowledgements

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3. Glossary of key terms

Age assurance: An umbrella term for methods used to determine the age or age range of an individual to varying levels of confidence. There are three principal categories of age assurance methods: age verification, age estimation and self-declaration. The word 'assurance' also refers to the varying levels of certainty that different solutions offer in establishing an age or age range that is influenced by which of these three types of method is applied.

Age estimation: A system that generally relies on estimation by reference to inherent features or behaviours related to the individual, to determine that the individual's age is likely to fall within an age range, to a specified level of confidence, to provide a lower degree of certainty in determining the age or age range of an individual than age verification techniques.

Age verification: A system that generally relies on hard (physical) identifiers and/or verified sources of identification, to determine the individual's age or age range, to a specified level of confidence, to provide a higher degree of certainty in determining the age or age range of an individual than age estimation techniques.

Child: A person under the age of 18 (UN, 1989).

Children's rights: Human rights afforded to minors.

Parent or caregiver: An adult responsible for a person under the age of 18.

Parental consent: Consent from a person holding parental authority over children under 16 (age varies across member states). It is the responsibility of the data controller to set up the verification procedures that guarantee the age of the child and the authenticity of the parental consent. *See* **age verification**.

Parental control tools: Parental control systems allow an adult responsible for a person under the age of 18 a degree of control over what content the child can see or hear. Parental control systems can be applied at the network or device level or through linking accounts between the child and parent or caregiver.

Parental mediation: Parental strategies and actions regarding children's internet use. These can be grouped into two broad categories – enabling (actively discussing, evaluating, supporting or sharing the digital activity with the child) and restrictive (limiting, policing or banning particular devices or digital activities).

Self-declaration: A method of age assurance that relies on the individual to supply their age or confirm their age range. This method establishes age or age range to a very low level of assurance. It may be fit for purpose in some contexts. The level of assurance can be slightly increased through the design of the self-declaration process. Self-declaration can be used in combination with other methods, for example age estimation, to provide a higher level of assurance.

For a full glossary, see: www.euCONSENT.eu/glossary

For age assurance types, tools, technologies and processes, see Billinge et al. (2021); van der Hof & Ouburg (2021); and 5Rights (2021a).

4. Introduction

How can children's experiences in a digital world be made age-appropriate or at the very least not age-inappropriate or harmful? The effort to achieve this, on the part of policymakers, businesses and parents/ caregivers, is primarily led by a concern to protect children from harm facilitated by digital technologies. Child protection measures, in turn, are typically designed as a matter of responsible (or reputational) business practice, to address public and parental concerns to manage children's access to and safety in the digital environment and/or in response to regulatory requirements (whether legislation or co- or self-regulation) (O'Neill & Dinh, 2018; O'Neill et al., 2020; UN, 2003).

A host of technical child protection measures, mostly provided and operated by safety tech businesses (for an overview, see Billinge et al., 2021; 5Rights Foundation, 2021a), are already widely used by all kinds of public, private and third sector providers of digital products and services (Perspective Economics & DCMS, 2021). These measures include but extend considerably beyond measures with an end user interface requiring information from or offering options to families in the form of parental control measures (also called parental control tools, parental tools, end user filters, family-friendly services, and so on).

Child protection measures are designed to solve a wide range of intersecting problems relating to the content, contact, conduct and contract risks children may encounter online (Livingstone & Stoilova, 2021). They are subject to continual innovation as societal expectations, regulatory frameworks and the digital environment co-evolve (EU, 2017; Lievens et al., 2018; Third et al., 2019b). Some of these measures are generally trusted by the public, and are even taken for granted as part of modern life in a civilised society. Some are little used or not trusted, already known for their failings and available workarounds. Yet others are contested for protecting children at the cost of their civil rights and freedoms or for professing to protect children at the cost of adult freedoms in a digital world (Lievens et al., 2018; Third et al., 2019a).

This report set out to review the available evidence concerning children's concerns and experiences regarding accessing potentially harmful content, including negotiating parental control tools, responding to parental mediation, possibly finding workarounds for filters and age restrictions. We focus the findings on two main areas of research, relating to two key measures to protect children online – age assurance and parental control tools – viewed from the perspective of children's everyday lives. Age assurance refers to technical measures that establish the age or age range of users, with varying degrees of certainty (e.g., through ID checks or face recognition-based age estimation) and in the context of varying degrees of online risk. Parental control tools are software tools that enable parents to manage or restrict their children's internet use, including filtering content, imposing time limits or monitoring use.

Age assurance and parental control tools are distinct conceptually and legally, and yet are often linked in practice. Specifically, while age assurance and parental permissions or consent are measures operated by the digital product or service provider, whether for legal or business reasons, insofar as their functioning requires information from children and/or parents, companies may embed them in the parental control tools used by parents in their everyday lives (as is commonplace in the research reviewed in this report). From an everyday life perspective, then, it may not be apparent to parents and children, nor even to

researchers, that some of the functioning of parental control tools is laid down in legislation or incorporated within a regulatory framework or code of practice, while other protection measures are offered as a business decision.

This report does not discuss efforts to design or test such measures as part of product development (see Nash et al., 2013; Pasquale et al., 2020). Nor do we address the regulatory rationale for these measures or their operation in practice (see Caglar & Nair, 2021; van der Hof & Ouburg, 2021). Instead, we examine evidence regarding how families engage with these measures in everyday life, including how they are viewed by parents and in particular, as they are experienced by children and young people. While it is beyond our remit to discuss how implementing legal requirements to verify or estimate the age of the child (hereafter, age assurance) and/or for parental consent (see the euCONSENT Glossary) relies on standards for the design of measures, specifies provision of explanation, accountability and remedy for users, it is within our remit to attend to evidence of the effectiveness of the measures in protecting children from harm.

○ The perspective of families' everyday lives

As with any technology, the practices of everyday life are critical to the success of child protection measures, albeit this is easily overlooked. In all their diversity of composition, values, practices, digital skills and contexts, the everyday lives of families can lead to full or partial use or non-use or creative workarounds to any technological innovation. Theories of the 'domestication' or 'appropriation' of technologies conceive technologies as encompassing the devices in the home, the networks that afford digital opportunities and risks, the specific measures deployed to implement regulation, and even the regulations themselves. They hold that domestication is an active process of meaning-making that is heavily shaped by the structures and activities of everyday life (Chambers, 2016; Haddon, 2006; Hartmann, 2005; Livingstone, 2007; Silverstone & Hirsch, 1992).

In short, once embedded within the home, the meanings and potential of technologies begin to vary, depending on the contexts of everyday life, the imaginaries and practices that surround their use and the choices that families make. Outcomes are influenced by factors at all levels, from the formulation and enforcement of legislation to the design and provision of digital products and services, including child protection measures, to the actions of parents, children and others given their particular and diverse everyday circumstances.

Among the many obstacles faced by businesses developing and/or deploying child protection measures and those regulating these businesses, three have proved pivotal in regulatory frameworks and yet are seemingly intractable in practice. The first is the challenge of knowing who is actually a child online (5Rights Foundation, 2021a; Livingstone, 2020). The second (relevant if parental consent is required) is identifying the parent responsible for the child (Jasmontaite & De Hert, 2015). The third is establishing whether parental control tools are effective, and whether they are usable and used in practice and whether, for one reason or another, children find ways around them or more vulnerable children and families are excluded (DCMS, 2020). Each of these is a practical challenge whose solution must take into account the nature of families' everyday lives. Meeting these challenges depends in part on the legitimacy of the child protection measures, as viewed by parents and children. This, in turn, depends on how normative decisions are made regarding

the digital experiences considered age-appropriate for children, bearing in mind their varying situations of disadvantage or vulnerability (Kidron & Rudkin, 2017). Also important are the circumstances under which parents (or indeed, the state, the digital provider or some other actor, including the child him or herself) are accorded a say in decisions about what their child can or cannot do or be exposed to online.

At present, child protection measures often require a check to ascertain the user's age and, in some cases, consent from the child's parent might be required (whether for data to be collected from or about the child or for the child to access certain digital services). While the regulations requiring such checks are specific to particular legislation, depending on particular digital risks and provider responsibilities, implementing these regulations has not proved straightforward from either a practical or a normative perspective. For example, since it is known who is a child before an age check is made, the need for age assurance could apply to all users engaging with potentially harmful or exploitative aspects of the digital environment. Or, if age assurance is not undertaken, it may be held that minimum safety and privacy standards are needed for all users by default. Thus, the operation of child protection measures has widespread implications for all internet users, posing a further and notable challenge for providers, regulators and the public.

○ Why age assurance and parental control tools matter

The importance of age assurance and related child protection measures is set out by the recent 5Rights Foundation report, whose title (*But how do they know it is a child?*) captures a critical issue from the perspective of digital policy and provision. As the report says, while 'age assurance should not be mistaken for a silver bullet or a shortcut to making the digital world fit for children' (5Rights Foundation, 2021a, p. 4), there is need for 'a mixed economy of age assurance solutions' (p. 7) that are appropriate to the digital product or service that impacts a child, that respect the full range of their rights, and that comply with agreed standards and regulatory oversight. Crucially, the report articulates not only the risks of getting things wrong, but also what good practice could and should look like:

> At its best, age assurance offers the children the prospect of being invited into a digital world that offers them greater privacy, freedom from commercial pressures, content and information in formats and language that they like, protection from misinformation or material that promotes harmful activities (such as suicide, self-harm or disordered eating), as well as supporting digital services in their legal duty not to provide children with age-restricted contact and content. Rather than being the route to keeping children out of the digital world, age assurance can drive the development of new products and services to create a richer and more diverse digital ecosystem in which children (one in three internet users) are a recognised user group. (5Rights Foundation, 2021a, p. 9)

The judgement of whether society's effort to protect children from harm related to the digital environment is successful and whether the outcomes respect the full range of children's rights is inevitably complex, reflecting regulatory, business and domestic practices and their interdependencies. In this report, we focus on the families' domestic practices relating to age assurance and parental control tools in particular, and parental mediation strategies more broadly (Livingstone et al., 2017). We pay attention to how these measures depend on the structural and cultural factors shaping everyday contexts. Our purpose is to

understand the outcomes of families' engagement with child protection measures and to formulate evidence-based, child rights-respecting recommendations for the future development of age assurance and parental control measures.

Contribution to the euCONSENT project

This work is part of an EU-funded project euCONSENT that aims to put into live operation a pan-European open system for age verification and parental consent that is secure, certified and interoperable, and proposes measures that respect, protect and remedy children's rights in the digital age (UN, 2021). This is part of the Working Group on Existing Methods, User Needs and Requirements, and is responsible for:

- Conducting research on the existing laws and regulations relevant to age verification in the EU member states and the UK (see Caglar & Nair, 2021).
- Reviewing methods in the EU for obtaining parental consent and maintaining children's rights (see van der Hof & Ouburg, 2021).
- Studying methods in the EU for compliance with the Audiovisual Media Services Directive (AVMSD) and General Data Protection Regulation (GDPR) (see Billinge et al., 2021).
- Undertaking a rapid review of the existing evidence on age assurance and parental control tools from the perspective of children and families (this report).
- Conducting a qualitative study on the views of children in the EU on online protection systems (forthcoming).

The results of this Work Package will inform recommendations for the principles (collated in D2.4: *Understanding of user needs and problems*) that the euCONSENT technical partners should follow as they design the solution, which will be the foundation for D2.5: *System features and user requirements*. This will ensure that the measures proposed by euCONSENT respond to the needs and expectations of all involved users and related stakeholders, also taking into consideration established methods and practices, as well as legal and ethical factors.

As explained later in this report, when drawing out the implications of the rapid evidence review findings, according to the United Nations Convention on the Rights of the Child (UNCRC), a child rights approach necessitates a holistic vision, as children's rights under the Convention are interdependent, indivisible and cannot be ranked (UN, 1989). It is imperative, therefore, that the measures developed to protect children from harm in relation to digital technologies should be effective and proportionate, respecting the full range of children's rights (UN, 2021). This should be achieved in a way that is informed by children's views, as required by Article 12 of the UNCRC (the right to be heard), and grounded in robust evidence rather than moral panic (Livingstone et al., 2018).

In what follows, we present the findings from the analysis of 61 studies identified by the rapid evidence review. The report focuses on what the evidence tells us about the attitudes to age assurance and parental control tools and the experiences with specific tools as situated

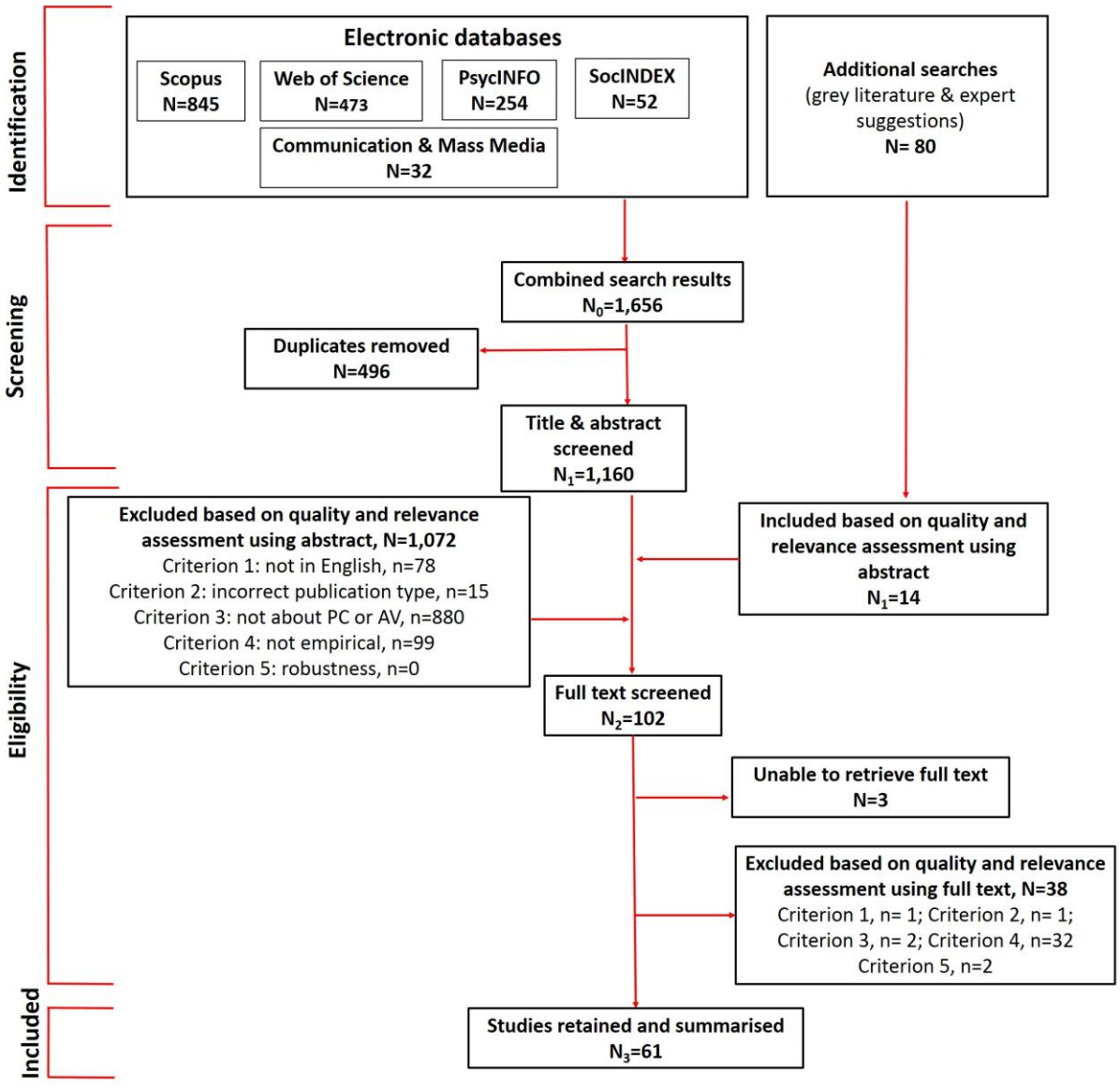
within everyday life, pinpointing specific areas in which additional research is needed and drawing out insights for designers, policymakers and researchers. The report focuses first on the evidence on age assurance and then on parental control tools (which might embed age assurance).

5. Methodology

We conducted a rapid evidence review and assessment following the Preferred Reporting Items for Systematic Review and Meta-Analysis Protocol (PRISMA-P) guidelines (Moher et al., 2015). This aimed to answer the question:

> *What is known about children's and families' everyday experiences with age assurance and parental control tools?*

Figure 1: PRISMA flow diagram for selecting studies to be reviewed



We searched five multidisciplinary and subject-specific databases, covering a range of subject areas for evidence published in English since 2010. The search included a combination of four groups of words: words related to age assurance, to children, to the digital environment, and to consent. For more details on the methodology, including databases, search protocol, inclusion criteria, screening and analysis, see Appendix 1 and also Smirnova et al. (2021).

The search identified 1,656 results from database searches, and 1,160 results were left after de-duplication. These studies were screened first based on abstract and then on full text applying several criteria including type of research, the nature of the research question and the quality of evidence (see Figure 1). For example, we excluded items that did not deal with the subject matter of age verification or parental control tools in the context of digital lives; we only included empirical research studies, secondary analysis and evidence reviews based on empirical research that was directly relevant to the experiences of children and families; and we excluded studies that lacked methodological rigour. It is important to note that studies of age-restricted goods that dealt with physical products but had a digital access element were considered within the scope of the review.

In addition to the database searches, we contacted 80+ subject experts to gather additional sources and conducted supplementary online searches to identify the grey literature (mainly research reports that the systematic search might miss). The studies identified were screened using the same procedures as for the database searches.

A total of 61 studies met the inclusion criteria and were retained for coding and analysis. This involved recording bibliometric and descriptive data for each study, as well as more analytical information such as a summary of conclusions, what type of age assurance or parental control tools was studied, the significance of the findings for the rapid evidence review, the rigour of design and execution, and the child's rights examined.

6. What evidence is available?

From the 61 studies analysed, 70% (N=43) focused on parental control measures, 27% (N=16) examined issues related to age assurance, and two studies addressed both.[1] This difference might be partly influenced by the search and screening process, focusing on empirical findings in the context of family everyday life while screening out publications on the technical or legal aspects of age assurance online. Still, the amount of existing evidence on the experiences of children and their parents is underwhelming.

Over half of the studies (33) made a reference to age-restricting activities to some kind of services, and less than a third (17) discussed access to various types of online content, such as pornography or violence (for a more detailed analysis, see Appendix 2). Most of the age assurance studies cover multiple mechanisms, such as self-declaration (tick boxes, age boxes, self-confirmation), hard ID checks (in-store or on check-out or delivery),

[1] The studies do not always explicitly state the mechanism used or are not correct in how they label it, hence we use the broader term 'age assurance' to cover different tools and mechanisms.

third party identification and remote age identification systems. Four studies discuss only one mechanism (age ratings and age gating). All but one parental control study failed to discuss in a meaningful way the specific mechanism used. In relation to children's rights, the most frequently mentioned aspects are children's 'autonomy' (by which we summarise rights relating to children's status as an independent rights-holder, namely 'best interests', 'evolving capacity', the right to be heard and the responsibility of parents), health and wellbeing, and privacy (see Table 1 and also Appendix 4).

Table 1: Studies that cover aspects of children's rights

Child right (UN Convention on the Rights of the Child)	Studies focusing on this right
Autonomy (Articles 3, 5, 12, 18)	22
Health and wellbeing (Articles 6, 24)	21
Privacy (Article 16)	19
Access to information (Article 17)	10
Violence against children (Article 19, 34)	7
Education, play, rest (Articles 28, 31)	4
Family life (Article 18)	4
Freedom of association (Article 15)	4
Freedom of expression (Article 13)	5

Most of the evidence (almost four-fifths) has been published since 2015, likely reflecting a growing interest in the topic, as well as the changing regulatory landscape. The majority of the evidence comes from North America (USA and Canada – 52%) or Europe (22%), with individual studies representing countries in the rest of the world.[2] The large majority of the evidence was from computer science, health and related disciplines, and media and communication studies. Most studies (49 out of 61) included children, and over half included parents. Most child studies involved teenagers (aged 12–17), and a small number looked at younger children (under 12, N=10). However, arbitrary age cut-off points (at 13, 14 or 15) and lack of comparisons between the age groups make any meaningful discussion of the child's developing capacity impossible.

Children's vulnerabilities and experiences of disadvantage is an area where the evidence base is notably lacking, despite efforts made to search for and include studies covering any dimensions of vulnerability (e.g., household compositions, disability, refugee background, socioeconomic status). The review identified two studies reporting on multiple dimensions of vulnerability. (See Appendix 2 for a detailed overview of the state of the evidence.)

[2] Again, this might be influenced by the methodology (English language search).

7. Age assurance findings

Eighteen studies on age assurance examined purchasing behaviours, access to restricted content and media ratings. The largest group (11 studies) and the most conceptually important category involves the experimental purchasing of age-restricted goods by under-age shoppers. Six studies analysed under-age shoppers' attempts to purchase various tobacco products (e.g., cigarettes, cigars, e-liquid) and alcohol in an online setting, and two studies tested a digital assurance system in a bricks-and-mortar store. The remaining three studies on age assurance include two surveys of young people's behaviours and an examination of the features of a tobacco selling website.

○ Age assurance is rarely implemented when purchasing goods or on delivery

The available evidence suggests that age assurance procedures are rarely implemented at the point of either order or delivery despite the legal requirements for selling age-restricted goods to minors. To illustrate, in one of the studies, out of 68 attempts to purchase tobacco products by mystery shoppers who were minors, none failed because of age assurance (Williams et al., 2017).[3] In another study, out of 120 attempts at purchasing e-liquid, only four failed due to age assurance (Nikitin et al., 2016). A similar experiment with e-cigarettes revealed that out of 80 successful purchases in the experiment, only 5 were rejected due to age assurance (Williams et al., 2020). When it came to similar mystery shopping activities for alcoholic products, the purchasing success rate was lower (out of 100 attempts, 28 were rejected due to age assurance; see Williams & Ribisl, 2012). Still, the problem of ineffective age assurance measures remains, and applies across access to restricted goods.

○ Age assurance is ineffective due to non-compliant or weak measures

The reasons for ineffective age assurance across different contexts revealed a range of cases of non-compliance with the legal requirements for selling and shipping prohibited goods. In the studies, between 5% and 40% of vendors failed to implement any kind of age assurance procedures on order or delivery. In contrast, others had only nominal compliance by using ineffective age assurance strategies, such as providing only a date of birth or using self-declaration check boxes, but not following up with hard ID checks. For example, one of the studies demonstrated that out of 43 orders placed, 22 used date of birth declaration, 19 applied self-declaration of being over the age of 18, one did not introduce any checks and only one, an auction website, required age to be verified (Peeters & Gilmore, 2012). Human non-compliance with checking IDs on delivery or in-store was also a contributing factor (van Hoof, 2016; Williams & Ribisl, 2012). Finally, one study found that being a part of a trade

[3] It should be noted that most of the evidence on tobacco and alcohol purchasing was generated in the USA, creating not only variation arising from different legislative regimes, but also within nation states. Further complication is created by a dynamic nature of legislation arising as a reaction to novel nicotine products.

association was not associated with having age-gating mechanisms (Nikitin et al., 2016).

Two studies (van Hoof, 2016; van Hoof et al., 2010) compared various types of age assurance in-store. The assessed measures include a remote age assurance system where a check is triggered and done via a video feed, an integrated ID reader and a clerk check. The findings showed a remote age assurance system (via receiving authorisation from trained personnel at a remote call centre) to be more effective compared to using integrated store equipment (where decisions are made by the sales assistant). Compliance with age assurance requirements with the remote system was 96% vs. only 12% of traditional in-store purchases. This compliance was accompanied by both statistically significant difference in ID requests and refusal to sell restricted items. When the remote system was used, the refusal rate was 98%, which is more than twice as much as the traditional scenario. This is most likely because the latter required a human-triggered check that also allowed a manual overriding of the system. Similarly, the evidence suggests non-compliance with hard ID checks at the point of delivery of restricted goods, which are simply left at the door (Williams et al., 2017). In the cases where age check was implemented at delivery (16 out of 100 orders), the orders were cancelled, illustrating the effectiveness of the methods when implemented correctly (Williams & Ribisl, 2012, p. 810).

○ Accessing restricted goods became easier during COVID-19 lockdowns

A survey of young people's use of e-cigarettes during the COVID-19 pandemic found that it had become easier to access such goods during lockdown when online purchasing increased (Gaiha et al., 2020). The study found that one in four participants were not asked to verify their age while buying e-cigarettes online, and the deliveries were made directly to them or their friends. These findings 'underscore the need to effectively verify age online and in-person' (Gaiha et al., 2020, p. 11).

Given the high rates of success in purchasing and delivering prohibited goods, the overreaching conclusion is that minors do not face significant barriers to accessing such restricted products online (Nikitin et al., 2016), and age assurance mechanisms currently implemented do not work. The evidence also shows that young people can use workaround strategies to challenge the system, for example using parents' IDs (Williams et al., 2017) or gift cards (van Hoof, 2016) to purchase age-restricted goods, but perhaps not having to work around an effective system is the most significant finding in that respect.

○ Some measures can pose risks to safety or privacy

The analysed studies make some recommendations as to how to make age assurance approaches more effective and where some of the pitfalls might be. Third party age assurance was shown to be effective in cases where it was implemented, yet it was an expensive tool for businesses to employ (Nikitin et al., 2016; Williams et al., 2015). The security and privacy of third-party providers varied greatly, according to the data-sharing demands of the services using the third-party service. Some cost-effective, low-tech age assurance measures were also suggested, such as using challenger questions (the answer to which can be checked against public databases). The literature also warned about the dangers of using hard identifiers such as social security numbers for age assurance purposes

as they are likely to become targets of digital crime. For example, after a mystery shopper experiment, the researchers found themselves the victims of US$7,000 fraudulent charges (Williams et al., 2020).

○ Most barriers to accessing age-restricted content are ineffective

We found three studies that examined age assurance and access to age-inappropriate content. All of them focused on commercial communications related to advertising restricted goods and services: nicotine product discussions on Reddit, alcohol advertisements on YouTube, and social networking sites being accessed by children under the minimum required age (Barry et al. 2015; boyd et al., 2011; Brett et al., 2019). The studies operated under the assumption that media exposure (e.g., seeing advertisements for restricted goods) might encourage young people to use such restricted goods, thus, age gating might be beneficial in those instances. The study of Reddit posts about a nicotine product (Brett et al., 2019) analysed about 40 contributions that were attributed to young people. It showed that age gating was reported as the highest barrier to access, with 35% of posts mentioning it, followed by price. The authors interpreted this finding as evidence of the limited effectiveness of age restriction.

Barry et al. (2015, p. 89) examined 'whether alcohol companies were implementing effective strategies that would prevent persons under the minimum legal drinking age in the USA from accessing their content on YouTube'. The researchers created fake accounts posing as 14-, 17- and 19-year-old users and discovered that fake minors could subscribe to 100% of all channels (regardless of their age) and view 67% of the content. This shows that the alcohol brands in the study did not employ the guidelines written by trade organisations and the available age-gating measures. Thus age-restricted content was shown to users who registered as younger than the required minimum age.

○ Parents are looking for flexibility to decide when a service may be appropriate

The social media study by boyd et al. (2011) examined how many under-13s (the minimum age for opening an account) have accounts on Facebook and parental knowledge and attitudes towards age limitation on social media. The study findings (via a survey of parents) showed that 19% of 10-year-olds, 31% of 11-year-olds and 55% of 12-year-olds had Facebook accounts, challenging the effectiveness of the legislation. It also showed that some parents helped their children to circumvent the rules – two-thirds of parents of children under 13 helped them open an account and lie about their age. Another notable finding of the study is that while parents were aware of minimum age requirements, they also believed that there should be flexibility around the minimum age of access, depending on the circumstances (e.g., for education purposes, socialisation and use under supervision). The parents thought that they and not the companies or the government should have the final say on their child's access to social media.

○ Content ratings are seen as advisory by parents

The evidence gathered also captured two studies (based in the USA and the Netherlands) related to soft age assurance measures – age ratings for media. They examined compliance (Gosselt et al., 2012) and parental use and satisfaction (Gentile et al., 2011), showing similar findings to the mystery shopping experiments and the studies on access to unsuitable content. The Netherlands study found that in 86% of the cases, minors successfully secured access to age-restricted content via purchasing cinema tickets (in a physical location and over the phone). In 89% of cases they were not asked about their age. Being asked about their age or to provide an ID had a preventative effect on their access to age-restricted content.

The two studies showed that parents preferred a universal ranking system rather than a product-specific one that introduces complications in its use. They were also interested in knowing the ranking appropriateness, and believed that parents should be the deciding authority on their children's access to content.[4] Parents in the USA mostly agreed on the type of content that needed age rating, but there were disagreements on the specific ages for which content descriptors were appropriate (Gentile et al., 2011). This echoes the findings by boyd et al. (2011), who showed that parents were aware of media rankings, guidelines and legislation, but believed they had the final say about their children's digital access, including making exceptions based on their child's maturity and circumstances. The second study, by Gosselt and colleagues (2012), tested vendors' compliance with the legislation and examined their guidance to parents on DVD renting. The mystery shopping experiment involving parents asking for advice about age-restricted DVDs showed that only a third followed the legal requirements. Another third replied that it was okay for children to watch the age-restricted content, and a third either deferred the decision to parents or did not provide any advice. The authors concluded that vendors spoke about the legal requirements for viewing age-restricted content in terms of recommendations and useful information, rather than mandatory regulation, and find the current surveillance practices strong enough to enforce compliance (Gosselt et al., 2012).

○ Conclusion

The evidence on age assurance was rather limited, leaving important knowledge gaps. The reviewed studies on age assurance show that the existing technical measures, best practice guidelines and enforceable regulation are not successful in limiting children's access to age-restricted goods, services and content. The reasons behind this relate mainly to the lack of enforcement of existing regulations and the use of inefficient technical measures. In some cases, however, the ineffectiveness relates to children's desire and ability to bypass the existing age gating and parental reluctance to follow provisions that are not flexible enough to meet their children's needs. The studies reveal conflicting dynamics and the complexity of decision-making for families in everyday life. While agreeing with the importance of ratings and access regulation, parents believed that they should have the final

[4] At present, films, games and TV programming are rated differently in the USA, and parental knowledge of these vary (Gentile et al., 2011, p. 40). In the Netherlands, two content rating systems exist simultaneously, with both carrying age cut-off points and content warning labels (for a discussion, see Gosselt et al., 2012).

say as to what is age-appropriate for their children, and, in the light of that, sometimes helped them to break the rules. Given the realities of everyday life, current age assurance measures are rarely effective.

8. Parental control tools

From the 61 studies analysed, 43 focused on parental control measures, which embed age-gating mechanisms. The evidence demonstrates that parents use controls to limit the time children spend online, filter content or restrict access to it, limit the people who can get in touch with their child, switch off device functions and limit access to specific applications and/or websites.

The studies used various methodologies, including textual analysis, surveys, qualitative studies (interviews, diaries and observations) and participatory research designs (see Appendix 2 for further details). Surveys were the largest group, representing 22 studies. However, their direct contribution to illuminating the issue of parental control tools in everyday life is limited by their self-reporting nature and the generally broader focus of the research. Collectively, the evidence from the textual analysis studies (Alelyani et al., 2019; Cino et al., 2020; Ghosh & Wisniewski, 2016; Ghosh et al., 2018a; Hartikeinen et al., 2016) provides a bird's-eye overview of parents' and young people's experiences of various parental control measures – how such measures are viewed, used and evaluated by both parties, what their main likes and dislikes are, and what some of the general attitudes are in regards to using such measures. On the other hand, qualitative research offers valuable insights concerning various aspects of user vulnerability, discussed in 5 of the 8 studies.

Overall, the findings in this section suggest that the use of parental control tools is not a stand-alone practice but is embedded in parental mediation of digital access and broader processes of parenting. To function effectively, such technical measures have to address the needs of both children and parents – the evidence suggests that parental control measures that were developed based on identifying family values were perceived more positively by their users (Ghosh et al., 2020; Ko et al., 2015; Nouwen et al., 2017). Approaches that rely on privacy-invasive techniques, authoritarian rule setting and inflexible measures tend to be ineffective and are not viewed positively by the user groups. Granting almost exclusive power to parents and prioritising restriction over communication can result in missed opportunities for children to learn about online risks, develop coping skills and negotiate their specific needs with parents. In addition, measures that children see as too restrictive or invasive can lead to erosion of trust within the family. Hence, including children's views in developing and applying parental control tools is a good way to ensure that the measures are effective. Yet the findings show that the development of parental control measures rarely involves children's perspectives (Nouwen et al., 2015). Below we focus on the key findings.

○ Children value having control over their internet use

Children do recognise why their parents might want to monitor their digital lives – and even reported that they find helpful measures that enable them to recognise and control problematic behaviours, such as excessive use or unwanted interactions. Children

recognise the positive aspects of available measures and occasionally install apps themselves to assist with self-discipline and boundary negotiation with parents (Alelyani et al., 2019; Ghosh et al., 2018b). However, this aspect of control measures is not presently prioritised in product design. To illustrate, the analysis of 75 applications aimed at adolescent safety online (Ghosh & Wisniewski, 2016) showed that 89% of the applications enabled parental control strategies over supporting children's self-regulation strategies, such as education, impulse control, coping with risk and self-monitoring. This finding comes up repeatedly in participatory studies (Ko et al., 2015; McNally et al., 2018; Nouwen et al., 2017), where one of the artefacts created by the children was entitled 'Table of inequality' to reflect their current experiences with the parental control measures.

○ Parental control measures can respond to the anxieties of digital parenting

Technical mediation via parental control measures is an emotionally charged topic for both parents and children, often involving mixed experiences, yet having the potential to respond to parental anxieties about the dangers the online environment presents to their children. The research evidence demonstrated that for parents, various parental control mechanisms reduce anxiety and worry over children's digital lives and content they encounter and enable them to offer some protection (Alelyani et al., 2019). Still, such measures may create a false sense of security while broader risks like data processing and commercial surveillance remain.

○ Parental control tools work best when they facilitate enabling mediation

Current parental control technologies predominantly facilitate restrictive mediation styles reliant on prohibiting access. The evidence shows that the use of technical controls without other involvement in children's digital lives is likely to harm parent–child relations, resulting in more conflict over media use, less sharing about online experiences and poorer communication (Gallego et al., 2020; Law et al., 2010; Noll et al., 2013; Soldatova et al., 2020, also reflected in Alelyani et al., 2019; Cino et al., 2020; Erickson et al., 2016; Ghosh et al., 2018; Ko et al., 2015). On the other hand, parental solicitation, open communication, rule setting, negotiation and child involvement in decision-making were mentioned in studies as positive practices.

Further, Álvarez-García and colleagues (2019) concluded that 'in order for parental control to be an effective protective factor, it must happen in an environment of parental affection, and communication' (p. 5), due to factors such as better self-disclosure. At a minimum, parental communication should be used in parallel with technical measures, which cannot substitute the parental capacity to be involved in children's lives (Gallego et al., 2020).

Children stress that, while they might need mediation when developing the necessary digital risks and competence, their protection cannot come at any cost. Ability to negotiate, granularity of controls and having learning opportunities was important to them and often to their parents in applying technical mediation tools (Hundlani et al., 2017; Ko et al., 2015; McNally et al., 2018; Nouwen et al., 2017). The findings of the effectiveness of

active parental involvement and monitoring were further highlighted by a study on access to violence and prosocial content in which the authors concluded that 'autonomy-supportive active monitoring was the only parental monitoring strategy that promoted prosocial behavior' (Holmgren et al., 2019, p. 671). At the same time, a survey by Pew Research found that almost all parents (98%) reported discussing with their children what is appropriate online, with about half of the respondents doing so frequently (Anderson, 2016). With this in mind, the design suggestions from the literature argue for enabling measures to be embedded (Ghosh et al., 2018a), which can help children build competence, resilience and autonomy (Holmgren et al., 2019).

○ Fostering communication and trust between parents and children

The importance of open communication, mutual learning from digital experiences, negotiation of access and use and the involvement of children in mediation decisions came up especially strongly in the studies representing children's point of view. Similarly, Law and colleagues stressed that their analysis emphasises 'the importance of establishing good communication between parents and adolescents rather than investing money on monitoring software and on controlling adolescent internet use' (2010, p. 1651).

In analysing what is liked and disliked most about parental control measures (Ghosh et al., 2018a), 'bad parenting/lack of communication' came out as the third most disliked dimension of parental control apps preceded only by the overly restrictive and invasive nature of the available measures. A quote from one of the studies poignantly summarises this issue:

> Seriously, *if you love your kids at all, why don't you try communicating with them instead of buying spyware.* What's wrong with you all? And you say we're the generation *with communication problems*. (cited in Ghosh et al., 2018b, p. 5)

These conclusions were echoed in a study of teenagers' TV viewing practices. Russell and colleagues (2021) argued that rules about media consultation that do not promote dialogue are unlikely to be effective, resulting in high reactance (Russell et al., 2021). Parents also recognise the need to foster communication with children in several qualitative and participatory studies (Badillo-Urquiola et al., 2019; Erickson et al., 2016; Ghosh et al., 2020; Nouwen et al., 2017; Wisniewski et al., 2014, 2017a). The process of building mutual trust is crucial for the successful application of parenting control measures, as suggested by Hartikainen and colleagues (2016, p. 367):

> While some control is needed, instead of risking to lose their children's trust through restricting or monitoring, parents may want to build a trusting relationship with their children so that they can trust children to make good decisions and that the children trust them.

The studies point out the importance of communication in cases of technological mediation as a way of boundary negotiation, showing flexibility and building trust – principles that lie within authoritative rather than authoritarian mediation strategies.[5] They

[5] For the role of trust in the relationship between the child, digital parent and platform, see DCMS (2020, p. 3).

also suggest significant considerations in relation to designing parental control measures – the vitality of embedding communication channels and trust-building opportunities for parents and children and making supervision visible and override-able by the child (Hartikainen et al., 2016). This approach, which goes against currently predominating models of parental control measures, affords the means for ensuring that children's autonomy is at the heart of all measures aimed at them (Cino et al., 2020; Ghosh & Wisniewski, 2016) and for supporting parents to engage in enabling over-restrictive mediation (Ghosh et al., 2018b).

○ Supporting children's evolving capacities

Hartikainen and colleagues (2016) stress the importance of flexibility, divergent and evolving needs, and the role different actors within and beyond the family might play in mediating children's online experiences. Therefore, technical measures need to account for the child's evolving capacities in a way that enables children's learning and development.

Several studies discuss how approaches to parental control measures change with children's age and development. For example, younger children are more likely to use their parents' devices to access the internet than to have their own, are less likely to communicate with people outside their immediate family, and are more likely to have a limited range of activities, mainly watching videos. Two studies on children under 10 reported a strong negative emotional reaction to parental mediation, such as tantrums and crying (Pavan Kumar Attavar & Rani, 2018; Seo & Lee, 2017). As a response to this, some parents resorted to deception and attempted to conceal parental control measures – which is unlikely to work with older children. For example:

> We had enabled the password for YouTube, and she would throw a tantrum and demand we put the password. Finally, the internet people deleted YouTube. [P2, father of a five-year-old girl]. (cited in Pavan Kumar Attavar & Rani, 2018, p. 18)

A study on the digital experiences of young children in New Zealand (Starkey et al., 2019) emphasised that participating in the digital environment and having a voice is a critical developmental milestone, and learning how to do so safely while facing tighter controls may limit the opportunity for creativity: 'The interrelated influences of access, enablement and control are key aspects of the parenting role' (Starkey et al., 2019, p. 1940).

Relatedly, younger teens are subjected to more technical mediation and monitoring, while older teens experience less restriction (Anderson, 2016; Sonck et al., 2013; Wisniewski et al., 2014). Some studies explain such differences by children's growing desire for autonomy and parents' willingness to maintain a trusting relationship with older children. A survey on access to prosocial violence materials also found that children's age is a key factor in the effectiveness of parental control measures (Holmgren et al., 2019). Hence, measures that allow the granular management of parenting controls can enable development and scaffold children's learning. Such an approach is also recognised by parents, acknowledged in several studies, that digital participation is no longer optional or undesirable, despite their reported sense of worry about their children device use.

○ Family diversity matters to the use of age assurance

Children, parents, parental styles and design needs are not universal. While some

parents put more emphasis on trusting their child and supporting their autonomy to make their own decisions, others believe that it is their role to protect their children from online harms, regardless of the costs (Ghosh et al., 2018b; Hashish et al., 2014; Hundlani et al., 2017; McNally et al., 2018; Nouwen et al., 2015). In terms of practical design, this means that a singular measure, such as full restriction, would not serve all parents effectively.

To some extent family composition and parenting support in the household shapes the use of parental control measures. Findings from the Netherlands show that the number of children living in the household is an important predictor for using technical mediation and parental control measures (Sonck et al., 2013). More controls are used in larger family sizes. This has important design implications, as 12% of the European households contain three or more children (see Section 9).

Multiple studies stressed that parental supervision conflicts with children's desire for autonomy, echoing qualitative and textual studies that brought out sentiments of betrayals, mistrust and erosion of trust when used by parents. However, it is worth highlighting that some authors pointed out that the conclusion about damages to parent–child relationships cannot be universally applied: 'This suggests that high levels of parental control over an East Asian adolescent's online activities may be culturally appropriate, and might not undermine adolescent/parent relationships in the same way as it might for adolescents of European descent' (Shapka & Law, 2013, p. 733).

Taken together, these studies illustrate that the nature and need of technical mediation differs depending on family circumstances, parenting practices and cultural norms. Those findings reinforce the importance of flexibility and trust bundling as a core principle for development in terms of design recommendations. The studies in this group also highlighted diverse parenting approaches associated with various levels of controls. Thus, granularity is also an important design consideration.

○ Measures often demand technical skills

Existing measures often require technical proficiencies of parents and knowledge about the measures if they are to be applied competently and effectively. While some parents may lack the digital competence to take advantage of existing measures, others might use them as a 'quick fix' to make up for their lower digital skills (Badillo-Urquiola et al., 2019; Erickson et al., 2016). Competences were highlighted as determining factors of the use of technical mediation. For example, parents who felt less technologically capable or reported a lack of control were more likely to resort to controlling their children's behaviour online (overusing communicative strategies) (Erickson et al., 2016; Wisniewski et al., 2014). Similarly, parents who were less experienced with technology practised bans and restriction over other control methods (Badillo-Urquiola et al., 2019).

Several studies show that child protection measures are associated with parental education and training (Al-Naim & Hasan, 2018; Badillo-Urquiola et al., 2019). For example, a survey of over 1,800 parents and guardians from Spain revealed that more than half of them did not know how to install a content filter (Pons-Salvador et al., 2018). Similarly, a child–parent dyad study by Sonck and colleagues (2013) found that restrictive techniques are applied more often in less educated families and when children use the internet less. Supporting parents to install parental control software is also an ineffective measure,

according to a study of 7,700 parents in Chile, as it is inefficient on its own to change behaviour (Gallego et al., 2020).

○ Age assurance may not respect children's rights to privacy and autonomy

For children, the use of parental control measures surfaced a consistent violation of children's rights to privacy and autonomy. Both children and parents (not universally) expressed privacy concerns about measures currently available to them. For example, most children did not find parents reading their private communication acceptable (McNally et al., 2018). This issue is particularly well illustrated by children's comments on their parents' use of parental control measures:

> My mom put this on my phone. Awful invasion of privacy! Worst thing ever! Parents should be ashamed of themselves for downloading this app because you are invading their private lives. *I will be putting this on my mom's phone and seeing what happens!* This is evil! (cited in Ghosh et al., 2018b, p. 5)
>
> This *totally takes ALL my privacy away*. I can't even talk to my biological dad, or my boyfriend, or best friend *without being stalked by my mom*. (cited in Ghosh et al., 2018b, p. 4)
>
> I *used to feel happy with what little privacy* and internet time I had but you made the little into none… Now I feel that *I have no privacy. Thanks for ruining my life*! (cited in Cino et al., 2020, p. 215)
>
> I'm 15. my dad got this app just to limit time on my phone. I have no problem with that and I agree that I use my phone too often. but how you can restrict apps is the worst. *i could have a really nice conversation with a new person I met at school. not anymore. i have a social problem and texting helps me talk to people*. well now I'm screwed. *my friends don't want to text me anymore because they know my dad can see my messages*.[6] (cited in Alelyani et al., 2019, p. 15)

These show that children are well aware of the power imbalances created by parental control measures, and point to a finding that came out strongly in the evidence – children's voices, opinions and needs are not heard or well embedded in the design of parental control measures. Similarly, the computational analysis of over 29,000 online comments by parents and children shows that children used emotionally charged phrases in about a quarter of their reviews, revealing their 'frustration regarding privacy violations by their parents and limits on their freedom' (Alelyani et al., 2019, p. 12). While some parents also pointed out the importance of respecting their children's privacy, others justified their full access to their children's digital world and authoritarian controls over access.

The evidence that focused on reviewing specific measures (Alelyani et al., 2019; Cino et al., 2020; Ghosh & Wisniewski, 2016; Ghosh et al., 2018a) consistently demonstrates the concern about the one-sided consideration of needs. The rights to autonomy and privacy and the desire for trust, communication and better communication within the family were

[6] To preserve the authentic voices of the children, we kept the original spelling and grammar of quotes cited from the studies.

especially powerfully captured by the evidence. The quotes cited above address privacy and the chilling effect of the lack of it on relationships with others.

While some level of supervision from parents might be acceptable to young people, such measures might create disadvantages for children in and beyond the digital world. Such a conclusion calls for any new measures to be privacy and autonomy preserving and to grant children agency. This can only be achieved if children's rights, wishes and voices are considered at the outset. The privacy-preserving approaches discussed by the studies include the use of automation, rule setting and abstract representation of data rather than allowing access to private communication. For example, data aggregation, word clouds and dashboards, automated content flagging and approval of contacts were preferred by children (Fuertes et al., 2015; Ghosh et al., 2020; Hundlani et al., 2017; Ko et al., 2015; McNally et al., 2017). These mechanisms may help address the issue of parent 'stalking', undermining of trust and the lack of privacy discussed by the children.

○ Restricting children's internet use reduces digital skills and opportunities

The evidence shows that restrictive mediation comes at a cost for children as it undermines their capacity to learn to cope with online risks and build resilience, to understand about the complexity of the online environment, and to take advantage of online opportunities (Álvarez-García et al., 2019; Martínez et al., 2020; Soldatova at al., 2020; Wisniewski et al., 2015). Restricting internet use can adversely impact children and young people's search for autonomy, adjustment and learning how to behave differently in the future, taking away opportunities to learn about the consequences of personal decisions (Álvarez-García et al., 2019; Ghosh et al., 2018b; Miltuze et al., 2020). Restriction can also have a negative effect on moral cognition, personal skill development and growth, while at the same time it is less likely to be effective in protecting from online harm (Erickson et al., 2016; Wisniewski et al., 2014).

○ Restricting access may not reduce the online risk of harm

Parental control measures are often implemented with the intent of protecting children from harmful experiences. A recent UK study on user experiences of video-sharing platforms (Ofcom & Yonder, 2021) found that parental control measures were seen as the second most popular safety measure against online harms (reported by 54% of those surveyed), preceded only by reporting mechanisms. However, the evidence on the relationship between parental control tools and the risk of harm is complex, as we discuss below.

Some evidence suggests that parental control tools are somewhat effective in reducing online risk by limiting young people's access to the internet (Álvarez-García et al., 2019; Soldatova et al., 2020). For example, Tomczyk et al. (2018) found that in the Polish context, parent controls reduced illegal downloading and time spent on social media, while a study set in Malaysia concluded that technical mediation reduces online gaming (Benrazavi et al., 2015). Further, restriction might be effective in some contexts, such as high-risk teens in foster care who would otherwise use their phones to contact people who exploit them

(Badillo-Urquiola et al., 2019). While some of these activities are harmful, others, such as gaming and social media, are not necessarily harmful. Some parents may undervalue them insofar as they can afford opportunities for children to gain digital skills and socialise. Hence, any reduction of risks happens at the expense of online opportunities.

The studies almost univocally stress that parental control tools are not the silver bullet parents might hope for, and indeed might reinforce ineffective strategies or have chilling effects on child–parent relations. Technical mediation, for example, can limit children's privacy skills (Soldatova et al., 2020) and increase exposure to online risks (Ghosh et al., 2018a). Another study found that 'using software or checking computer histories is not effective in reducing online aggression' (Law et al., 2010, p. 1654), leading to worse outcomes for young people. As such, technical mediation can have a further adverse effect on teens, such as making prohibited behaviours or content more appealing, leading to poorer judgements and victimisation (Álvarez-García et al., 2019; Ghosh et al., 2018a; Miltuze et al., 2020). A study on the high-risk internet behaviour of girls who have been previously maltreated showed that the use of parental control software did not moderate the associations between adolescent risk factors and internet behaviours, whereas 'high-quality parenting and parental monitoring' had the desired effect (Noll et al., 2013, p. 510).

Based on the evidence, it is crucial that parental control measures are not sold as a silver bullet solution to parents claiming to resolve 'the problem' of children's exposure to online risk. Limiting the time spent on a service does not eliminate the risks inherent to that service; this requires systemic change in the design of services. In addition, exposure to some risks can help children build resilience and learn about online safety – features that enable this should be part of technology design.

○ Controls may exacerbate prior vulnerabilities or compound disadvantage

There is evidence that parental control tools sometimes risk exacerbating existing vulnerabilities. Restrictions are more often applied in households where the child 'feels a lack of family support' (Martínez et al., 2020, p. 72), thus potentially exacerbating issues for children who already lack a supportive environment. Further, a study of maltreated girls concluded that parental control, unlike high-quality parenting, did not moderate risk and harm (Noll et al., 2013, p. 514). Qualitative studies show that parents who feel that they lack control over teens' digital lives and have lower technical skills are more likely to resort to overbearing restriction, suggesting that parental control tools are a multiplier for vulnerabilities among those already disadvantaged (Badillo-Urquiola et al., 2019; Erickson et al., 2016).

A study examining foster care settings showed the dilemmas and complexities that parents face in deciding how to employ technical mediation in high-risk situations, such as teenagers who face online and offline exploitation and abuse (Badillo-Urquiola et al., 2019). The complications presented by past traumas, prohibited contacts and use of technology to run away create complexities other families are unlikely to face. Badillo-Urquiola et al. show that 'overall, foster parents were at a loss for how to balance online safety with technology access in a way that engendered positive relationships with their foster teenagers. Instead, parents often resorted to outright restriction' (2019, p. 1), leading them to advocate for

educational programmes about effective digital parenting that will enable parents to make more informed choices.

○ Children find unjustified restrictions frustrating

Children express negative views about poor app functionalities as well as overall frustration, dislike and even anger in relation to uses of parental control tools and mediation practices, especially when they are primarily restrictive or exercised with little warmth or open communication. Studies univocally agree that parental mediation can lead to conflict in the household, and necessitates negotiation (Badillo-Urquiola et al., 2019; Erickson et al., 2016; Seo & Lee, 2017; Wisniewski et al., 2014). Parents most often complain when the measures are malfunctioning, there are flaws in the design functionality and the costs are high.

In terms of design recommendation, beyond making sure that any future measures perform the functions they are intended to, don't interfere with the functioning of devices and are maintained through the lifecycle (as reflected in the studies that captured discontinued applications), designers should consider the level of flexibility to account for different-aged children, the granularity of control, privacy preserving as the default, as well as transparency of processes of supervision.

○ Some parental control tools show promise

A description and testing of nine independent proposed measures for parental control was captured by our analysis (Fuertes et al., 2015; Ghosh et al., 2020; Hashish et al., 2014; Hundlani et al., 2017; Ko et al., 2015; McNally et al., 2018; Nouwen et al., 2015, 2017; Wardhana et al., 2015). It is crucial to point out that all nine discussed measures included children in data gathering to some degree.[7] Two of the discussed measures addressed or involved the needs of industry as well as parents (Hundlani et al., 2017; Nouwen et al., 2015). One of the measures was inspired by the information security approach and trying to remove the burden of authentication from children (Hundlani et al., 2017). Another measure focused on self-regulation of internet use (Ko et al., 2015). The remaining studies focused broadly on examining values that should guide the development of future parental control tools.

○ Enabling the negotiation and re-drawing of boundaries

The studies flagged the processes of negotiation and boundary re-drawing to address the changing needs of families. For example, in Nouwen and colleagues' (2017) participatory research, parents conceptualised a parental control measure as a 'peacemobile' that would turn off devices when the rules were not followed. But they also embedded rule renegotiation as a monthly process that culminated in mutual confirmation of agreement from both parents and children. The measure that focused on the family as a unit for limiting media use resulted in less time spent online and less app use from both parents and children (Ko et al., 2015). Further, an app that focused on limiting media use and included functionality that created transparency and visibility of media habits across the entire family

[7] One of the studies did so nominally as children were present, but the focus was on parental experiences (Nouwen et al., 2015).

rather than singling out children, resulted in parents and children reporting more collaboration and communication about media use, including problematic use by parents (Ko et al., 2015).

○ Supporting children's agency and autonomy

The desire for more child agency and better communication came up in the studies that proposed embedding communication mechanisms in their measures: for example, children asked for 'Ask child' or 'Consult kid' buttons to be added to help parents to communicate with them before taking further action (McNally et al., 2017) or an in-built communication feature (in this case, voice-enabled, as the authors worked with 5- to 6-year-olds) that would help children to communicate back and forth with their parents (Wardhana et al., 2015).

○ Addressing the needs of children and families

Further studies focused on testing a prototype that involved an educational measure to address mutual learning needs (Hashish et al., 2014; Ko et al., 2015; McNally et al., 2018). In the studies, parents and children reported that some of the features made it easier to initiate discussions about what is appropriate online. For example, a descriptive app feature helped parents understand what applications their children use and initiate conversations between them. A child reported, 'my parent and I had a discussion about each other's app usage. We had a conversation about which apps were useful or harmful' (quoted in Ko et al., 2015, p. 9). Learning needs ranged from knowing what to do after being exposed to an incident, such as bullying online or inappropriate content, to being able to discuss digital content and behaviours with parents (Hashish et al., 2014; McNally et al., 2018). Often parents might not understand the risks themselves, so better transparency from the service about risky features, such as data processing practices, could benefit not only children but also their families.

In conclusion, the studies on parental control tools showed both the promise of these measures and the challenges that need to be addressed to ensure effectiveness and adherence to child rights. There is an overall emphasis on enabling an over-restrictive environment that holistically engages with parenting and family dynamics and enables children to develop and learn. Flexibility and granularity are some of the factors that seem to show promise. Equally important, however, is recognising the limitations of such measures and the need to use them as only one tool among a wide repertoire of practices that enable children's positive engagement with digital technologies.

9. Implications and challenges for child online protection measures

The evidence review demonstrated significant gaps in the existing knowledge on the everyday experiences of children and families with age assurance and parental control tools. Importantly, few studies addressed age assurance, and most of the research we found focused on parental control tools. There is limited understanding of the effectiveness of different measures within domestic settings, mostly due to the studies exploring a mixture

of tools without distinguishing among them or not clearly specifying the particular technique being studied. Worryingly, there is little evidence on the use of these measures among diverse family forms and vulnerable groups, limiting our ability to draw concussions about possible implications for inequality and exclusion. Finally, technical developments that take a child rights perspective seem to be the exception rather than the norm, leaving many questions unaddressed regarding the potential for a child rights approach to age assurance and parental control tools. We discuss these limitations below, focusing on child rights, diversity, design and policy.

○ Designing for children's rights

It is imperative that the measures developed to protect children should respect the full range of children's rights (UN, 2021).[8] In March 2021, the UN Committee on the Rights of the Child adopted its 25th General Comment on the UNCRC (UN, 1989), with the focus on realising children's rights in relation to the digital environment (UN, 2021; see Appendix 4 for its relevant requirements).[9] A child rights approach to the digital environment seeks to enable children to enjoy their civil rights and freedoms while also protecting them from harm, until they are 18 years old. However, not only is the importance of children's rights specifically in relation to the digital environment gaining policy attention, but so, too, are the challenges regarding interpretation, implementation, expertise and compliance (Mukherjee et al., 2021).[10]

Importantly for the euCONSENT project, the European Commission has committed to mainstream children's rights in all of its policies and actions, recognising that 'there is no such thing as a child-neutral policy. Whether intended or not, every policy positively or negatively affects the lives of children' (EU-UNICEF, 2014, p. 3). The EC's (2021) new 'Strategy on the rights of the child' addresses the digital environment as one of its six main pillars, explicitly noting General Comment no. 25.

Structured according to the UNCRC, General Comment no. 25 begins by setting out how the four general principles of children's rights apply to the digital environment:

(i) Non-discrimination: Children must be protected from discrimination and treated fairly whoever they are and not excluded on the grounds of any group

[8] As the primary duty bearer, the state is accountable for the provisions of the UNCRC. It must report periodically on how it has met these obligations to the Committee as the treaty body (see www.ohchr.org/EN/HRBodies/Pages/TreatyBodies.aspx). States are also obliged to ensure that all duty bearers within their jurisdiction meet their responsibilities to children's rights – including businesses (see UN, 2011) and others whose activities significantly impact on children.

[9] A General Comment is an authoritative document that sets out how the UNCRC should be interpreted and implemented by states – in this case, in relation to the digital environment. Like the Convention itself, a General Comment must apply in wealthier and poorer nations, to governments of all political stripes, and for all children whatever their abilities or circumstances (see www.ohchr.org/EN/HRBodies/Pages/TBGeneralComments.aspx).

[10] In addition to the European Commission's activities, calls for a child rights approach to the digital environment have recently come from the European Network of Ombudspersons for Children (ENOC, 2019), the European Network of Youth Advisers (ENYA, 2019) and the Council of Europe (2018), including concerning children with disabilities (Council of Europe, 2019).

characteristic, including in relation to digital access, privacy and data collection, the operation of algorithms and the exercise of rights in the digital environment.

(ii) Best interests of the child: When making any decision, adults – including governments and businesses – must prioritise what is best for children, including in relation to the provision, regulation, design, management and use of the digital environment.

(iii) Survival and development: Children must be supported to grow up into what they want to be, ensuring optimal development and without harmful interference; hence states should address the full range of content, contact, conduct and contract risks that might harm children in relation to the digital environment, in balance with their civil rights and freedoms.

(iv) Respect for children's views: Children have opinions that must be taken into account in all matters that affect them. Hence, states and digital service providers should seek out and take into account children's views when developing products and services.

Several further themes are of particular relevance here. One concerns the often-thorny relation between a child's age and the responsibilities of their parent(UNCRC, Article 5). Here, the General Comment (para. 19) highlights:

> … the evolving capacities of the child as an enabling principle that addresses the process of their gradual acquisition of competencies, understanding and agency … [recognising that this] has particular significance in the digital environment, where children can engage more independently from supervision by parents and caregivers.

Thus, child protection measures for the digital environment should treat children according to their age and stage of development. This builds on Article 18 of the UNCRC that sets out parental responsibilities, and the state's responsibility to support parents in this regard.

Of particular relevance to UNCRC Article 16 (the right to privacy) in a digital world is that General Comment no. 25 clarifies that this now includes the right to data protection, necessitating therefore that states ensure robust data protection measures. It also emphasises that parents must respect the child's right to privacy, albeit this is in tension with Article 18. The General Comment advocates coordinated support for parents from the government, civil society and in particular from digital providers in designing services in age-appropriate ways (Atabey, 2021) so that children's right to privacy, along with their other rights, is respected.[11] It also emphasises the rule of law, regulation and standards to drive a better experience for children, including that providers must evaluate their actions and the development of digital products and services in advance as well as after entering the market for possible costs to children's other rights (DFC, 2021). Insofar as their actions impact

[11] This includes consulting children and parents about digital policy and design, and explaining to them how services work and what remedies are available if needed. The process of preparing the General Comment involved a global consultation with children living in diverse contexts, with special efforts made to consult those living in disadvantaged or marginalised situations. The children consulted were clear in their message to policymakers that accessing the digital environment is no longer optional but instead, a necessity for their education, information, family life, social relationships, work, identity, play and more (5Rights Foundation, 2021b). Hence, solutions to child online protection that restrict their access to the internet and thereby restrict their access to their rights are unacceptable.

children's rights, their actions must be lawful, proportionate and necessary.

On parental consent, the *Explanatory Notes* clarify that 'obtaining parental or caregiver consent does not exempt private institutions from following children's rights-by-design standards.' Para. 77 notes that:

> Children have the right to retract, correct and delete their personal data in ways that are easy to access and understand and, that data processing does not exceed the uses that children (or parents on their behalf) may have consented to. In all cases, a child should be able to withdraw consent at any time, with a facility which is equal to that used when they first gave their consent; for example, they should not have to prove their age to remove an image if they were not asked to prove that same age and same level of assurance at the time it was created.

Further, the *Explanatory Notes* (5Rights Foundation, 2021c) add that while 'businesses who sell or make available age-restricted goods and services need to employ age assurance mechanisms that provide appropriate levels of safeguarding, privacy and data protection' (para. 114), the process of verifying a child's age or identity conducted for reasons of child protection should be quite distinct from the process of sharing information with third parties or the public (para. 77).

A further challenge arises in relation to the dimensions of difference, inequality, vulnerability and marginalisation that differentiate among children. The UN Committee on the Rights of the Child (UN, 2021, para. 11) specifies as follows, in requiring that children should not be subject to discrimination in any form in relation to the digital (or any other) environment:

> The Committee calls upon States parties to take proactive measures to prevent discrimination on the basis of sex, disability, socioeconomic background, ethnic or national origin, language or any other grounds, and discrimination against minority and indigenous children, asylum-seeking, refugee and migrant children, lesbian, gay, bisexual, transgender and intersex children, children who are victims and survivors of trafficking or sexual exploitation, children in alternative care, children deprived of liberty and children in other vulnerable situations. Specific measures will be required to close the gender-related digital divide for girls and to ensure that particular attention is given to access, digital literacy, privacy and online safety.

It is worth dwelling on these multiple dimensions of difference when it comes to designing measures to protect children online in ways that are fair, effective, practical and inclusive.

The UNCRC sets out the entirety of child rights, and General Comment no. 25 embraces an equally broad agenda related to the digital environment. Many forms of digital technology may impact child rights, and measures must not be limited to screen-based or user-facing technologies, nor only to technologies that the child directly uses as many others may impact on them and should therefore be rights-respecting; moreover, when developing child rights-respecting measures, future innovations must be anticipated where possible (paras 2–3). General Comment no. 25 elaborates a host of measures designed to ensure effective implementation, including due diligence, child rights impact assessments, independent monitoring, oversight and accountability, training of professionals, provision of information and support to the public, and child-friendly remedy and redress. These are too many to describe here, but, noting also the four general principles discussed above, further

crucial points relevant to age assurance and parental control tools are summarised below (see also Appendix 4), specifically relating these to the evidence reviewed in this report.

Table 2: Measures relevant to age assurance and parental control tools from General Comment no. 25 and research findings

General Comment no. 25, Measures relevant to age assurance and parental control tools	How addressed by the reviewed evidence
Child protection measures These should be available in all settings where children access the internet; they should be effective in protection and respect children's other rights.	Child protection measures were not addressed exhaustively in the review due to its focus. In relation to age assurance and parental control tools, protection was a main focus of the existing measures, but there seemed to be important gaps (e.g., cases where protection failed).
Independent monitoring Human rights institutions should receive, investigate and address complaints relating to children's rights in the digital environment.	There is a large pool of evidence that children express their concerns and objections to age assurance, parental control and consent measures, but we did not find evidence to show that the industry or regulators consider these comments.
Training for professionals Professionals working with or for children, and businesses including the technology industry, should be trained in children's rights and relevant standards.	Again, we found no evidence to suggest that professionals working with or for children, and businesses including the technology industry, are trained in children's rights and relevant standards.
Business responsibilities Businesses should respect, protect and remedy children's rights in relation to the digital environment, and states should ensure that they do so.	While businesses should respect, protect and remedy children's rights in relation to the digital environment, the majority of existing measures do not fulfil this obligation. Many solutions do not promote transparency on how the mechanisms operate. It is uncertain whether all children are made aware when age gating or parental control measures are used. There is also a need for minimum standards of privacy, security and efficacy for age assurance solutions.
Due diligence Businesses should undertake child rights due diligence, including child rights impact assessments, paying particular attention to vulnerable or disadvantaged children.	With some minor exceptions, businesses do not undertake child rights due diligence. There was no evidence on child rights impact assessments being undertaken. Paying particular attention to vulnerable or disadvantaged children is a particular weakness of these measures, which tend to be designed for 'the average child'.
Access to information Restrictions to children's right to access information must be lawful, proportionate and necessary to protect them from harm.	Both children and parents expressed concerns about adverse effects from the restrictions on children's right to access information. Parents sometimes felt that they should 'bend the rules' and allow children to access media rated as unsuitable for their child's age. This issue

	can be particularly tricky in relation to accessing sexual information and content, which can be part of children's sexual development.
Protection from harmful content Businesses and content providers must develop and implement guidelines to protect children without unduly limiting their access to content.	Protection from such content (and, relatedly, contact, conduct and contract risks) lies at the core of all age assurance initiatives. However, the evidence that such measures reduce the risk and harm to children is mixed. It is often assumed, rather than demonstrated, that such measures offer effective protection. In some cases, the evidence suggests that the measures are counter-productive and exacerbate vulnerability or risk. Rarely does the research relate the findings to the level of risk, although policy solutions regarding the level of age assurance take a risk-based approach.
Data minimisation Systems designed to protect children from age-inappropriate content must be consistent with the principle of data minimisation.	Systems designed to protect children from age-inappropriate content were often inconsistent with the principle of data minimisation.
Balancing rights Guidelines, standards, moderation, filters and other safety measures must prevent children's exposure to harmful material but not violate their expression or privacy.	Guidelines, standards, moderation, filters and other safety measures generally prioritised children's exposure to harmful material, often at the expense of their expression or privacy. Parenting styles made a difference – when parents prefer a restrictive approach of mediating their children's media use, the already restrictive measures are even more likely to be evaded by children.
Freedom of expression and association Any restrictions to these rights must be lawful, necessary and proportionate, and the rationale must be communicated to children clearly.	Children found that parental monitoring of their communication with friends affected their social relationships and ability to participate online. Knowing their parents will see the messages made their friends reluctant to share their thoughts, and children felt left out.
Right to privacy Any interference with this right must be lawful, legitimate, proportionate, consistent with the UNCRC, data minimising and in the child's best interests.	Most available measures did not preserve children's privacy and were quite invasive. This caused concern to children and some parents.
Privacy-by-design States should require integrating privacy-by-design into digital products and services that affect children.	The evidence suggests that privacy-by-design is overall not sufficiently integrated into digital age assurance products and services. An important concern relates to occasions where age assurance tools might require privacy data from children and how this can be achieved in a legally conforming way (e.g., ensuring parental consent when required).

Parental and child consent Where a child's or parent's consent is sought, it must be informed and freely given; consent from a parent must be verified.	Parental consent was prioritised while the measures were most often 'imposed' on children. When children were young, parents also concealed the measures to avoid tantrums. When consulted, children asked for functionalities such as 'Ask the child', which would enable them to consent when they agree.
Data protection rights Processing of children's data must adhere to the highest data protection standards and respect children's data protection, privacy and other rights.	We did not find any discussion of how the processing of children's data in the context of age assurance and parental consent adheres to the standards of data protection. This issue is either not researched or not discussed by research on children and families.
Children's access to help Safety or other technologies must not prevent a child from accessing a helpline or searching for sensitive information, and nor require parental consent.	We did not find any discussion on whether safety technologies might prevent a child from accessing a helpline or searching for sensitive information, and if parental consent might be required in such cases. Children's access to help within parental control apps was also not covered.
Children separated from parents Technology should be used to sustain family connections but not place children at risk, whether from family members or technology itself.	These technological functions usually operate on the assumption that children are not separated from their parents, and there is an adult who can be responsible for making decisions about access. There were no examples of scenarios where this was not the case, which might mean that these measures further marginalise the most vulnerable children.
Children with disabilities These children should not face additional barriers because of the use of technology, and existing barriers relating to the digital environment should be removed.	There was no evidence on how age assurance measures can ensure that these children do not face additional barriers because of the use of technology and utilise opportunities to remove existing barriers relating to the digital environment.
Health and welfare Children should have safe, secure and confidential access to trustworthy health information and services, including psychological counselling services.	Age assurance has a specific role in ensuring that children do not access content, activity or commercial pressures that are harmful to their health – notably, tobacco, alcohol or drugs and gambling. These products are generally age gated at 18 or are illegal. Yet the measures to protect children are often ineffective, thereby failing to protect their health and welfare.
Right to education The design and uses of educational technologies should be ethical and safe, and not expose children to risks or abuses of their privacy.	The design and uses of age assurance and parental control mechanisms seem to harm rather than support children's learning. The existing technical tools are often too restrictive to allow children to develop their safety skills gradually.
Right to play Provision of guidance, age ratings, labelling or certification should not	Both children and parents expressed scepticism that the existing guidance, age ratings, labelling or certification match children's needs and development. Provisions

curtail children's access to the digital environment as a whole or interfere with their rights.	were taken only as guidance, and parents sometimes felt that they needed to override mechanisms that curtailed their children's access to the digital environment.
Age-restricted goods and services Robust age assurance systems should be used to prevent children from accessing or using these; such systems must be safe and privacy respecting.	The evidence shows that the existing age assurance solutions are not robust and are generally ineffective in preventing children from accessing or using these.

A theme running through the global children's consultation for the General Comment (5Rights Foundation, 2021c) was the gap between child and adult perceptions of children's online activities. This results in misunderstanding, conflict and uncertainty. These, in turn, can lead adults (including policymakers, educators, providers and parents) to take interventionist or restrictive 'top-down' or seemingly high-handed approaches that children find frustrating (Third et al., 2019a).

Children fully recognised in the consultation that adults may know more about the risks of the digital world and indeed, about what is in the child's own best interests, but adult approaches that appear to disrespect their perspective, or fail to listen to and take account of their views, are problematic and can unintentionally lead to adverse outcomes. This applies as much to designers and policymakers as to parents. It is problematic that the former often develop products for a generic user, notwithstanding that such products may impact children and young people. Such products may impact children and young people in significant and problematic ways (Lenhart & Owens, 2021; Livingstone et al., 2015). It is also problematic that child online protection, including age assurance, tends to be thought of as involving measures that restrict or exclude children from opportunities rather than encouraging design and policy solutions that include them in ways that respect their rights and evolving capacity.

○ Business responsibilities

With YouTube, Instagram, Roblox, TikTok and WhatsApp, among other digital products and services, heavily used by young children in many countries, it is clear that children's enthusiasm and companies' marketing combined is overriding the specifications of minimum age for users. As the International Telecommunications Union (ITU) (2020, p. 9) puts it, 'with surveys showing that most children are using social media before the minimum age of 13 and age assurance services being generally weak or lacking, the risks facing children can be serious.' Although it is important to emphasise that risk is not harm but instead, the probability of harm, evidence is mounting of harm associated with children's online activities (Livingstone, 2013). The incidence of such harm is linked to other forms of disadvantage or vulnerability, experienced both online and offline, pointing to a vicious cycle in which the digital environment can amplify prior problems in a child's life, even though it can, at the same time, offer a pathway to opportunities, including sources of online help and digital resilience (Hollis et al., 2020; Stoilova et al., 2016).

The ITU urges that businesses should 'where possible, use age assurance to limit access to content or material that, either by law or policy, is intended only for persons above a certain age' (2020, p. 32). It observes that it is essential 'that age assurance systems do not jeopardise the genuine need for specific age groups to access content that is relevant for

their development' (p. 26) nor 'endanger their privacy' (p. 32).

With such requirements increasingly also demanded by national and regional (European) legislation (see Caglar & Nair, 2021), the search is on for robust, rights-respecting systems of age assurance and parental control tools, as part of a broader and multidimensional strategy for child online protection. In many ways, Europe leads in this work, with its Better Internet for Kids (BIK) strategy making significant advances in protecting children and identifying routes to viable self-, co- or statutory regulation.

Nonetheless, the task ahead is considerable, and the nature of the digital environment continually evolves, posing new challenges to children's rights, including their safety and privacy. There are, crucially, gaps and slippages between policy frameworks, policymaking and policy implementation, with EU member states struggling at times to keep pace with socio-technological developments or to enact sufficient multistakeholder cooperation for a smooth transition from policy frameworks to full and effective implementation on a national basis (O'Neill et al., 2020).

Pillar 3 of the EC's BIK strategy is designed to 'implement measures that would prevent children from coming in contact with … harmful behaviour or content' (EC, 2012, p. 10), complementing pillars on high-quality online content, digital and media literacy and awareness-raising, and combating child sexual abuse and exploitation. The strategy requires the provision of age-appropriate tools and regulation for a safe online environment. Reporting on progress in this regard, O'Neill et al. (2020) observe an increase in implementation of EU legislation on 'age-appropriate privacy settings', reporting three-quarters of European countries taking steps to implement these by November 2020, together with nearly the same proportion also promoting the adoption of age rating and content classification. Mandated by the GDPR and AVMSD, respectively, these steps and others relating to the BIK strategy have significant implications for the safety of children online, and for how parents, children and other relevant actors engage with digital technologies in terms of their choices, concerns, opinions and familial practices.

○ Providing support that benefits children

The last 20 years has seen an escalating volume of research on parental actions regarding children's internet use, commonly put under the umbrella heading of 'parental mediation'. As Altarturi et al.'s (2020) bibliometric analysis reveals, most research comes from the USA, followed by the UK, Australia, Spain, Canada, China, the Netherlands, and scattered studies in other countries. Their analysis also shows that most research is conducted by the social sciences, closely followed by psychology and, less commonly, from computer science. This last is more involved in research specifically on parental control tools (tracking, browser-based, filters, etc.), with social sciences and psychology focusing more on the human practices of parental mediation. A recent review of studies of parental mediation strategies found that what matters to children's experience of online risk is the warmth of the child–parent relationship and the collaborative and communicative actions this enables, more than any use of technical tools, surveillance or restrictions (this applies especially in Europe compared with Asia; see Elsaesser et al., 2017).

Research broadly concurs that, from a parent's perspective, several strategies by which they can personally mediate their child's use of the internet present themselves. The

EU Kids Online network previously classified these into five broad strategies: active mediation of internet use (actively discussing and/or sharing the activity); active mediation of internet safety; restrictive mediation; technical controls; and monitoring (checking on the child's online activities after use). However, further statistical analysis of a European survey of parents found that these five could be grouped into two broad strategies – enabling and restrictive (Livingstone et al., 2017). Two notable points arose from this analysis.

First, parents who actively engage with, advise on and share digital activities with their children also tend to monitor them and use technical tools. The strategy that stands out as different is the restrictive one, in which parents tend to limit, police or ban particular devices or digital activities by their children. In other words, although technical tools are sometimes spoken of and even advertised as restrictive and controlling, in practice, parents are finding ways to integrate them as part of positive parenting when combining co-use (or joint media engagement: see Ewin et al., 2020) centred on open communication and respectful negotiation within the family. It is the use of restrictions (whether managed through parental rules and bans or technical means) that, however unintentionally, tends to result in children evading or finding workarounds to parental decisions, even to child–parent conflict (Livingstone & Blum-Ross, 2020; Third et al., 2019a). Second, the same statistical analysis found that enabling mediation is more effective in promoting children's digital skills and opportunities than reducing their experience of risks; indeed, more skilled and experienced children tend to encounter more, not fewer, risks online (Livingstone et al., 2017). Meanwhile, restrictive mediation is associated with a drop in online risks encountered by children and lower levels of digital skills and the uptake of fewer online opportunities.

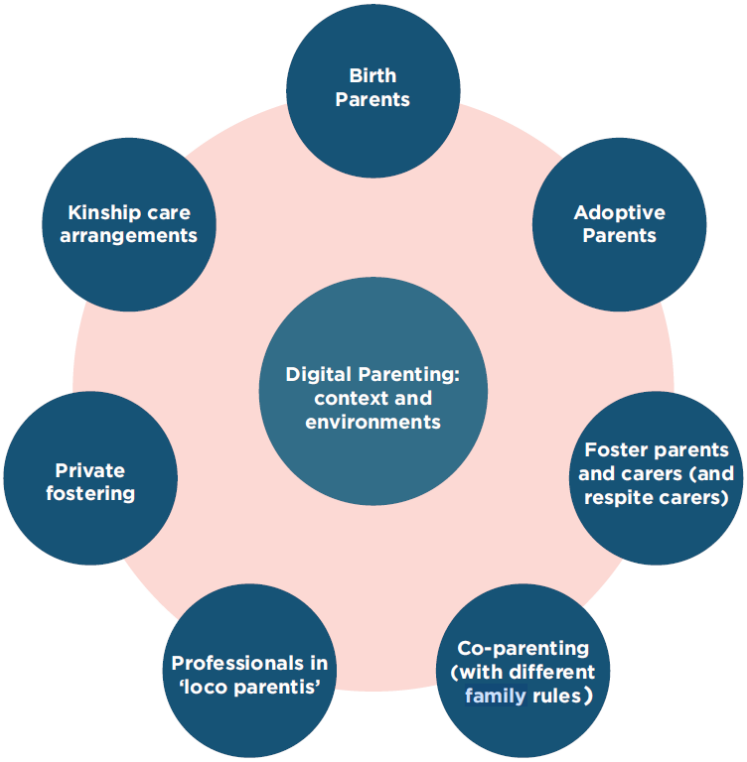
The evidence therefore points to a genuine dilemma in which parents face having to trade off their child's experience of online risks versus opportunities. In other words, this and other evidence suggests that, at present, it is difficult for them both to protect and also empower their child in a digital world. Whatever balance they strike, they seem to sacrifice one right for another when we examine parental mediation in terms of its outcomes for children. Given this situation, it is often simply concluded that parents and children must each find their balance, knowing the strengths, vulnerabilities and particular circumstances of their household. The incidence with which children across Europe report that their parents undertake these different mediation strategies in practice, along with a host of European and country-level findings for children's digital access, skills, opportunities and risk of harm, can be found in the EU Kids Online 2020 report (Smahel et al., 2020).

However, the more policymakers rely on parents, and notwithstanding parents' acknowledgement of their responsibility to protect their child, the task is in many ways beyond the capacity of individual parents – because of the extreme, even criminal, nature of some risks, and because of the complexity of technological innovation (Livingstone & Blum-Ross, 2020). To the extent that policymakers rely on parents, the outcomes will be unequal for children, reflecting parents' differential resources, expertise and competence to manage and mediate the impact of the digital environment on their child. So, can policy and design step in to ease the task of parents?

○ Designing for the diversity of childhood and parenting across Europe

Further challenges for any age assurance measures arise from the diversity of childhood and parenting in Europe. Families' appropriation of technologies, and the consequences of their use, differ depending not only on regulation and business operations but also on families' material and symbolic resources, in turn, a matter of culture and tradition, socioeconomic position and inequalities, individual interests and many other factors. A diagram from the Verification of Children Online (VoCO) project (DCMS, 2020, p. 39) captures the complexity of child–parent relationships and parenting in a digital context.

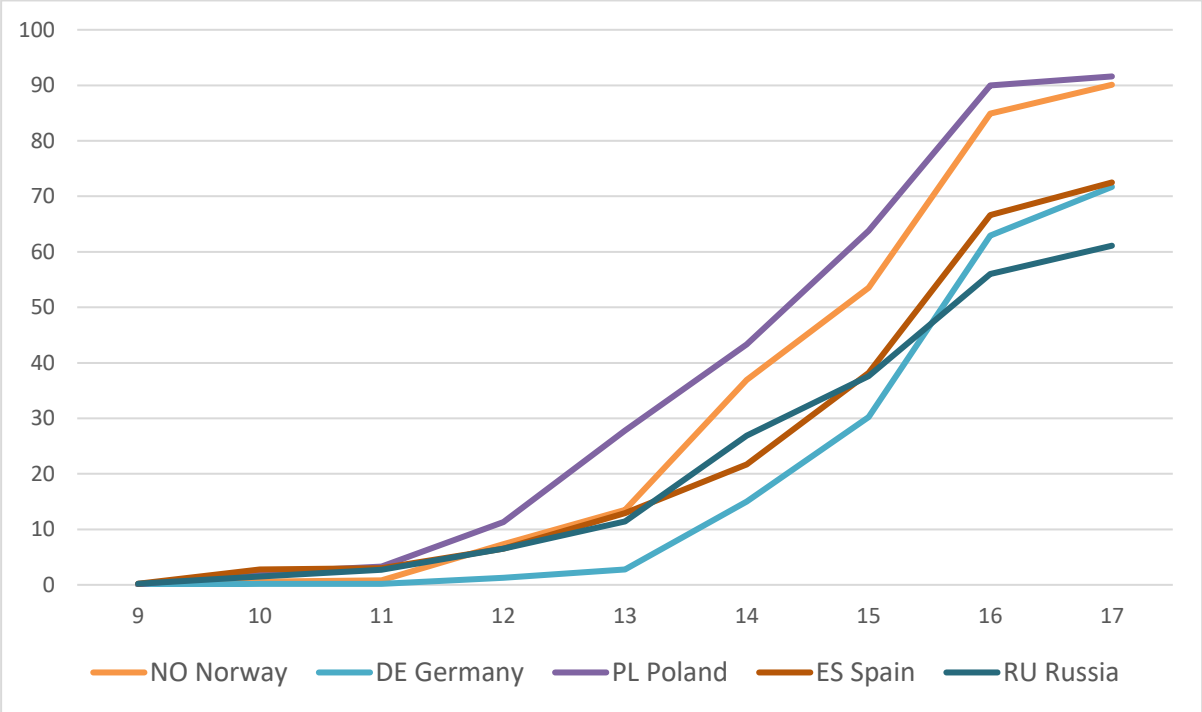
Figure 2: Context and environment of digital parenting (DCMS, 2020)



The lives and circumstances of children differ based on a range of socioeconomic and cultural factors. Hence, measures that are appropriate for some contexts might be unsuitable or inefficient in others. A range of factors can influence how age assurance measures are adopted and used by families, including parental attitudes to technology and age assurance measures, mediation styles and the general approach to parenting, cultural norms about children's needs, best interests and independence. For example, data from the cross-national comparative project EU Kids Online shows that parents' views about their child's age of digital independence vary substantially between countries, demonstrating that in some countries parents are more relaxed about their child making their own decisions about the websites, social media, apps or games they use (see Figure 3; see also Smahel et

al., 2020 for methodology and findings).[12]

Figure 3: At what age do you think your child will be or was old enough to make their own decisions about the websites, social media, apps or games they use? (Smahel et al., 2020)

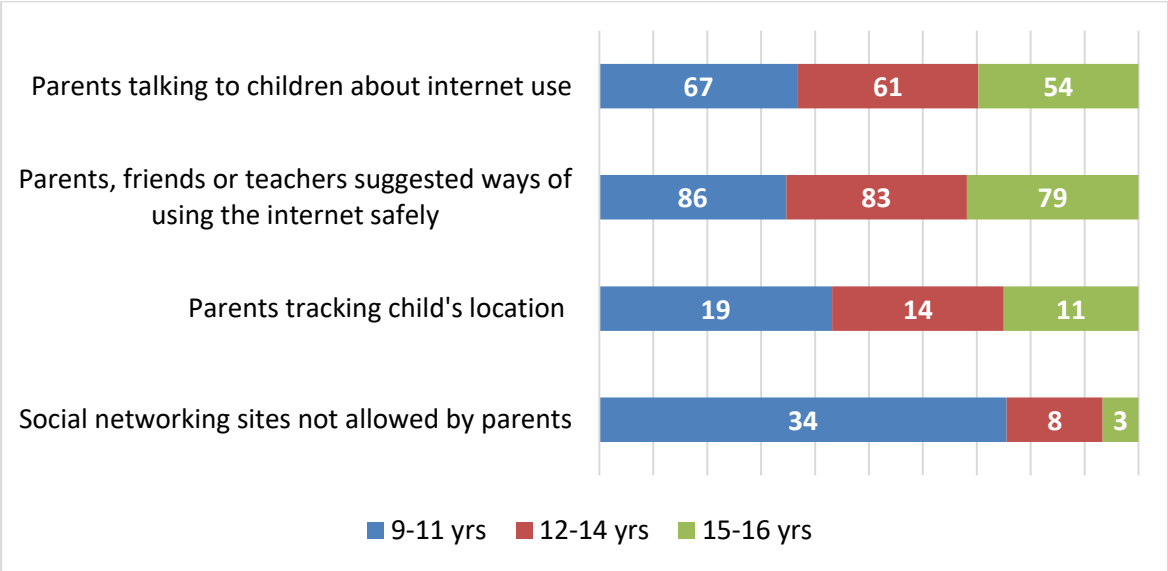


Note: The graph shows the cumulative percentage of the age limits to indicate where parents are more relaxed vs. more strict. Base: Parents of children aged 9–16 who use the internet

The amount of parental involvement in different mediation strategies also changes with age (see Figure 4) – parents in all countries tend to be more engaged when children are younger and do less as they grow older. This is true for both enabling mediation where the parent talks to their child about internet use or suggests ways of staying safe online and restrictive mediation where they limit what the child can do online. Still, the data shows that being on social networking sites is not allowed for only 34% of children aged 9–11, while this group is under the minimum required age for using most social media.

[12] Some graphs include unpublished EU Kids Online data.

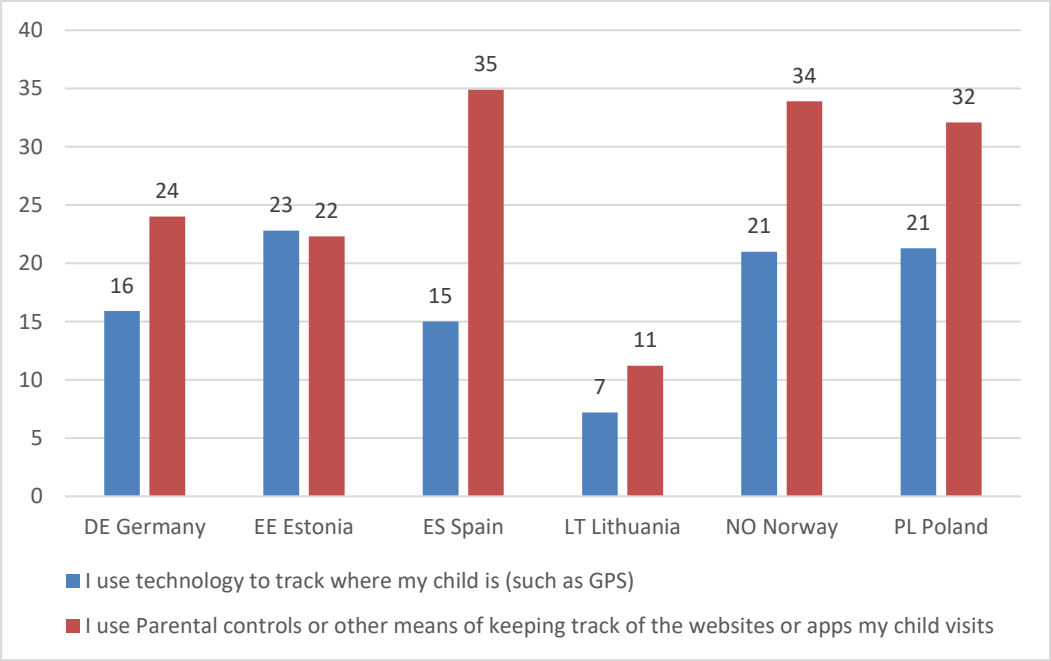
Figure 4: Parental mediation by age, % who do it at least sometimes (Smahel et al., 2020)



Note: European average for 19 countries; % of children saying their parents do this sometimes, often or very often. Base: All children aged 9–16 who use the internet

The proportion of parents who use some measure to monitor their children's whereabouts or their online activities also varies. From the countries where this data is available (see Figure 5), between one in ten and over a third of parents use parental control tools. Tracking children's location is overall less popular than keeping track of the websites they visit. Still, in some countries, the gap is substantial (e.g., in Spain, parental control tools are used by parents twice more than location tracking), while in other countries, they are equally popular (e.g., in Estonia).

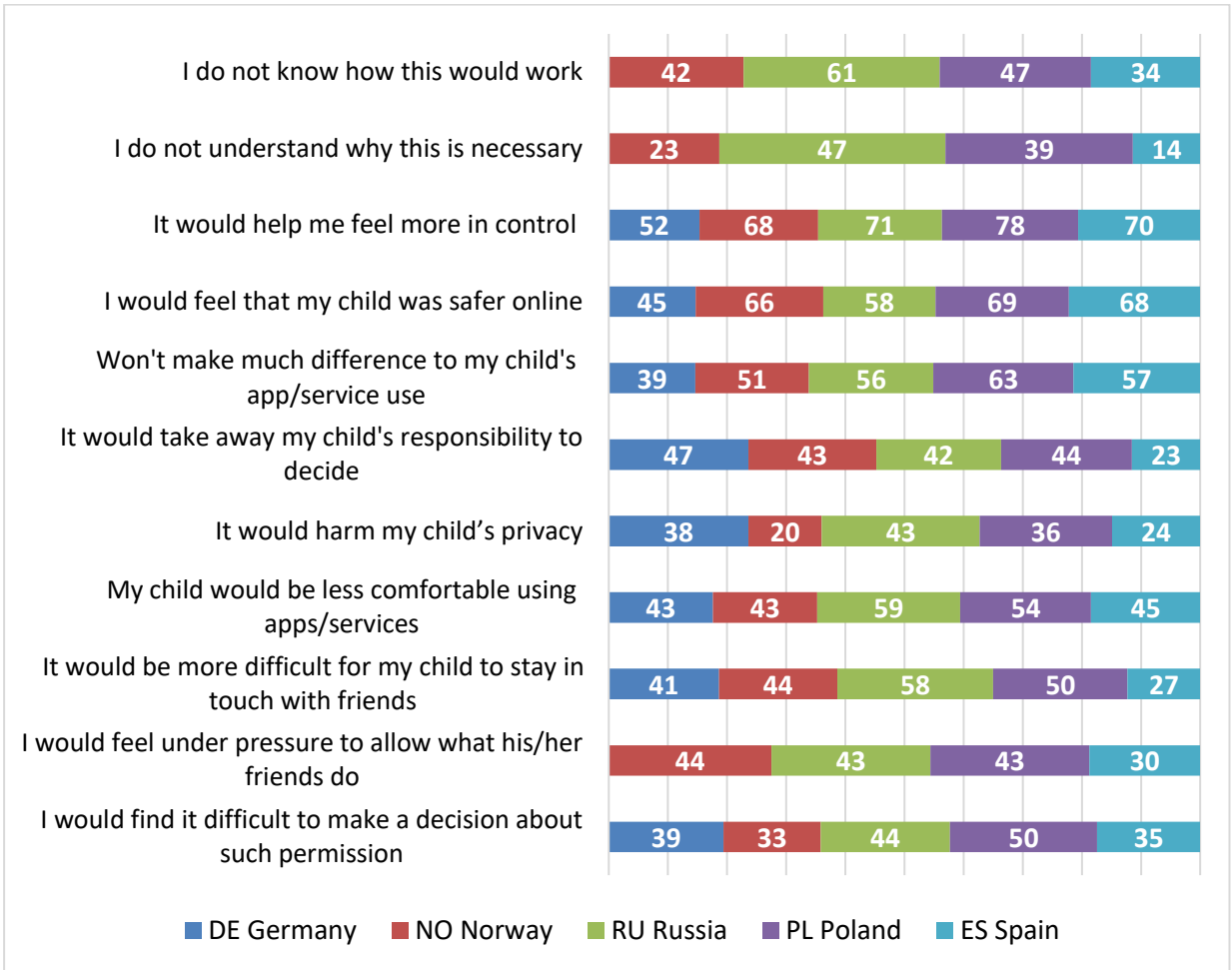
Figure 5: Parents who track child's location and online activities (Smahel et al., 2020)



Note: % of parents saying 'yes'.

The EU Kids Online study explored parental attitudes to the possibility of requiring parental permission in the future for children under 16 to use social media, apps and smart devices. The findings show that many parents are not even sure how such features may work – between a third and two-thirds of parents in the countries with available data (see Figure 6). Many do not understand why this is necessary (14% to 47%), would find it difficult to decide (35% to 50%) or do not feel that this would make much of a difference to how the child uses apps or services (39% to 63%). Importantly, there is some parental concern about possible adverse effects on children's privacy, autonomy and decision-making. At least one in five parents (20% to 43%) think that such a measure would harm their child's privacy from their parents and limit their responsibility to decide on their own (23% to 47%). In some countries, most parents worry that this would make it less comfortable for children to use apps or services (43% to 59%) or harder to stay in touch with friends (27% to 58%). The positive aspects of parental control measures include helping parents to stay more in control (52&% to 78%) or to feel that their child is safer online (45% to 69%). Still, at least a third of parents (30% to 44%) worry that they will be under pressure to allow what their children's friends can access.

Figure 6: Attitudes to parental control tools (% of parents who agree; Smahel et al., 2020)



Note: Referring to: 'In the future, young people under 16 may have to ask their parents for permission in order to be able to use social networking sites, apps and smart devices.' Response scales differ slightly between the countries, presented as % for 'Agree' and 'Strongly agree' or 'I tend to agree' and 'I definitely agree'. There was no data on Germany for three items.

Considering the diversity of family forms and living arrangements in Europe, parental permissions might not be that easy to obtain or reinforce. Seventeen per cent of children in Europe live with only one parent, and a further 1% do not live with a parent at all (see Appendix 5 for detailed data and sources). In addition, 12% of the European households contain three or more children, which means that device sharing or hand-me-downs might disrupt or override parental permissions. Enforcing parental permissions and existing regulation is a challenge on its own, even concerning age-restricted goods, such as alcohol and tobacco. Fourteen per cent of the 11-year-olds have consumed alcohol in their life, 5% have done this in the past 30 days, and 1% have been drunk in the past month. On average, 3% of children aged 11 have tried smoking, but this is as high as over 10% in several European countries. Hence, any measures to restrict children's online access to information, goods and services that are not considered appropriate for their age face the challenge of how best to account for the existing diversity of children's circumstances.

As children's needs and capabilities are not universal, 'catch-all' measures might leave out groups of children who are most socially marginalised and would benefit from inclusion the most. For example, 7% of European youth experience long-standing limitations in their usual activities due to a health issue. Ensuring that measures work for any marginalised or disadvantaged groups is a crucial aspect of a children's rights approach.

○ Aligning design and policy

Ten years ago, acknowledging the growing rationale for and interest in age assurance techniques, Nash et al. (2013) examined their effectiveness when used by the online gambling industry to prevent the sale of age-restricted goods to minors and in relation to social gaming. Nash et al. concluded that while 'there is unlikely to be a "one-size fits all" single model of age assurance that suits the diversity of all business needs' (2013, p. 3), reflecting different levels of risk to children and particular business principles, there were reasons to be optimistic about the growing effectiveness of business efforts. The report addressed consumer rights rather than specifically child rights. Still, it did note that 'children should not be age-gated at every step: the recommendations here are intended to strengthen existing regulatory frameworks limiting access to age-restricted goods, rather than to create new barriers as there is great value in free exploration of the Internet' (2013, p. 5).

Technology has moved forward since then. While most research still focuses on children's interaction with screen-based devices, some studies address different kinds of technology. Informed by a review of studies of the risks that smart toys, including dolls, teddies and robots, pose to children's security, safety and privacy, revealing failings on the part of both regulators and toy designers, Albuquerque et al. (2020) set out 37 parental control requirements for smart toy makers. Half are functional requirements (e.g., create a parent profile, verify the authenticity of the parent, obtain parental permissions, create privacy rules, provide guidelines for parents, etc.). Half are usability requirements (e.g., multiplatform use, ease of installation, interoperability, privacy-by-design principles, encrypt communication, etc.). None, interestingly for our present purposes, address the challenge of ensuring that services are appropriate to the age of the child user, implicitly passing this responsibility to the parent consenting on behalf of their child to the product's terms of service.

Adolescent gambling online is a particular challenge gaining policy attention. A review of the research available a decade ago by Griffiths and Parke (2010) found that young people with greater digital skills encounter more risks (a finding recently confirmed by the pan-European EU Kids Online survey; see Smahel et al., 2020). As they also document, the use by gambling companies of age assurance measures was largely ineffective online, especially compared with under-age access to offline gambling services. This may seem to pass the responsibility to parents, but, as Griffiths and Parke add, this is to demand a lot from parents who often do not grasp the nature of the risks and nor do they necessarily have the capacity to intervene. Policy attention often turns to efforts to build resilience in young people, given evidence that neither provider tools nor parental actions are always effective. A review by Sage et al. (2021) finds some evidence of success. But while more resilient children may be less vulnerable to harm, this exacerbates inequalities insofar as it leaves less resilient children even more vulnerable to online risk of harm. A convincing body of research shows that offline risk compounds online risk, and that one online risk is associated with others so that a vicious circle results whereby the more disadvantaged or vulnerable young people are left to face online risks with neither resilience nor, often, effective parental mediation or access to other forms of support (Livingstone, 2013).

In short, even though family life evolves – ever more digital, ever more digitally literate – both technology and the challenges associated with their use also evolve. Pasquale et al. (2020) claim that social media apps have increased their use of age assurance mechanisms since the enactment of the GDPR, albeit, they suggest, as a response to the potential application of financial penalties (which has mostly remained superficial and tokenistic, as van der Hof and Ouburg, 2021, show). They specifically 'recommend age assurance as an ongoing process that does not terminate after sign-up' (Pasquale et al., 2020, p. 7) together with efforts to incentivise honesty, not deception, by users about their age. But whether such changes are forthcoming and whether the measures available and in development for child online protection are fit for purpose and child rights-respecting in practice, only time will tell.

Appendix 1: Detailed methodology

The search included five databases – a combination of two multidisciplinary (Scopus and Web of Science) and three specialist databases selected to cover subject disciplines relevant to the review – media and communication (Communication & Mass Media Complete, CMMC), sociology (SocINDEX), psychology (PsycINFO), computing (ACM Digital Library) and technology (IEEE Xplore). This combination was selected to help draw a picture of how age verification and parental consent tools are used in everyday life, rather than to describe the legal and technical landscape in relation to the age assurance solutions.

The search words were organised into four thematic groups (for the full list included in each category, see Smirnova et al., 2021):

- **Age:** This includes a panoply of terms related to verifying the age online, such as 'age assurance', 'age-based' restrictions or rating, 'age check', 'identity assurance', and others. This set of terms focused on the practice of age checking in online environments.

- **Child:** This includes terms that can describe a child under the age of 18, for example, 'child', 'school student', 'minor', 'kid' and 'under-age*'. This set of key terms was used to circumscribe our key focus on children and their experiences.

- **Digital:** This consists of a subset of key terms relevant to the online environment: (1) generic terms related to the digital environment or online activities, such as 'internet', 'online', 'digital', 'streaming', 'apps', 'social media' or 'Googl*'; (2) names of platforms such as Facebook, Twitter and Instagram, the use of which is age-restricted; and (3) similarly age-restricted games, such as 'Minecraft', 'Call of Duty' and 'League of Legends'. The key aim of this category was to capture various digital spaces and activities in relation to which age checking might take place.

- **Consent:** The final category deals directly with parental control tools and consent. The terms included in this category fall into: (1) a combination of words describing parental control and consent, such as 'content monitoring' or 'parent* lock*'; and (2) names of specific software, apps and solutions, such as 'Net Nanny' or 'Kaspersky Safe Kids'. The terms in this category were used to get at the specific experiences of age verification in everyday life.

For the large multidisciplinary databases (see the next sub-section) that allow a complex syntax, the search formula was child AND digital AND (age OR consent) words. This means that the search results included a child term and a digital term plus either an age verification or a consent word (for the full syntax, see Smirnova et al., 2021). For smaller, specialist databases we needed to cast a 'wider net' and used a slightly less restrictive search without the child words, so the formula was digital AND (age OR consent) words. Each of the four-word groups was derived after extensive term-by-term testing.

The searches across all the academic electronic databases were conducted on the same day (29/03/2021) to ensure the consistency of research output, as databases are updated daily. The search results were downloaded, assembled into a single EndNote Library and de-duplicated. This produced a sample of 1,656 results, which were screened for

relevance.

The screening of the results was conducted in two stages – first, based on abstract, title and key words and then, on reading the full text. For the first stage of the screening, we used Rayyan, a specialist screening software that enables computer-assisted screening of the literature. We designed exclusion criteria based on the aims of the review and adjusted it after some test screening. We used the following five criteria to evaluate each of the items in the library, applying these hierarchically (for a detailed description of each, see Smirnova et al., 2021):

- **C1: language:** We excluded items that were not published in English.
- **C2: publication type:** We excluded items that were not academic articles, book chapters, reports or conference papers (e.g., dissertations, book reviews and posters).
- **C3: Theme:** We excluded items that did not deal with the subject matter of age verification, parental control or parental consent in the context of digital lives. We only included studies that dealt with children under the age of 18. For example, items that dealt with age verification of fossils, athletes, migrants or various advanced forensic techniques for age estimation were excluded. At the same time, items that at least partially addressed age verification in digital spaces were included. For example, if an academic article discussed age verification procedures in the context of bricks-and-mortar and online tobacco stores, it was included.
- **C4: Research type:** We only included empirical research studies, secondary analysis and evidence reviews based on empirical research that was directly relevant to the experiences of children and families. We excluded theoretical and framing studies, technical protocols, legal and literature reviews. We also excluded empirical technical work that focused on the development and testing of tools, rather than people's everyday life experiences. The same logic was applied to legal reviews and frameworks. Empirical studies from those domains were marked for inclusion in the background and framing of the final report.
- **C5: Robustness:** We excluded studies with problematic methodological dimensions, such as studies that were poorly executed or that didn't provide enough details for evaluation or replication.

In parallel with the database search, a call for evidence was circulated to a group of multidisciplinary experts (90+ people, networks and organisations) including academics, NGO partners, policymakers and experts working for commercial and governmental organisations. The call was aimed at any relevant empirical evidence, and in particular, 'edge cases' in the context of parental control and age verification, such as children with disabilities, foster care settings, shared custody and single-parent households. The consultation generated a lively response and a further 80 sources were added to the review sample. These sources were screened applying the same inclusion criteria used for the database resources. After the screening, 7 texts were included in the final sample for analysis. Extensive supplementary searches in ACM Digital Library, IEEE and citation searches took place and resulted in an additional 7 articles added to the final sample, taking the total

number of studies added from supplementary searches to 14.

A total of 61 studies met the inclusion criteria and were retained for coding and analysis. The team designed, pilot tested and adapted a coding grid to systematise analysis of the empirical evidence. This included three main sections: bibliometric, descriptive and analytical. The bibliometric section includes information about the author(s), year of publication, title and place where an item was published. The descriptive section included a discussion of the main methodological and framing decisions (e.g., the key research questions, methodological design, populations and the location where the study took place). The analytical section was the most wide-ranging and included records of simpler factors, such as a summary of conclusions and what type of age assurance or parental control was studied, as well as more complex analysis of the significance of the findings for the rapid evidence review, the rigour of design and execution, and child's rights aspects examined in the study. The studies in the final samples were coded using the grid with responses recorded in a spreadsheet for analysis and synthesis.

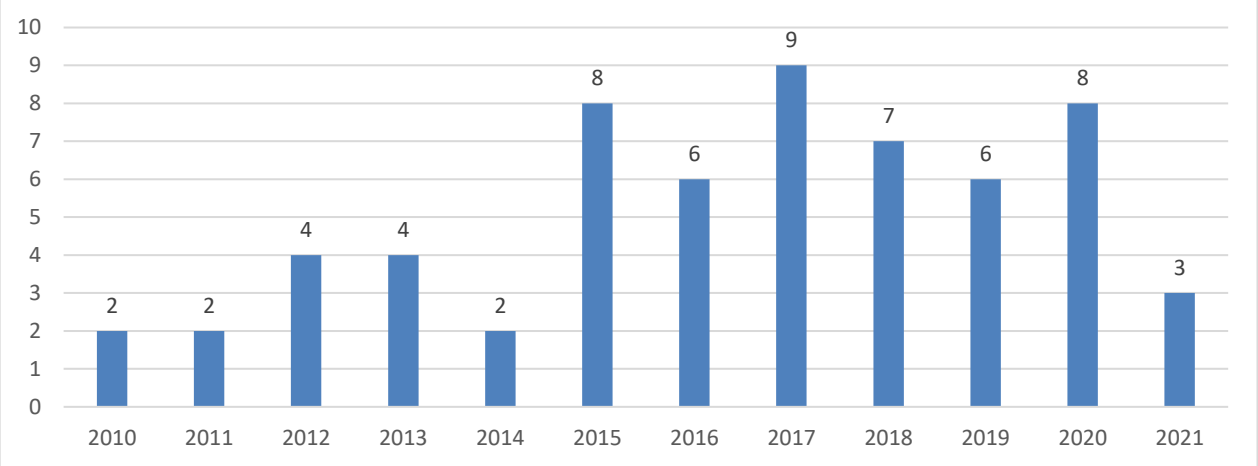
Appendix 2: Detailed overview of the available evidence

The final set of evidence analysed for the review consisted of 61 studies: 2 reports, 37 academic articles, and 20 conference papers, a book chapter, and a working paper. As the peer review process is considered the gold standard of academic evidence and assures quality of evidence, peer review sources were included. Conference papers that reflect the most recent changes in the field were also included. Seventy per cent of the studies (43) focused their attention on parental control measures, with 27% (16) examining issues related to age assurance, and two studies touching on both.

The difference in the number of studies focused on each of the two topics is likely explained by the demand made by our research framing, as we only analysed existing research that presented empirical findings related to either age assurance or parental control tools as grounded in everyday life and family context. Such framing excluded any studies dealing with the classification of age assurance measures and mechanisms, the online burgeoning literature on the technical aspects of age assurance, studies of the legal dimension of parental consent and age assurance, or discursive studies that did not involve human participants.

Most of the evidence (almost four-fifths of the studies) analysed was published in 2015 or later, probably reflecting growing interest in the topic as well as the changing regulatory landscape. The fact that the evidence analysed was up to date means that the arguments examined are current, despite the dynamic nature of the field and the changing technological nature of age assurance.

Figure 7: The number of studies published per year between 2010 and 2021



USA-based studies dominate, with 45% (28 studies) of the sample; 4 studies were set in Canada; 22% were set in a European context, with the Netherlands (4), Spain (3) and Belgium (2) having higher counts, and others having a single study set, in the UK, Sweden, Poland, Latvia and Finland. Studies set in India (2), Indonesia (1), Malaysia (1), as well as South Korea (2) and Saudi Arabia (1) were also represented in the dataset. While the USA/EU-based nature of the field is indisputable, just under a fifth of the studies came from

different cultural contexts. Two were set in unspecified states, although as the limiting factor of the study was use of the English language, it is most likely that they were English speaking.

Studies included in the analysis reflected on the linguistic and cultural limitations of the current research landscape, and such limitations equally apply to this report. First, are the English language-exclusive parental control measures limiting such measures' workability in other linguistics context (Hartikeinen et al., 2016)? Thus, further research in other linguistic contexts would be illuminating. Second, parenting practices, including technical mediation, are culturally sensitive (Seo & Lee, 2017; Shapka & Law, 2013), and so future research might benefit from a comparative analysis of the use of age assurance and parental control measures.

From a disciplinary perspective (see Table 3), three academic fields contributed almost four-fifths of all evidence, with computer science accounting for over a third of all analysed studies, followed by health and related disciplines, and media and communication studies contributing about 20% of the sample each. Psychology was also well represented within the sample. However, what is more telling is the predominance of parental mediation theory as the key analytical lens for research in over a third (22) of studies analysed suggesting that this theory is adopted beyond disciplinary categories. Other frequently used theories focus on privacy (7), public health (9), risk taking and victimisation (5), and values in design (5). Some studies employed more than one framework and others did not use any theoretical framing.

Table 3: The distribution of analysed evidence by academic discipline

Discipline	Count
Computer science, including HCI	22
Economics	1
Education	2
Health, including public health	13
Media and communication	12
N/A	2
Policy	1
Psychology	7
Sociology	1
Total	**61**

Children were involved in an overwhelming number of studies (49 out of 61). In 5 studies they were either involved by proximity, for example were fictitious or were part of a larger study but the data on children was not necessarily presented in the article analysed. Just 7 articles analysed did not include children's voices. Of the studies that included children, 5 did not specify the child's age (most frequently as a result of the methodological impossibilities of attributing age to online comments) and 10 studies only involved children between the ages of 0 and 11. Another 5 studies included a category of young people over 18 but under 21 (the legal age for purchasing restricted goods in the USA), with only one study dealing exclusively with 18- to 20-year-olds. The majority of the studies involved teenagers between the ages of 12 and 17, although arbitrary age cut-off points at 13, 14 or

15 make any meaningful comparison between younger and older teenage groups impossible. It is not unexpected that most of the studies focus on older children owing to their growing autonomy, more opportunities and their need to be engaged in the digital world. Almost 40% (23 studies) did not include any parent data in the analysis.

It is difficult to draw hard conclusions from the vulnerability category we included in the coding, such as household composition, disability and other socioeconomic proxies, because (1) these are not uniformly discussed in all research; (2) they have a different weight in qualitative and quantitative contexts; and (3) we found only one study that reports on multiple dimensions of vulnerability. Of the 15 studies that explicitly mentioned one or more dimensions of vulnerability, 2 included child immigrants, 2 included children who had experienced various types of abuse and/or neglect, and 10 mentioned various types of living arrangements (guardians, single-parent households, foster care), as well as low-income families.

In the evidence examined, less than a third of the studies had a specific focus, while the majority focused on general access to the digital world. To illustrate, 4 studies focused on social media websites or a specific platform; 4 examined specific content, such as commercials or various types of TV programming; and 13 examined access to specific goods, such as alcohol and tobacco. This is unsurprising and reflective of the multiple activities enabled by the internet.

In line with the accompanying reports in WP2 (see page 18) we analysed the type of age-restricted activities in three categories: sales of goods, access to online content, and online services (including social media platforms). About half of all the studies analysed (29) examined only one of these categories and 2 covered all three. The remaining 30 studies discussed types of age-restricted activities (26 studies), combining references to both content and services, signalling perhaps that differentiation between services and content is problematic. More specifically, over half (33 studies) referred to age-restricting access to some kind of services, less than a third (17 studies) discussed age restriction in relation to sales, and almost three-quarters (44 studies) discussed restriction in relation to various types of online content, such as pornography or violence.

We hoped to be able to analyse the effectiveness of specific age assurance and parental control measures, for example, to explore if blocking content had been used more frequently or with better outcomes than remote monitoring. However, this proved impossible as the available studies tended to explore parental control measures generally without specifying the particular functionalities being studied. Only one study provided sufficient details on the mechanisms – proposing a new parental control prototype that employed self-monitoring strategies (Ko et al., 2015). The remaining studies discussed the multiple functions of parental control tools simultaneously, either labelling them as technical measures or software or not specifying types of functions used.

Overall, temporal and content restriction, filtering, monitoring of access, blocking or pausing young people's activities, withdrawing or granting permissions for access, and reading communications were most commonly mentioned. In addition, some studies included discussions of the physical removal of devices, shutting down digital access, disabling phone functioning, password sharing, and supervising online content as part of such mediation. It is important to note that discursive studies focusing on classifying and analysing features of parental control tools are available (Wisniewski et al., 2017a; Zaman &

Nouwen, 2016). In light of this, future research efforts should examine how various types of parental control, especially when age assurance is involved, play out in the context of family.

The analysis of specific mechanisms in the studies on age assurance was more informative (for a good overview of available mechanisms, see 5Rights Foundation, 2021a; Nash et al., 2013). This is probably due to the stricter regulation of age-restricted activity. Four studies deal with one specific mechanism of age assurance. Two deal exclusively with media age ratings as a mechanism for defining what is age appropriate and limiting access (Gosselt et al., 2012; Russell et al., 2021). Another two studies focus on age gating in restricting online access (Barry et al., 2015; Brett et al., 2019). The remaining 12 studies tend to examine multiple age assurance techniques in a comparative manner, most frequently examining types of age assurance used and the effectiveness of such mechanisms. The most typical comparison is of self-declaration mechanisms (tick boxes, age boxes, self-confirmation) with hard ID checks in-store, on check-out, or delivery. A few studies (5) discuss third party identification and remote age identification systems.

The two studies that deal with both parental control and age assurance (Hundlani et al., 2017; Ofcom & Yonder, 2021) touch on multiple dimensions of each. The empirical analysis (Hundlani et al., 2017) focuses on developing child–parent authentication for younger children in the context of online security and password use, but evolves into a more comprehensive parental control and age assurance measure. The Ofcom and Yonder (2021) report discusses both age assurance and parental control measures in the context of video-sharing platforms and online harms, as well as data on awareness and use of parental control tools.

The diversity of methodological tools used in the analysed evidence is noteworthy. At least 12 studies employed more than one methodology in data collection, and at least 4 redeployed the same methodology on multiple populations or on multiple occasions. Table 4 presents a bird's-eye view of the methodological tools employed, with further detail presented in the next section.

Table 4: The number of instances a specific methodological tool was used in a study

Methodological designs	No. of studies
Various types of textual analysis (including computational, thematic, qualitative and quantitative content analysis)	7
Interviews and focus groups	12
Participatory research methodologies (including prototyping, user studies, co-design and re-design)	5
Diary	1
Survey (including cross-national, small sample, compliance)	30
Observations (including log monitoring)	3
Experiment (including mystery shoppers, purchasing online, measuring use over time)	12
Total	**70**

Overall, the categories of participatory research, textual analysis research and experiments deserve special attention as they present the most atypical evidence. For example, a study involving computational analysis (textual analysis; see Ghosh et al., 2018a)

of user-generated comments not only provided strong comparative analysis of children's and parents' attitudes towards parental control tools, but also served to prove that computational analysis can successfully distinguish between two categories of users. In participatory methodologies, nine potential new measures are design, re-design or user-tested (Fuertes et al, 2015; Ghosh et al., 2020; Hundlani et al., 2017; Hashish et al., 2014; Ko et al., 2015; McNally et al., 2018; Nouwen et al., 2015, 2017; Wardhana et al., 2017). The category of surveys is the most numerous quantitatively, but it is also the broadest, including cross-national surveys, small sample surveys, user surveys and surveys that, while focused on other issues, touched on age assurance or parental control tools.

Given the focus of our analysis is on the rights of children, we examined each article included in the sample from the perspective of the particular right it touches on. For example, if an item examined or made reference to some dimension of data privacy or commented on the nature of a proposed measure as privacy preserving, it was coded under the right to 'privacy'. An article that discussed creativity and opportunities for expression online was coded under 'freedom of expression'. Or, if an item specified the importance of learning effective coping strategies, it was coded under 'autonomy'. Out of 61 studies analysed, over half (34 studies) focused on one core right, about a third addressed two child rights, 4 addressed two rights, and 2 four or more rights.

Some of the studies also addressed child rights aspects. Autonomy, health and wellbeing, and privacy are top of the list and were discussed in a third of the studies analysed. Access to information and violence against children were also prominently featured. The rights to privacy and autonomy were most frequently paired in the sample, with about 20% of the studies examining those in parallel and in relation to each other. The strong presence of the right to health and wellbeing is potentially explained by the studies that focused on examining age assurance in the context of the sale of age-restricted good such as tobacco and alcohol, necessitating health as a framing lens, but also due to the online harms discourse that appears in discussing access of minors to online content.

Appendix 3: Details of the 61 analysed studies

	Author(s)	Focus	Age-restricted activity	Domain	Country	Methodology	Sample focus/size	Age of child
1	Barry, A. E., Johnson, E., Rabe, A., Darville, G., Donovan, K. M., & Efunbumi, O., 2015	Age assurance	Goods	YouTube adverts for alcohol	USA	Experiment ('fake' children attempted to access and view ads of the alcohol brands)	Fake YouTube accounts	14, 17, 19
2	Brett, E. I. et al., 2019	Age assurance	Goods and content	Smoking (via Reddit)	USA	Quantitative content analysis	364 posts and comments from Reddit	Unclear
3	boyd, d., Hargittai, E., Schultz, J., & Palfrey, J., 2011	Age assurance	Services	Facebook	USA	Survey	1,007 parents and guardians (of children aged 10–14)	No children
4	Cino, D., Mascheroni, G., & Wartella, E., 2020	Parent controls	Services and content	Specific device (Circle)	USA	Qualitative content analysis	154 reviews by children and parents posted on Amazon and Searchman	Unclear
5	Gaiha, S. M., Lempert, L. K., & Halpern-Felsher, B., 2020	Age assurance	Goods	Tobacco (e-cigarettes)	USA	Cross-sectional survey (national)	2,167 respondents who smoked	13–24
6	Gentile, D. A., Maier, J. A., Hasson, M. R., & de Bonetti, B. L., 2011	Age assurance	Content	TV	USA	3 cross-sectional national surveys	5,554 adults, including 2,227 parents of children under 17	No children

7	Gosselt, J., van Hoof, J., & De Jong, M., 2012	Age assurance	Goods and content	DVD rental stores and cinemas	Netherlands	Experiment (mystery shopper); survey	16 child mystery shoppers; 149 telephone calls by parents (for advice); 114 surveyed vendors	11 and 15
8	Nali, M. C., Purushothaman, V., Xu, Q., Cuomo, R. E., & Mackey, T. K., 2021	Age assurance	Goods	Electronic nicotine delivery systems	USA Massachusetts	Experiment (simulated purchases and content analysis of websites	50 stores	No children
9	Nikitin, D., Timberlake, D. S., & Williams, R. S., 2016	Age assurance	Goods	Shopping websites	USA	Experiment (mystery shoppers)	102 online vendors	16–17
10	Peeters, S., & Gilmore, A. B., 2013	Age assurance	Goods	Tobacco (snus, moist snuff)	Sweden/ EU	Experiment (online purchasing; 5 purchases in 10 member states)	43 orders placed	No children
11	Unger, J. B., & Bartsch, L., 2018	Age assurance	Goods	Tobacco (ads)	USA	Survey	13,651 respondents	12–17
12	van Hoof, J. J., 2016	Age assurance	Goods	Alcohol (no age verification in store, ID readers, remote age verification)	Netherlands	Experiment (mystery shopper)	132 purchases made	17–20
13	van Hoof, J. J., Gusset, J. F., & de Jong, M. D. T., 2010	Age assurance	Goods	Tobacco	Netherlands	Experiment (mystery shoppers)	10 ‘fake’ children made 100 attempts to purchase tobacco online	15
14	Williams, R. S., Derrick, J., & Phillips, K. J., 2017	Age assurance	Goods	Shopping websites	USA	Experiment (mystery shopper)	10 ‘fake’ children made 68 attempts to purchase	14–17

							tobacco online	
15	Williams, R. S., Derrick, J., & Ribisl, K. M., 2015	Age assurance	Goods	Tobacco	USA	Experiment (online shopping)	98 orders by fake children, none blocked	14–17
16	Williams, R. S., & Ribisl, K. M., 2012	Age assurance	Goods	Alcohol	USA	Cross-sectional survey	100 online vendors	18–20
17	Williams, R. S., Phillips-Weiner, K. J., & Vincus, A. A., 2020	Age assurance	Goods	Tobacco	USA	Experiment (online shopping)	100 orders by 'fake' children, only 2 blocked	14–17
18	Hundlani, K., Chiasson, S., & Hamid, L., 2017	Age assurance and parent controls	Content and services	Internet	Canada	Prototype testing, 3 studies	25 children and 25 parents	7–11
19	Ofcom & Yonder, 2021	Age assurance and parent controls	Services and content	Video-sharing platforms	UK	Survey	1,958 UK internet users for whole survey	13–17
20	Al-Naim, A. B., & Hasan, M. M., 2018	Parent controls	Services and content	Internet	Saudi Arabia	Survey	251 parents	No children
21	Alelyani, T., Ghosh, A. K., Moralez, L., Guha, S., Wisniewski, P., & Meiselwitz, G., 2019	Parent controls	Services and content	52 mobile applications	USA and EU	Quantitative content analysis	29,272 Google Play reviews by parents and children, 52 apps	Unclear
22	Álvarez-García, D., Núñez, J. C., González-Castro, P., Rodríguez, C., & Cerezo, R., 2019	Parent controls	Services	Internet	Spain	Survey	3,360 children and young people	11–18
23	Anderson, M., 2016	Parent controls	Content and services	Internet	USA	Survey	1,060 parents and 1,060 children	13–17

24	Badillo-Urquiola, K., Page, X., & Wisniewski, P., 2019	Parent controls	Services and content	Internet	US	Interviews	29 parents of children aged 13–17	No children
25	Bate, F., MacNish, J., Males, S., Chova, L. G., Torres, I. C., & Martinez, A. L., 2012	Parent controls	Services and content	Internet gaming and porn	Australia	Survey, interviews, focus groups, observation, log monitoring	192 parents and children	No children
26	Benrazavi, R., Teimouri, M., & Griffiths, M. D., 2015	Parent controls	Services	Games	Malaysia	Survey	592 children, young people and parents	16–22
27	Fuertes, W., Quimbiulco, K., Galarraga, F., Garcia-Dorado, J. L., Ryoo, J., & Kim, H., 2015	Parent controls	Services and content	New measure	Ecuador	3 surveys: student, parent and school technicians as separate populations	N/A	11–17
28	Chrima, R. M., Kircaburun, K., Kabir, H., Riaz, B. K., Kuss, D. J., Griffiths, M. D., Mamun, M. A., 2020	Parent controls	Services, content, goods	Internet	Bangladesh	Survey (face-to-face)	350 children	13–17
29	Erickson, L. B., Wisniewski, P., Hu, X., Carroll, J. M., Rosson, M. B., & Perkins, D. F., 2016	Parent controls	Content and services	Internet	USA	Interviews	12 parent–child dyads	13–17
30	Gallego, F. A., Malamud, O., & Pop-Leeches, C., 2020	Parent controls	Content	Internet	Chile	Randomised intervention with text messages	7,700 parents	No children
31	Ghosh, A. K., Badillo-Urquiola, K., Guha, S., LaViola, J. J., & Wisniewski, P. J., 2018	Parent controls	Services and content	37 mobile applications	USA and EU	Thematic content analysis	736 Google Play reviews by children, 37 apps	8–19

32	Ghosh, A. K., Badillo-Urquiola, K., Rosson, M. B., Xu, H., Carroll, J. M., & Wisniewski, P. J., 2018	Parent controls	Services and content	Apps	USA	Survey	215 parent–child dyads	13–17
33	Ghosh, A. K., Badillo-Urquiola, K., . B., Xu, Rosson, M, H., Carroll, J. M., & Wisniewski, P. J., 2018	Parent controls	Services and content	Apps	USA	Survey	215 parent–child dyads	13–17
34	Ghosh, A. K., Hughes, C. E., & Wisniewski, P. J., 2020	Parent controls	Services	Content control app ('Circle of trust')	USA	Interviews with parents and children	17 parent–child pairs	9–17
35	Ghosh, A. K., & Wisniewski, P., 2016	Parent controls	Content	Apps	USA	Thematic analysis of user reviews	29,272 Google Play reviews of 71 adolescent safety apps	Unclear
36	Hartikainen, H., Iivari, N., & Kinnula, M. 2016	Parent controls	Services and content	Internet	Finland	Discourses survey (screening various media, including blogs, websites, online discussions, slides)	338 sources	No children
37	Hashish, Y., Bunt, A., & Young, J. E., 2014	Parent controls	Content (apps)	Own content control app	Canada	Qualitative interviews	12 parents interviewed; 13 parent–child dyads for prototyping	6–8
38	Holmgren, H. G., Padilla-Walker, L., Stockdale, L. A., & Coyne, S. M., 2019	Parent controls	Content	Internet	USA	Survey	1,193 children and young people	10–20

39	Ko, M., Choi, S., Yang, S., Lee, J., & Lee, U., 2015	Parent controls	Content	Own app	South Korea	Survey and in-depth user study (3 weeks long)	100 surveyed parents; 7 parents and 18 children	Older teens, average age 16.4
40	Law, D. M., Shapka, J. D., & Olson, B. F., 2010	Parent controls	Services and content	Internet	Canada	Survey	733 children and young people	10–18
41	Martínez, G., Casado, M. A., & Garitaonandia, C., 2020	Parent controls	Content	Internet	Spain	Survey	2,900 children	9–17
42	McNally, B., Kumar, P., Hordatt, C., Mauriello, M. L., Naik, S., Norooz, L., Shorter, A., Golub, E., & Druin, A., 218	Parent controls	Content and services	Own measure	USA	2 co-design workshops; survey	12 children	7–12
43	Miltuze, A., Sebre, S. B., & Martinsone, B., 2020	Parent controls	Content	Internet access	Latvia	Survey; repeat in a year's time	261 parent–child dyads at first measure; 236 dyads at second measure	8–11
44	Noll, J. G., Shenk, C. E., Barnes, J. E., & Haralson, K. J., 2013	Parent controls	Services and content	Internet	USA	Survey, interviews, observation of online profiles	251 girls	14–17
45	Nouwen, M., JafariNaimi, N., & Zaman, B., 2017	Parent controls	Services and content	App	Belgium	2 co-creation workshops; MeToDi project	7 parent–child dyads	9–15
46	Nouwen, M., van Mechelen, M., & and Zaman, B., 2015	Parent controls	Services (apps)	Own app	Belgium (Northern Dutch-speaking	Value alignment workshops (commercial stakeholders and parents); interviews with parents	14 parents (of children aged 4–10)	Unclear

47	Pavan Kumar Attavar, S., & Rani, P., 2018	Parent controls	Services and goods	Multiple devices	India	In-depth interviews	14 parents of children under 10	No children
48	Pons-Salvador, G., Zubeida-Mendez, X., & Frias-Navarro, D., 2018	Parent controls	Services and content	Internet	Spain	Survey	1,827 parents	6–9
49	Prakash, S., Vaish, A., Coul, N., Kumar, G. S., Srinidhi, T. N., & Botsa, J., 2013	Parent controls	Content	Internet	India	Survey	104 children	12–16
50	Russell, C. A., Buhrau, D., & Hamby, A., 2021	Parent controls	Content	TV content	USA	Survey	396 teens	13–17
51	Shapka, J. D., & Law, D. M., 2013	Parent controls	Services and content	Internet	Canada	Survey	518 children	12–18
52	Seo, H., & Lee, C. S., 2017	Parent controls	Services and content	Any use (touchscreen phones and tablets)	South Korea and USA	Interviews and observations	20 parents and 10 children	2–6
53	Soldatova, G. U., Rasskazova, E. I., & Chigarkova, S. V., 2020	Parent controls	Services, content, goods	Internet	Russia	Survey	1,533 children and 1,219 parents	12–17
54	Sonck, N., Nikken, P., & de Haan, J., 2013	Parent controls	Content	Internet	Netherlands	Surveys	1,004 parent–child dyads	9–16
55	Starkey, L., Expel, E. A., Sylvester, A., 2019	Parent controls	Services and content	Internet	New Zealand	Survey and focus groups	68 children	9–11
56	Tomczyk, L., Ryk, A., & Prokop, J., 2018	Parent controls	Goods and content	Intent goods	Poland	Survey	1,137 school students	Teens, average age 15.5

57	Vaala, S., & Bleakley, A., 2015	Parent controls	Content and services	Internet	USA	Survey	629 parents and children	12–17
58	Wardhana, S., Sabariah, M. K., Effendy, V., & Kusumo, D. S., 2017	Parent controls	Content	App	Indonesia	Interviews and observations	7 parent–child dyads	5–6
59	Wisniewski, P., Jia, H., Xu, H., Rosson, M. B., & Carroll, J. M., 2015	Parent controls	Services (SMS) and content	Social media	USA	Survey (phone)	558 parent–child dyads	12–17
60	Wisniewski, P., Xu, H., Rosson, M. B., & Carroll, J. M., 2014	Parent controls	Content and services	Internet	USA	Interviews	12 parent–child dyads	13–17
61	Wisniewski, P., Xu, H., Rosson, M. B., & Carroll, J. M., 2017	Parent controls	Content	Internet	USA	2-month diary study	68 parent–child pairs	13–17

Appendix 4: Children's rights relating to age assurance and parental control tools

Child's right (UNCRC)	Relevant segment of text quoted from General Comment no. 25 on the digital environment
Non-discrimination (art. 2)	'The right to non-discrimination requires that States parties ensure that all children have equal and effective access to the digital environment in ways that are meaningful for them.' (para. 9)
Best interests of the child are primary (art. 3.1)	'States parties should ensure that, in all actions regarding the provision, regulation, design, management and use of the digital environment, the best interests of every child is a primary consideration.' (para. 12)
Risk of harm	'Risks relating to content, contact, conduct and contract encompass, among other things, violent and sexual content, cyberaggression and harassment, gambling, exploitation and abuse, including sexual exploitation and abuse, and the promotion of or incitement to suicide or life-threatening activities, including by criminals or armed groups designated as terrorist or violent extremist. States parties should identify and address the emerging risks that children face in diverse contexts, including by listening to their views on the nature of the particular risks that they face.' (para. 14)
The child's right to be heard	'States parties should involve all children, listen to their needs and give due weight to their views. They should ensure that digital service providers actively engage with children, applying appropriate safeguards, and give their views due consideration when developing products and services.' (para. 17)
Evolving capacities	'The risks and opportunities associated with children's engagement in the digital environment change depending on their age and stage of development. [States] should be guided by those considerations whenever they are designing measures to protect children in, or facilitate their access to, that environment.' (para. 19)
Child protection measures	'States parties should ensure the operation of effective child protection mechanisms online and safeguarding policies, while also respecting children's other rights, in all settings where children access the digital environment, which includes the home, educational settings, cybercafés, youth centres, libraries and health and alternative care settings.' (para. 26)

Independent monitoring	'States parties should ensure that the mandates of national human rights institutions and other appropriate independent institutions cover children's rights in the digital environment and that they are able to receive, investigate and address complaints from children and their representatives.' (para. 31)
Training for professionals	'Professionals working for and with children and the business sector, including the technology industry, should receive training that includes how the digital environment affects the rights of the child in multiple contexts, the ways in which children exercise their rights in the digital environment and how they access and use technologies. They should also receive training on the application of international human rights standards to the digital environment.' (para. 33)
Business responsibilities	'Businesses should respect children's rights and prevent and remedy abuse of their rights in relation to the digital environment. States parties have the obligation to ensure that businesses meet those responsibilities.' (para. 35)
Due diligence	'States parties should require the business sector to undertake child rights due diligence, in particular to carry out child rights impact assessments and disclose them to the public, with special consideration given to the differentiated and, at times, severe impacts of the digital environment on children.' (para. 38)
Access to information	'States parties should ensure that children have access to information in the digital environment and that the exercise of that right is restricted only when it is provided by law and is necessary for the purposes stipulated in article 13 of the Convention.' (para. 50)
Protection from harmful content	'States parties should protect children from harmful and untrustworthy content and ensure that relevant businesses and other providers of digital content develop and implement guidelines to enable children to safely access diverse content, recognizing children's rights to information and freedom of expression, while protecting them from such harmful material in accordance with their rights and evolving capacities.' (para. 54)
Data minimisation	'Age-based or content-based systems designed to protect children from age-inappropriate content should be consistent with the principle of data minimization.' (para. 55)
Balancing rights	'States parties should ensure that digital service providers comply with relevant guidelines, standards and codes and enforce lawful, necessary and proportionate content moderation rules. Content controls, school filtering systems and other safety-oriented technologies should not be used to restrict children's access to information in the digital

	environment; they should be used only to prevent the flow of harmful material to children. Content moderation and content controls should be balanced with the right to protection against violations of children's other rights, notably their rights to freedom of expression and privacy.' (para. 56)
Freedom of expression	'Any restrictions on children's right to freedom of expression in the digital environment, such as filters, including safety measures, should be lawful, necessary and proportionate. The rationale for such restrictions should be transparent and communicated to children in age-appropriate language.' (para. 59)
Freedom of association	'No restrictions may be placed on the exercise by children of their right to freedom of association and peaceful assembly in the digital environment other than those that are lawful, necessary and proportionate.' (para. 65)
Right to privacy	'Interference with a child's privacy is only permissible if it is neither arbitrary nor unlawful. Any such interference should therefore be provided for by law, intended to serve a legitimate purpose, uphold the principle of data minimization, be proportionate and designed to observe the best interests of the child and must not conflict with the provisions, aims or objectives of the Convention.' (para. 69)
Privacy-by-design	'States parties should require the integration of privacy-by-design into digital products and services that affect children.' (para. 70)
Parental (and child) consent	'Where consent is sought to process a child's data, States parties should ensure that consent is informed and freely given by the child or, depending on the child's age and evolving capacity, by the parent or caregiver, and obtained prior to processing those data. Where a child's own consent is considered insufficient and parental consent is required to process a child's personal data, States parties should require that organizations processing such data verify that consent is informed, meaningful and given by the child's parent or caregiver.' (para. 71)
Data protection rights	'States parties should ensure that children and their parents or caregivers can easily access stored data, rectify data that are inaccurate or outdated and delete data unlawfully or unnecessarily stored by public authorities, private individuals or other bodies, subject to reasonable and lawful limitations. They should further ensure the right of children to withdraw their consent and object to personal data processing where the data controller does not demonstrate legitimate, overriding grounds for the processing. They should also provide information to children, parents and caregivers on such matters, in child-friendly language and accessible formats.' (para. 72)

	'Privacy and data protection legislation and measures should not arbitrarily limit children's other rights, such as their right to freedom of expression or protection.' (para. 74)
Children's access to help	'Technologies that monitor online activities for safety purposes, such as tracking devices and services, if not implemented carefully, may prevent a child from accessing a helpline or searching for sensitive information.' (para. 76) 'Protecting a child's privacy in the digital environment may be vital in circumstances where parents or caregivers themselves pose a threat to the child's safety or where they are in conflict over the child's care.' (para. 77) 'Providers of preventive or counselling services to children in the digital environment should be exempt from any requirement for a child user to obtain parental consent in order to access such services.' (para. 78)
Children separated from parents	'It is important that children separated from their families have access to digital technologies … in the context of separated families, States parties should support access to digital services for children and their parents, caregivers or other relevant persons, taking into consideration the safety and best interests of the child.' (para. 87) 'Measures taken to enhance digital inclusion should be balanced with the need to protect children in cases where parents or other family members or caregivers, whether physically present or distant, may place them at risk. States parties should consider that such risks may be enabled through the design and use of digital technologies, for example, by revealing the location of a child to a potential abuser.' (para. 88)
Children with disabilities	'States parties should … take steps to prevent the creation of new barriers and to remove existing barriers faced by children with disabilities in relation to the digital environment.' (para. 89)
Health and welfare	'States parties should ensure that children have safe, secure and confidential access to trustworthy health information and services, including psychological counselling services.' (para. 94)
Right to education	'Standards for digital educational technologies should ensure that the use of those technologies is ethical and appropriate for educational purposes and does not expose children to violence, discrimination, misuse of their personal data, commercial exploitation or other infringements of their rights, such as the use of digital technologies to document a child's activity and share it with parents or caregivers without the child's knowledge or consent.' (para. 103)

Right to play	'Where States parties or businesses provide guidance, age ratings, labelling or certification regarding certain forms of digital play and recreation, they should be formulated so as not to curtail children's access to the digital environment as a whole or interfere with their opportunities for leisure or their other rights.' (para. 111)
Age-restricted goods and services	'Robust age assurance systems should be used to prevent children from acquiring access to products and services that are illegal for them to own or use. Such systems should be consistent with data protection and safeguarding requirements.' (para. 114)

Appendix 5: Statistics relevant to children's circumstances in Europe (selected)

	Population under 18[1]	% of under 18s in the total population[1]	Child living with both married parents (% of all children)[2]	Child living with both parents cohabiting (% of all children)[2]	Child living with a single parent (% of all children)[2]	Child not living with parents (% of all children)[2]	Households with 1 child (% of all households with children)[2]	Households with 2 children (% of all households with children)[2]	Households with 3 children (% of all households with children)[2]	Households with 4 or more children (% of all households with children)[2]	Ever drank alcohol, age 11[3] (girls/boys)	Ever smoked aged 11, age 11[3] (girls/boys)	Long-standing limitations in usual activities due to health (% of all aged 16–19)[2]	Individuals using the internet to interact with public authorities (% of all aged 16–19)[2]
EU28	95,698,544	19	67.9	14.3	16.8	1	49.4	38.6	9.6	2.4	14[a]	3[a]	6.8	47
Austria	1,535,958	17	74.3	14.2	11	0.5	48.3	36.6	11.9	3.2	5/16	1/3	12.4	80
Belgium	2,313,502	20	54.1	20.5	24.8	0.6	43.8	39.7	11.9	4.6	9/17[b]	1/3[d]	7.4	43
Bulgaria	1,189,745	17	55.9	26.2	16.2	1.7	56	36.4	5.6	2	23/32	12/12	3	19
Croatia	705,498	17	86.7	3.1	9.2	1	47.3	38.5	11	3.2	10/22	2/6	5.8	39
Cyprus	169,238	19	83.3	3.2	13.1	0.4	48.7	38.7	10.7	2	–	–	4.3	52
Czechia	1,975,121	19	66.5	19.7	13.5	0.3	51.8	40.5	6.4	1.3	13/21	2/5	4.2	69
Denmark	1,160,384	20	61.2	17.5	20.4	0.8	43.1	42.5	12.9	1.4	6/20	1/3	18.9	83
Estonia	254,445	19	53.2	30.4	15.7	0.8	52	35.9	10	2.2	10/17	4/8	11.2	81
Finland	1,058,091	19	67.7	17.9	14.1	0.3	44.3	37.3	12.5	5.8	–	1/6	16.2	86
France	14,626,188	22	49.9	27	22.6	0.4	44.1	43.1	10.2	2.6	25/39	2/6	6.5	54
Germany	13,597,428	16	74.8	8.4	15.2	1.6	49.5	36.6	11.3	2.6	5/13	1/1	4.8	48
Greece	1,861,740	17	93.3	0.3	6.1	0.3	47	38.8	11.9	2.3	14/27	2/2	3.3	68
Hungary	1,711,452	18	61	15.1	22.6	1.4	53.5	32.9	8.3	5.3	15/30	5/5	6.2	45
Ireland	1,201,002	25	71.3	7.1	21.4	0.2	42.1	39.9	14.5	3.5	4/10	1/2	6.1	45
Italy	9,679,134	16	76.4	8.2	14.8	0.6	55.1	37.5	6.7	0.8	9/21	2/4	4.6	19

Latvia	358,813	19	54.5	16.5	26.7	2.3	55.6	34	8.3	2.1	13/21	3/10	8.5	62
Lithuania	499,575	18	66.5	6.6	26.7	0.3	54.6	36.6	6.9	2	13/20	8/16	6.9	55
Luxembourg	117,879	19	76.2	5.8	16.9	1.1	52.1	38.8	7.4	1.7	7/15	4/3	12.8	35
Malta	80,196	16	73.5	4.3	21.5	0.8	64.8	30.6	4	0.6	16/27	1/1	1.6	73
Netherlands	3,357,755	19	69.9	18.2	11.6	0.3	42	41.2	12.6	4.2	5/13	1/2	12.5	67
Poland	6,894,860	18	61.5	28.5	9.3	0.8	51.8	37.1	9	2.1	9/13	4/9	3.9	14
Portugal	1,729,675	17	61.7	17.5	19.8	1.1	62.8	32	4.5	0.7	7/15	2/3	7.8	30
Romania	3,656,789	19	79.5	6	11.9	2.6	54.8	35.1	7.7	2.4	15/27	3/8	5.2	6
Slovakia	1,011,959	19	75.5	9.9	13.8	0.8	47.8	41.4	8.2	2.6	9/15	4/7	6.8	65
Slovenia	368,733	18	57.8	29.5	12.2	0.5	47.6	42	8.5	2	9/21	1/4	12.9	67
Spain	8,336,394	18	72.3	9.6	16.6	1.5	53.3	38	7.6	1.1	6/16	1/2	4.7	43
Sweden	2,155,379	21	50.9	25.8	22.1	1.2	42.9	41.3	11.8	4.1	6/14	2/3	3.3	77
UK	14,091,611	21	64.9	13.2	20.8	1.1	46.7	39.1	11.1	3.2	17/23[c]	1/2[e]	11.9	67

[1] Eurostat — Base: Usually resident population; 2019

[2] EU-SILC, 2019 — Base: All private households and their current members; data from 2019 except UK (2018)

[3] HBSC, 2018 — Base: 220 000 children attending school aged 11-, 13- and 15-years old from 45 countries and regions in Europe and Canada.

[a] Average for HBSC counties (Albania, Andorra, Armenia, Austria, Azerbaijan, Belarus, Belgium, Bosnia and Herzegovina, Bulgari, Croatia, Cyprus, Czechia, Denmark, Estonia, Finland, France, Georgia, Germany, Greece, Hungary, Iceland, Ireland, Israel, Italy, Kazakhstan, Kyrgyzstan, Latvia, Lithuania, Luxembourg, Malta, Monaco, Montenegro, Netherlands, North Macedonia, Norway, Poland, Portugal, Republic of Moldova, Romania, Russian Federation, San Marino, Serbia, Slovakia, Slovenia, Spain, Sweden, Switzerland, Tajikistan, Turkey, Turkmenistan, Ukraine, United Kingdom, Uzbekistan)

[b] French Belgium, Flemish: 9/15

[c] England, Scotland: 14/19, Wales: 16/27

[d] French Belgium, Flemish: 1/1

[e] England, Scotland: 2/1, Wales: 2/2

Appendix 6: Abstracts of analysed studies

Details of the 61 analysed studies (with the original author-provided abstracts).

Al-Naim, A. B., & Hasan, M. M. (2018). Investigating Saudi parents' intention to adopt technical mediation tools to regulate children's internet usage. International Journal of Advanced Computer Science and Applications, 9(5), 456–464.

'The adverse and harmful effects of Internet on young children have become a global concern. Parents tend to use different strategies to ensure their children's online safety. Many studies have suggested that parental mediation may play a positive role in controlling children's online behavior. The purpose of this study is to identify the factors that shape Saudi parents' intention to regulate their children's online practices using technical mediation tools. An integrated model has been proposed based on famous Information System theories and models to investigate parental intention to adopt technical mediation tools. A questionnaire-based survey is conducted for data collection. Basic descriptive statistical analysis, reliability, and validity assessments were used to analyze the data at the preliminary stage, followed by advanced analysis using Structural Equation Modeling to test the research hypotheses. Research results indicate that effort expectancy, performance expectancy, general computer self-efficacy, perceived severity, and perceived vulnerability are the main predictors of Saudi parent's intention to regulate their children's online behaviors using technical mediation tools.'

Alelyani, T., et al. (2019). Examining parent versus child reviews of parental control apps on google play. *11th International Conference on Social Computing and Social Media (SCSM)*, 11579, 3–21 [held as part of the 21st International Conference on Human–Computer Interaction, HCI International 2019, Springer Verlag].

'Mobile devices have become a ubiquitous means for teenagers and younger children to access the internet and social media. Such pervasive access affords many benefits but also exposes children to potential online risks, including cyberbullying, exposure to explicit content, and sexual solicitations. Parents who are concerned about their children's online safety may use parental control apps to monitor, manage, and curate their children's online access and mobile activities. This creates tension between the privacy rights and interests of children versus the legal, emotional, and moral imperatives of parents seeking to protect their children from online risks. To better understand the unique perspectives of parents and children, we conducted an analysis of 29,272 reviews of 52 different parental control apps from the Google Play store. We found that reviews written by parents differed statistically from those written by children such that it is possible to computationally automate the process of differentiating between them. Furthermore, latent themes emerged from the reviews that revealed the complexities and tensions in parent-child relationships as mediated by parental control app use. Natural Language Processing (NLP) revealed that the underlying themes within the reviews went beyond a description of the app, its features or performance and more towards an expression of the relationship between parents and teenagers as mediated through parental control apps. These insights can be used to improve parental control app design, and therefore the user experience of both parents and children.'

Álvarez-García, D., et al. (2019). The effect of parental control on cyber-victimization in adolescence: The mediating role of impulsivity and high-risk behaviors. *Frontiers in Psychology*, 10, 7.

'The aim of this work is to analyze the relationship between parental control and cyber-victimization in adolescence, considering the possible mediating effect of impulsivity, and high-risk internet behavior. To that end we analysed the responses of 3360 adolescents aged between 11 and 18 (M = 14.02; SD = 1.40), from Asturias (Spain), to four previously validated questionnaires in order to measure the level of parental control over the use of the internet (restriction and supervision), along with high-risk internet behaviors, impulsivity, and cyber-victimization in the adolescents. The results show that parental control tends to have a protective effect on the likelihood of the children being victims of cyber-aggression, with impulsivity, and high-risk

internet behaviors as mediating variables. More specifically, parental restriction and supervision are positively related to each other; both forms of parental control are negatively related with the adolescent's engaging in high-risk internet behaviors; supervision is negatively related with impulsivity; impulsivity is positively related with high-risk internet behaviors; and both impulsivity and high-risk internet behaviors are positively related to being a victim of cyber-aggression. The practical implications of these results are discussed.'

Anderson, M. (2016). *Parents, teens and digital monitoring*. Pew Research Center.

'The widespread adoption of various digital technologies by today's teenagers has added a modern wrinkle to a universal challenge of parenthood – specifically, striking a balance between allowing independent exploration and providing an appropriate level of parental oversight. Digital connectivity offers many potential benefits from connecting with peers to accessing educational content. But parents have also voiced concerns about the behaviors teens engage in online, the people with whom they interact and the personal information they make available. Indeed, these concerns are not limited to parents. Lawmakers and advocates have raised concerns about issues such as online safety, cyberbullying and privacy issues affecting teens. A Pew Research Center survey of parents of 13- to 17-year-olds finds that today's parents1 take a wide range of actions to monitor their teen's online lives and to encourage their child to use technology in an appropriate and responsible manner. Moreover, digital technology has become so central to teens' lives that a significant share of parents now employ a new tool to enforce family rules: "digitally grounding" misbehaving kids. Some 65% of parents have taken their teen's cellphone or internet privileges away as a punishment. But restrictions to screen time are not always consequences of bad behavior, parents often have rules in place about how often and when their teen can go online. Some 55% of parents say they limit the amount of time or times of day their teen can be online.'

Badillo-Urquiola, K., et al. (2019). Risk vs. restriction: The tension between providing a sense of normalcy and keeping foster teens safe online. Paper presented at the CHI Conference on Human Factors in Computing Systems Proceedings (CHI 2019).

'Foster youth are particularly vulnerable to offline risks; yet, little is known about their online risk experiences or how foster parents mediate technology use in the home. We conducted 29 interviews with foster parents of 42 teens (ages 13–17) who were part of the child welfare system. Foster parents faced significant challenges relating to technology mediation in the home. Based on parental accounts, over half of the foster teens encountered high- risk situations that involved interacting with unsafe people online, resulting in rape, sex trafficking, and/or psychological harm. Overall, foster parents were at a loss for how to balance online safety with technology access in a way that engendered positive relationships with their foster teens. Instead, parents often resorted to outright restriction. Our research highlights the importance of considering the unique needs of foster families and designing technologies to address the challenges faced by this vulnerable population of teens and parents.'

Barry, A. E., et al. (2015). Underage access to online alcohol marketing content: A YouTube case study. *Alcohol and Alcoholism*, 50(1), 89–94.

'Aims: With the proliferation of the Internet and online social media use, alcohol advertisers are now marketing their products through social media sites such as YouTube, Facebook and Twitter. As a result, new recommendations have been made by the Federal Trade Commission concerning the self-regulation of digital marketing strategies, including content management on social and digital media sites. The current study sought to determine whether alcohol companies were implementing the self-imposed mandates that they have developed for online marketing. Specifically, we examined whether alcohol companies were implementing effective strategies that would prevent persons under the minimum legal drinking age in the USA from accessing their content on YouTube. Methods: We assessed 16 alcohol brands (beer and liquor) associated with the highest prevalence of past 30 day underage alcohol consumption in the USA. Fictitious YouTube user profiles were created and assigned the ages of 14, 17 and 19. These profiles then attempted to access and view the brewer-sponsored YouTube channels for each of the 16 selected brands. Results: Every underage profile, regardless of age, was able to successfully subscribe to each of the 16 (100%) official YouTube channels. On average, two-thirds of the brands' channels were successfully viewed (66.67%). Conclusion: Alcohol industry provided online marketing content is predominantly accessible to underage adolescents. Thus, brewers are not following some of the self-developed and self-imposed mandates for online advertising by failing to implement

effective age-restriction measures (i.e. age gates).'

Bate, F., et al. (2012). Managing student distraction: Responding to problems of gaming and pornography in a Western Australian school for boys. EDULEARN12 4th annual International Conference on Education and New Learning Technologies.

'This paper provides some initial findings from a current longitudinal study that examines the implementation of a 1:1 laptop program in a school for boys in Perth, Western Australia. One issue that has emerged from the study is the problem of managing student distraction. The school in this study has taken a proactive approach to managing student conduct on its own network. Two student monitoring initiatives were implemented during the course of the research. The first: parental control software sought to integrate the parental control features of the laptops with the school network. The second initiative: e-safe is a web tracking service that records suspicious searches and URLs that students visit. When used in tandem, these tools were shown to have a marked impact on the conduct of students in using their laptops. This paper describes these initiatives including their effect on the broader school community, and suggests some ways in which student distraction can be best managed in future practice.'

Benrazavi, R., et al. (2015). Utility of parental mediation model on youth's problematic online gaming. *International Journal of Mental Health and Addiction*, 13(6), 712–727.

'The Parental Mediation Model (PMM) was initially designed to regulate children's attitudes towards the traditional media. In the present era, because of prevalent online media there is a need for similar regulative measures. Spending long hours on social media and playing online games increase the risks of exposure to the negative outcomes of online gaming. This paper initially applied the PMM developed by European Kids Online to (i) test the reliability and validity of this model and (ii) identify the effectiveness of this model in controlling problematic online gaming (POG). The data were collected from 592 participants comprising 296 parents and 296 students of four foreign universities, aged 16 to 22 years in Kuala Lumpur (Malaysia). The study found that the modified model of the five-factor PMM (Technical mediation, Monitoring mediation, Restrictive mediation, Active Mediation of Internet Safety, and Active mediation of Internet Use) functions as a predictor for mitigating POG. The findings suggest the existence of a positive relation between 'monitoring' and 'restrictive' mediation strategies and exposure to POG while Active Mediation of Internet Safety and Active mediation of Internet use were insignificant predictors. Results showed a higher utility of 'technical' strategies by the parents led to less POG. The findings of this study do not support the literature suggesting active mediation is more effective for reducing youth's risky behaviour. Instead, parents need to apply more technical mediations with their children and adolescents' Internet use to minimize the negative effects of online gaming.'

boyd, d., et al. (2011). Why parents help their children lie to Facebook about age: Unintended consequences of the 'Children's Online Privacy Protection Act'. *First Monday*, 16(11).

'Facebook, like many communication services and social media sites, uses its Terms of Service (ToS) to forbid children under the age of 13 from creating an account. Such prohibitions are not uncommon in response to the Children's Online Privacy Protection Act (COPPA), which seeks to empower parents by requiring commercial Web site operators to obtain parental consent before collecting data from children under 13. Given economic costs, social concerns, and technical issues, most general-purpose sites opt to restrict underage access through their ToS. Yet in spite of such restrictions, research suggests that millions of underage users circumvent this rule and sign up for accounts on Facebook. Given strong evidence of parental concern about children's online activity, this raises questions of whether or not parents understand ToS restrictions for children, how they view children's practices of circumventing age restrictions, and how they feel about children's access being regulated. In this paper, we provide survey data that show that many parents know that their underage children are on Facebook in violation of the site's restrictions and that they are often complicit in helping their children join the site. Our data suggest that, by creating a context in which companies choose to restrict access to children, COPPA inadvertently undermines parents' ability to make choices and protect their children's data. Our data have significant implications for policy-makers, particularly in light of ongoing discussions surrounding COPPA and other age-based privacy laws.'

Brett, E. I., et al. (2019). A content analysis of JUUL discussions on social media: Using Reddit to understand patterns and perceptions of JUUL use. *Drug and Alcohol Dependence*, 194, 358–362.

'JUUL, an electronic cigarette, is estimated to occupy 50% of the e-cigarette market and appears to be particularly common among youth. However, there is little research on perceptions of JUUL. The aim of the current study was to examine posts on Reddit specific to JUUL and youth to better understand the context and perceptions of JUUL use. Methods: This content analysis utilized social media discussions posted between January 2015-May 2017. Public posts on Reddit, a social media platform, were gathered and coded. Posters of discussions relevant to both JUUL and youth were included for analysis. Results: 364 posts were included for quantitative content analysis. Posts were mixed in terms of polarity with many (41.1%) including positive and negative language regarding JUUL. In terms of polarity of youth use, 60% of posts showed negative perceptions of youth use. Among posts by youth, only 37% showed negative perceptions of youth use. Posts included a variety of reasons for using JUUL with the most frequent reason being the popularity of JUUL (34.2%) followed by using it to quit smoking (23.3%) and to feel a buzz (20.2%). Age restrictions were the most common barrier to use. Conclusions: Posters generally had a nuanced perception of JUUL and identified both positive and negative aspects. Interestingly, while primary reasons for youth use indicate the strong influence of social norms, barriers to use suggest that public health interventions such as age restrictions may curb youth use. Findings can inform prevention efforts and important factors for JUUL initiation.'

Chrima, R. M., et al. (2020). Adolescent problematic internet use and parental mediation: A Bangladeshi structured interview study. *Addictive Behaviors Reports*, 12.

'Internet-related problems such as excessive internet use, problematic internet use (PIU), and internet addiction, are becoming increasingly studied among Bangladeshi adult students, but there has been little research among adolescents. In Bangladesh, there has been no research examining the role of parental mediation in their children's internet use. Therefore, the present structured interview study investigated Bangladeshi adolescent PIU and its associated socio-demographics, internet use behaviors, and the parental mediation role among 350 high school students residing in Dhaka. The results showed that 84 of adolescents (24.0%) were classified as having PIU (cut-off score of >= 50 on the Internet Addiction Test) and nine adolescents (2.6%) were classified as having a severe dependency on the internet (cut-off score of >80 on the Internet Addiction Test). According to hierarchical regression analysis, significant PIU correlates included lower academic results, both parents' lower education, mother working outside the home, more than four days' weekly internet use, more than two hours daily internet use, and active mediation. Additionally, internet use behaviors (i.e., internet use locations, devices, purposes, and applications) and parental internet mediation dimensions other than active mediation (i.e., restrictive mediation, active mediation internet safety, monitoring, and technical mediation) were significantly related to PIU in t-tests and correlation analysis respectively. However, they were non-significant in the hierarchical regression analysis when included into equation altogether. The present study's findings will be helpful in developing country-level policymaking decisions and facilitating future research in the country.'

Cino, D., et al. (2020). 'The kids hate it, but we love it!': Parents' reviews of Circle. *Media and Communication*, 8(4), 208–217.

'The contribution aims to present a critical analysis of Circle-a screen time management and parental control device-through the lens of parental mediation, children's surveillance, and children's rights to online participation. Circle promises to sell parents peace of mind by allowing them to monitor their children's online activities. In order to investigate how parents themselves understand Circle, we conducted a quantitative and qualitative content analysis of a sample of 154 parental reviews about the device on Amazon and Searchman by parents of children from early childhood to adolescence, with respect to perceived advantages and disadvantages of the device, parenting styles, and (the absence of) children's voice and agency. Results suggest an ambivalent relationship between parents and the device. Most reviews adhere to the dominant discourses on 'screen time,' framing children's 'intimate surveillance' as a good parenting practice, and emphasize the need for the 'responsible parents' to manage their children's online experiences with the aid of Circle. Others, in turn, criticize the device for failing to enable fine grained monitoring, while few reported the device could dismiss children's voice and cause conflicts in the households. Overall, findings suggest that parental control devices may promote restrictive mediation styles hindering children's voice and their exploratory and participatory agency online.'

Erickson, L. B., et al. (2016). The boundaries between: Parental involvement in a teen's online world. *Journal of the Association for Information Science and Technology*, 67, 1384–1403.

'The increasing popularity of the Internet and social media is creating new and unique challenges for parents and adolescents regarding the boundaries between parental control and adolescent autonomy in virtual spaces. Drawing on developmental psychology and Communication Privacy Management (CPM) theory, we conduct a qualitative study to examine the challenge between parental concern for adolescent online safety and teens' desire to independently regulate their own online experiences. Analysis of 12 parent–teen pairs revealed five distinct challenges: (a) increased teen autonomy and decreased parental control resulting from teens' direct and unmediated access to virtual spaces, (b) the shift in power to teens who are often more knowledgeable about online spaces and technology, (c) the use of physical boundaries by parents as a means to control virtual spaces, (d) an increase in indirect boundary control strategies such as covert monitoring, and (e) the blurring of lines in virtual spaces between parents' teens and teens' friends.'

Fuertes, W., et al. (2015). *On the development of advanced parental control tools*. IEEE.

'Given the lack of completeness of the current implementations of parental control software along with the novel characteristics parents demand on these pieces of software, this paper presents the design decisions and implementation of parental control mechanisms that both register and avoid inappropriate content accesses by children and teenagers through the Internet. We first evaluated the state-of-the-art tools assessing their functionality, efficiency, usability, security, and accuracy. Then, we conducted an exploratory study spanning surveys of a representative sample of children, parents and network administrators to determine the baseline and the main requirements this sort of software must fulfil. With such foundations, we have implemented an application and front-end interface following criteria as relevance and internal consistency. As development method, we have applied Object Oriented Hypermedia Design combined with Natural Language Processing that uses the Boolean Retrieval Model by means of string searching algorithms as Boyer-Moore and fuzzy string search. The results show that not only inappropriate content accesses through the Internet have been blocked, but also that the proposal provides parents with mechanisms to control and measure their children's Internet use as a fundamental mean in the process of prevention and awareness among the young population.'

Gaiha, S. M., et al. (2020). Underage youth and young adult e-cigarette use and access before and during the coronavirus disease 2019 pandemic. *JAMA Network Open*, 3(12), 16.

'Importance Understanding patterns of e-cigarette use and access during the coronavirus disease 2019 (COVID-19) pandemic is important because e-cigarettes may put users at risk for more severe respiratory effects and other health problems. Objective To examine whether underage youth and young adults who ever used e-cigarettes self-reported changes in access and use of e-cigarettes since the COVID-19 pandemic began. Design, Setting, and Participants A national, cross-sectional online survey study was conducted from May 6 to May 14, 2020. This sample of 4351 participants aged 13 to 24 years across the US included 2167 e-cigarette ever-users. Quota sampling was used to balance for age, sex, race/ethnicity, and 50% having ever used e-cigarettes. Main Outcomes and Measures Change in e-cigarette use (increase, decrease, quit, no change, and switch to another product) and access to e-cigarettes (easier or harder, and change in point-of-purchase) before and after the COVID-19 pandemic began, reasons for change, number of times e-cigarettes were used, nicotine dependence, and sociodemographic data. Results This study focused on 2167 e-cigarette ever-users among 4351 participants who completed the survey. Among 2167 e-cigarette users, a total of 1442 were younger than 21 years and 725 were aged 21 years or older; 1397 were female (64.5%) and 438 identified as lesbian, gay, bisexual, transgender, queer (20.2%). The survey completion rate was 40%. Since the COVID-19 pandemic began, 1198 of 2125 e-cigarette users (56.4%) changed their use: 388 individuals (32.4%) quit, 422 individuals (35.3%) reduced the amount of nicotine, 211 individuals (17.6%) increased nicotine use, 94 individuals (7.8%) increased cannabis use, and 82 individuals (6.9%) switched to other products. Participants reported that not being able to go to vape shops and product unavailability were the reasons accessing e-cigarettes was difficult after the pandemic began. Since the COVID-19 pandemic began, individuals reported purchasing from alternative retail stores (disposables, 150 of 632 [23.7%]; pod-based, 144 of 797 [18.1%]; and other e-cigarette, 125 of 560 [22.3%], ie, between 18.1% and 23.7%), purchasing online instead of retail (disposables, 115 of 632 [18.2%]; pod-based, 156 of 797 [19.6%]; and other e-cigarette, 111 of 560 [19.8%], ie, between 18.2% to 19.8%), and shifted to retail instead of online (disposables, 11 of 632 [1.7%]; pod-based, 17

of 797 [2.0%]; and other e-cigarette, 13 of 560 [2.3%], ie, between 1.7%-2.3%). Other individuals reported no change: from retail stores (disposables 262 of 632 [41.5%]; pod-based 344 of 797 [43.2%]; and other e-cigarette, 223 of 560 [39.8%], ie, between 39.8% and 43.2%) and online (disposables 94 of 632 [14.9%]; pod-based 136 of 797 [17.1%]; and other e-cigarette, 88 of 560 [15.8%], ie, between 14.9% and 17.1%). Underage youth reported e-cigarette deliveries from vape shops and/or dealers or friends who received such deliveries, and 63 of 229 (27.5%) self-reported accessing e-cigarettes without age assurance. e-Cigarette users were 52% less likely to quit or reduce their use if they previously used e-cigarettes between 11 and 99 times (adjusted odds ratio, 0.48; 95% CI, 0.30-0.78), 68% less likely to quit if they previously used e-cigarettes more than 100 times (adjusted odds ratio, 0.32; 95% CI, 0.20-0.51), and 51% were less likely to quit if they were nicotine dependent (adjusted odds ratio, 0.49; 95% CI, 0.35-0.70). Conclusions and Relevance During the COVID-19 pandemic, youth e-cigarette users reported changes in e-cigarette use, point-of-purchase, and ability to purchase e-cigarettes without age assurance. The US Food and Drug Administration and local policy makers may find these data useful to inform policies to prevent e-cigarette sales to underage youth. Question Did underage youth and young adults (13-24 years) self-report changes in use and access to e-cigarettes during the coronavirus disease 2019 pandemic? Findings In this national, online, cross-sectional survey study of 2167 youth and young adults using e-cigarettes, 1198 respondents reported changing their amount of e-cigarette use, with 810 reducing or quitting e-cigarette use; e-cigarette access shifted to alternative retail stores and online. Reduced e-cigarette use or quitting was associated with adhering to shelter-in-place guidelines and was less likely if participants had used e-cigarettes more than 10 times or were nicotine dependent. Meaning Individuals younger than 21 years reported e-cigarette use and accessed e-cigarettes from online and retail stores during the coronavirus disease 2019 pandemic, suggesting a need to strengthen prevention of e-cigarette sales to such youth, including age assurance, and provide cessation resources. This survey study examines changes in use of e-cigarettes by individuals aged 24 years and younger during the coronavirus 2019 pandemic.'

Gallego, F. A., et al. (2020). Parental monitoring and children's internet use: The role of information, control, and cues. *Journal of Public Economics*, 188, 18.

'This paper explores the role of parental information and control on children's internet use in Chile. We designed and implemented a randomized experiment whereby 7700 parents were sent weekly SMSs messages that (i) provided specific information about their children's internet use, and/or (ii) offered assistance with the installation of parental control software. We find that providing parents with specific information changes parenting behavior and reduces children's internet use by 6-10%. Evidence from heterogeneity analysis and machine learning algorithms suggest that this information substitutes for the presence of parents at home and complements parents' capacity to be involved in their children's lives. We do not find significant impacts from helping parents directly control their children's internet access with parental control software. In addition, we find that the strength of the cue associated with receiving a message has a significant impact on internet use.'

Gentile, D. A., et al. (2011). Parents' evaluation of media ratings a decade after the television ratings were introduced. *Pediatrics*, 128(1), 36–44.

'The 3 national studies reported here were designed to find out how satisfied parents are with media rating systems, how regularly they use them, and what types of information they ideally would like to have. Methods: Parents (n = 745, study 1; n = 768, study 2; n = 769, study 3) were surveyed nationally by independent research firms. Studies 1 and 2 were conducted by Harris Interactive, and study 3 was conducted by Research Now. All of them were cross-sectional national surveys. Results: Parents desire ratings for many types of media, but they do not think the existing ratings accurately provide the information they want. They would prefer ratings to provide detailed content information. In general, parents tend to agree on the types and descriptors of content about which they would like to know. They do not, however, agree on the ages for which different content aspects are appropriate. Parents would support the creation of a universal rating system that could be applied to multiple types of media. Conclusions: Ratings can be effective only if they are useful for parents. This set of studies reveals that improvements in media ratings are needed to make them valuable for parents.'

Ghosh, A. K., et al. (2018). Safety vs. surveillance: What children have to say about mobile apps for parental control. *CHI 2018*.

'Mobile applications ("apps") developed to promote online safety for children are underutilized and rely heavily on parental control features that monitor and restrict their child's mobile activities. This asymmetry in parental surveillance initiates an interesting research question how do children themselves feel about such parental control apps? We conducted a qualitative analysis of 736 reviews of 37 mobile online safety apps from Google Play that were publicly posted and written by children (ages 8-19). Our results indicate that child ratings were significantly lower than that of parents with 76% of the child reviews giving apps a single star. Children felt that the apps were overly restrictive and invasive of their personal privacy, negatively impacting their relationships with their parents. We relate these findings with HCI literature on mobile online safety, including broader literature around privacy and surveillance, and outline design opportunities for online safety apps.'

Ghosh, A. K., et al. (2018). A matter of control or safety? Examining parental use of technical monitoring apps on teens' mobile devices. *CHI 2018*.

'Adoption rates of parental control applications ("apps") for teens' mobile devices are low, but little is known about the characteristics of parents (or teens) who use these apps. We conducted a web-based survey of 215 parents and their teens (ages 13-17) using two separate logistic regression models (parent and teen) to examine the factors that predicted parental use of technical monitoring apps on their teens' mobile devices. Both parent and teen models confirmed that low autonomy granting (e.g., authoritarian) parents were the most likely to use parental control apps. The teen model revealed additional nuance, indicating that teens who were victimized online and had peer problems were more likely to be monitored by their parents. Overall, increased parental control was associated with more (not fewer) online risks. We discuss the implications of these findings and provide design recommendations for mobile apps that promote online safety through engaged, instead of restrictive, parenting.'

Ghosh, A. K., et al. (2017). *Examining parents' technical mediation of teens' mobile devices*. Association for Computing Machinery.

'Parental control software has been one approach for promoting adolescent online safety, but there is still some ambiguity in the adoption patterns and perceptions of technical mediation for teens' mobile devices. We have collected empirical data from a paired sample of 215 parents and teens. We found that overall usage of technical mediation for mobile devices is low and that parents' and teens' perceptions about the frequency of use are not significantly different. We discuss the implications of our findings and opportunities of future research.'

Ghosh, A. K., et al. (2020). Circle of trust: A new approach to mobile online safety for families. *Proceedings of the ACM CHI Conference on Human Factors in Computing Systems (CHI 2020)*.

'Traditional parental control applications designed to protect children and teens from online risks do so through parental restrictions and privacy-invasive monitoring. We propose a new approach to adolescent online safety that aims to strike a balance between a teen's privacy and their online safety through active communication and fostering trust between parents and children. We designed and developed an Android "app" called Circle of Trust and conducted a mixed methods user study of 17 parent-child pairs to understand their perceptions about the app. Using a within-subjects experimental design, we found that parents and children significantly preferred our new app design over existing parental control apps in terms of perceived usefulness, ease of use, and behavioral intent to use. By applying a lens of Value Sensitive Design to our interview data, we uncovered that parents and children who valued privacy, trust, freedom, and balance of power preferred our app over traditional apps. However, those who valued transparency and control preferred the status quo. Overall, we found that our app was better suited for teens than for younger children.'

Ghosh, A. K., & Wisniewski, P. (2016). Understanding user reviews of adolescent mobile safety apps: A thematic analysis. *Group '16, Proceedings of the 19th International Conference on Supporting Group Work*, November, 417–420.

'With the growing use of mobile smart phones among teens, adolescent online safety is becoming more and more challenging. To overcome this problem, parental control applications have been developed.

Yet, no one knows why these apps have very low adoption rates nor if they are effective. To address this problem, we previously conducted a structured analysis of existing adolescent online safety apps. In this review, we summarize our previous results and introduce our new approach for gaining additional insights from the actual users of these apps. We summarize our methodology for doing this and present the results of an initial thematic analysis of user reviews of adolescent online safety apps. Copyright is held by the owner/author(s).'

Gosselt, J., et al. (2012). Media rating systems: Do they work? Shop floor compliance with age restrictions in the Netherlands. *Mass Communication and Society*, 15(3), 335–359.

'Media rating systems have been introduced in many countries to protect minors from being exposed to harmful media content. This study examines whether retailers comply with the guidelines of media ratings in the Netherlands. In a mystery shopping study, minors tried to buy or rent media products for which they were too young. An overall success rate of 86% shows that compliance on the shop floor is problematic. In a mystery call study, parents asked vendors for advice about media ratings. Only 33% of the parents were advised in accordance with the age classifications. A survey of vendors investigated the determinants of compliance. Personal acceptance, awareness of a legal basis, and perceived surveillance proved to be important determinants of self-reported compliance.'

Hartikainen, H., et al. (2016). Should we design for control, trust or involvement? A discourses survey about children's online safety. *IDC '16, Proceedings of the 15th International Conference on Interaction Design and Children*, June, 367–378.

'Children are growing up in an increasingly digitalized world and concerns for their online safety picture in research and in public debate. We contribute to the discussion about children's online safety through a discourses survey on public discussions carried out in Finland 2014-2015. We reveal that discourses on control, trust and involvement permeate debates on children's online safety, and we argue that this has important implications on the means that we develop for ensuring children's online safety. While some control is needed, instead of risking to lose their children's trust through restricting or monitoring, parents may want to build a trusting relationship with their children so that they can trust children to make good decisions and that the children trust them. There is a need to build technical mediation that is transparent and facilitates building of trust.'

Hashish, Y., et al. (2014). Involving children in content control: A collaborative and education-oriented content filtering approach. *CHI '14, Proceedings of the SIGCHI Conference on Human Factors in Computing Systems*, April, 1797–1806.

'We present an approach to content control where parents and children collaboratively configure restrictions and filters, an approach that focuses on education rather than simple rule setting. We conducted an initial exploratory qualitative study with results highlighting the importance that parents place on avoiding inappropriate content. Building on these findings, we designed an initial prototype which allows parents and children to work together to select appropriate applications, providing an opportunity for parents to educate their children on what is appropriate. A second qualitative study with parents and children in the six to eight year-old age group revealed a favorable response to this approach. Our results suggest that parents felt that this approach helped facilitate discussions with their children and made the education more enjoyable and approachable, and that children may have also learned from the interaction. In addition, the approach provided some parents with insights into their children's interests and understanding of their notions of appropriate and inappropriate content.'

Holmgren, H. G., et al. (2019). Parental media monitoring, prosocial violent media exposure, and adolescents' prosocial and aggressive behaviors. *Aggressive Behavior*, 45(6), 671–681.

'Prosocial violent media (e.g., media that combines both violent and prosocial content) is especially popular in entertainment media today. However, it remains unclear how parental media monitoring is associated with exposure to prosocial violent content and adolescent behavior. Accordingly, 1,193 adolescents were asked about parental media monitoring, media content exposure, and behavior. Main findings suggest that autonomy supportive restrictive monitoring was associated with lower levels of exposure to prosocial

violent content, but only among older adolescents. Additionally, autonomy supportive restrictive monitoring was the only form of parental media monitoring associated with lower levels of violent content and higher levels of prosocial content, and autonomy supportive active monitoring was the only parental monitoring strategy that promoted prosocial behavior via exposure to prosocial media content. Discussion focuses on the importance of autonomy supportive parental monitoring, as well as the implications of parents encouraging their children to watch media with limited violent content-even if it is prosocial violent content.'

Hundlani, K., et al. (2017). No passwords needed: The iterative design of a parent–child authentication mechanism. Paper presented at the MobileHCI 2017.

'Even though the vast majority of children are online, our exploration of the user authentication literature and available tools revealed few alternatives specifically for authenticating children. We create an authentication mechanism that reduces the password burden for children and adds customizable parental oversight to increase security. With Bluink, our industry partner, we iteratively designed and user tested three parent-child prototypes, with each iteration addressing issues raised in the previous iteration. Our final design is a parent-child authentication mechanism based on OpenID and FIDO U2F which allows children to log in to websites without requiring a pass- word and enables parents using their mobile device to remotely determine whether a login request should be granted.'

Ko, M., et al. (2015). FamiLync: Facilitating participatory parental mediation of adolescents' smartphone use. Paper presented at the International Joint Conference on Pervasive and Ubiquitous Computing (UbiComp '15).

'We consider participatory parental mediation in which children engage with their parents in activities that encourage both parents and children to participate in co-learning of digital media use. To this end, we developed FamiLync, a mobile service that treats use-limiting as a family activity and provides the family with a virtual public space to foster social aware- ness and improve self-regulation. A three-week user study conducted with twelve families in Korea (17 parents and 18 teenagers) showed that FamiLync improves mutual understanding of usage behavior, thereby providing common grounds for parental mediation. Further, parents actively participated in use-limiting with their children, which significantly increased the children's desire to participate. As a consequence, parental mediation methods and parent-child interaction in relation to smartphone usage changed appreciably, and the participants smartphone usage amount significantly decreased.'

Law, D. M., et al. (2010). To control or not to control? Parenting behaviours and adolescent online aggression. *Computers in Human Behavior*, 26(6), 1651–1656.

'Non-empirical publications have espoused the importance of monitoring/controlling children's online and computer activities through monitoring software; however, no empirical research has verified whether this is a viable means for promoting responsible and safe internet use. This study examined the association between parenting behaviours and adolescent online aggression. The sample included 733 adolescents (451 females), between 10 and 18 years, from Western Canada. Participants completed a questionnaire that included questions on internet aggression, and parenting. The parenting questions were modified from Stattin and Kerr's (2000) questionnaire to better suit the online environment. Results from the univariate least squares factor analysis revealed two distinct factors: (1) Parent Solicitation (parents ask where child is going on the internet), (2) Child Disclosure (child naturally tells parents what they are doing). Hierarchical Linear Regression analysis revealed that having a computer in the bedroom increased the likelihood of engaging in online aggression and that adolescent self-disclosure of online behaviours (and not controlling or monitoring online activities) was negatively associated with online aggression. These findings emphasize the importance of establishing good communication between parents and adolescents rather than investing money on monitoring software and on controlling adolescent internet use.'

Martínez, G., et al. (2020). Online parental mediation strategies in family contexts of Spain. *Comunicar*, 28(65), 65–73.

'This article explores online parental mediation strategies in Spain and their association with sociodemographic and family context Factors. The results of a survey conducted at the end of 2018 are

presented herein, based on a sample of 2,900 Spanish minors between 9 and 17 years of age who use Internet. The impact of the diverse parental mediation strategies applied to Internet use has been calculated by taking into account the sociodemographic Factor's of the participating minors (age and gender). Association analysis was performed using the SPSS statistical analysis programme. In this case, an extra analysis was carried out with regard to the relationship of influence between different strategies and the rules of behaviour and family support in the household context as perceived by the minor Findings suggest that enabling and restrictive mediation strategies are very common in Spanish families, while technical mediation strategies have a very limited presence. It is noteworthy that restrictions and security strategies generally apply more to girls than to boys. Household Ides related to the behaviour of minors have a positive correlation with an increase of influence of nearly all strategies. However; there is no relevant association between family support perceived by children and restrictive strategies and techniques applied by parents.'

McNally, B. K., et al. (2018). Co-designing mobile online safety applications with children. Paper presented at the CHI 2018.

'Parents use mobile monitoring software to observe and restrict their children's activities in order to minimize the risks associated with Internet-enabled mobile devices. As children are stakeholders in such technologies, recent research has called for their inclusion in its design process. To investigate children's perceptions of parental mobile monitoring technologies and explore their interaction preferences, we held two co-design sessions with 12 children ages 7-12. Children first reviewed and redesigned an existing mobile monitoring application. Next, they designed ways children could use monitoring software when they encounter mobile risks (e.g., cyberbullying, inappropriate content). Results showed that children acknowledged safety needs and accepted certain parental control tools. They preferred and designed controls that emphasized restriction over monitoring, taught risk coping, promoted parent-child communication, and automated interactions. Our results benefit designers looking to develop parental mobile monitoring technologies in ways that children will both accept and can actively benefit from.'

Miltuze, A., et al. (2020). Consistent and appropriate parental restrictions mitigating against children's compulsive internet use: A one-year longitudinal study. *Technology Knowledge and Learning*, 13.

'The aim of this study was to examine internet use of primary school-aged children in association with child-parent relationship, parenting practices in general and in regard to the child's internet use, as potential protective or risk factors for the development of child compulsive internet use (CIU). Participating in this study were 261 children (aged 8-11 years old) and one of their parents at the first measurement time, with 236 of these child-parent dyads participating at the second measurement time one year later. At both measurement times the children completed the Compulsive Internet Use Scale (Meerkerk et al. in Cyberpsychol Behav 12:1-6, 2009) and answered questions about the child-parent relationship, as well as parental restrictions on internet use. Parents completed items regarding parenting practices in general, and specific internet-related parenting practices. Correlational analysis showed that child CIU is positively associated with Inconsistent parenting, Forbidding internet access, and Technical Control of internet use. CIU was negatively associated with positive child-parent relationship and internet-related rules set by the parents. Regression analyses further suggested that the optimization of online opportunities and minimization of risks can be facilitated by positive child-parent relationships and consistent parenting practices, both general and internet-related, with appropriately applied internet use limitations.'

Nali, M. C., et al. (2021). Characterizing and assessing compliance of online vendors to the state of Massachusetts ENDS product sales ban. *Tobacco Induced Diseases*, 19.

'Recent reports of lung injury associated with Electronic Nicotine Delivery System (ENDS) products precipitated by increasing vaping prevalence and interest in flavors among adolescents has led to policies that restrict the sale, distribution, and accessibility of ENDS products. This study assessed compliance of online ENDS vendors to the Massachusetts temporary sales ban. Methods: The study involved structured web surveillance for online ENDS vendors using keyword searches on Google search engine (October to November 2019.) Once vendors were identified, we conducted simulated online purchases, defined as placing an order for an ENDS product by putting it in the website shopping cart without finalizing payment. Simulated purchases and content analysis of websites was conducted to determine compliance characteristics. Fisher's exact test was used to identify associations between compliance and website characteristics such as location and age

assurance requirements. Results: Simulated online purchases from 50 identified ENDS vendors yielded 72% (n=36) stores that were non-compliant and allowed placement of ENDS product orders, without restrictions, to a Massachusetts address. The remaining 14 websites had processes in place to prevent orders from buyers located in Massachusetts. Other characteristics of interest, including use of age assurance, location data, and web registrar/registrant data were collected and reported. Conclusions: The September 2019 Massachusetts executive order was a comprehensive ban on selling ENDS products both online and offline. However, our study found that close to three-fourths of the vendors appeared to be non-compliant, indicating that implementation and enforcement are ongoing challenges for future tobacco control efforts on the internet. Policymaking needs to be specifically tailored to address the unique challenges of online environments, particularly in the context of identifying non-compliant sites, ensuring age assurance, and addressing non-US sellers.'

Nikitin, D., et al. (2016). Is the e-liquid industry regulating itself? A look at e-liquid internet vendors in the United States. *Nicotine & Tobacco Research*, 18(10), 1967–1972.

'The objective of this study was to assess whether the nascent, but rapidly growing e-liquid industry prohibits Internet sales to minors and employs safety measures to prevent accidental poisonings. A stratified simple random sample (n = 120) was selected from the target population (N = 1107) of US online vendors of e-liquid in July 2015. The vendors were stratified and subsequently oversampled by trade association membership and vendor popularity. Three minors aged 16 to 17, who were supervised by adult research staff, attempted to purchase e-liquid from the 120 online vendors using debit cards issued in their names. Measures included vendors' use of age assurance, warning labels on e-liquid bottles, and child-resistant packaging. Statistically significant differences were observed by vendor popularity, but not by membership in a trade association. The differences by vendor popularity, however, occurred for measures that were limited to an age warning and list of ingredients. The most striking finding was the scant vendors (n = 4) who successfully prevented the sale of e-liquid to the minors. In contrast, 87.5% and 53.9% of the bottles contained child-resistant packaging and a health warning label, respectively. Irrespective of trade association membership or vendor popularity, online vendors of e-liquids are not taking the proper precautions in preventing sales to minors. The FDA's upcoming deeming rules on e-cigarette products should include explicit requirements for offline and online e-liquid vendors, particularly the use of effective age assurance, warning labels, and child-resistant packaging. This study demonstrates that, in the absence of any current FDA regulation of e-liquid products, self-regulation among vendors is not effective in preventing product acquisition by minors. Lax oversight of the e-liquid industry may draw consumers to bypass current tobacco control restrictions implemented in face-to-face sales settings. As a consequence, there may be an increase in online sales to minors. Further regulation of the industry may increase the already prevalent use of child-resistant packaging, leading to fewer cases of accidental nicotine poisoning.'

Noll, J. G., et al. (2013). Association of maltreatment with high-risk internet behaviors and offline encounters. *Pediatrics*, 131(2), E510–E517.

'OBJECTIVE: High-risk Internet behaviors, including viewing sexually explicit content, provocative social networking profiles, and entertaining online sexual solicitations, were examined in a sample of maltreated and non-maltreated adolescent girls aged 14 to 17 years. The impact of Internet behaviors on subsequent offline meetings was observed over 12 to 16 months. This study tested 2 main hypotheses: (1) maltreatment would be a unique contributor to high-risk Internet behaviors and (2) high-quality parenting would dampen adolescents' propensity to engage in high-risk Internet behaviors and to participate in offline meetings. METHODS: Online and offline behaviors and parenting quality were gleaned from 251 adolescent girls, 130 of whom experienced substantiated maltreatment and 121 of whom were demographically matched comparison girls. Parents reported on adolescent behaviors and on the level of Internet monitoring in the home. Social networking profiles were objectively coded for provocative self-presentations. Offline meetings with persons first met online were assessed 12 to 16 months later. RESULTS: Thirty percent of adolescents reported having offline meetings. Maltreatment, adolescent behavioral problems, and low cognitive ability were uniquely associated with high-risk Internet behaviors. Exposure to sexual content, creating high-risk social networking profiles, and receiving online sexual solicitations were independent predictors of subsequent offline meetings. High-quality parenting and parental monitoring moderated the associations between adolescent risk factors and Internet behaviors, whereas use of parental control software did not. CONCLUSIONS: Treatment modalities for maltreated adolescents should be enhanced to include Internet safety literacy. Adolescents and parents should

be aware of how online self-presentations and other Internet behaviors can increase vulnerability for Internet-initiated victimization.'

Nouwen, M., et al. (2017). ***Parental control tools: Reimagining technologies for parent-child interaction.*** **Paper presented at the Proceedings of the 15th European Conference on Computer-Supported Cooperative Work – Exploratory Papers, Reports of the European Society for Socially Embedded Technologies.**

'This article questions existing approaches in designing parental control tools and puts forward a hypothesis to reimagine technologies to mediate parent-child interactions. First, we present an overview of the current parental control tools. Second, we explain the gradual shift away from the idea of 'harmful' digital media in parental mediation studies and introduce previous work in CSCW and HCI that has proposed solutions to support discussions about digital media between parents and children. Then, we hypothesize that an emphasis on collaboration and mutual learning might help researchers and designers to rethink and reimagine technologies that support parent-child interactions with and through digital media. Finally, we share our findings of two co-creation workshops with children and parents on ways to instill parental involvement in children's digital media use. The workshop yielded insights on the differing views between parents and children about how technologies might instill long-term negotiations based on parents' and children's experiences, enriched by real-use data.'

Nouwen, M., et al. (2015). A value sensitive design approach to parental software for young children. ***IDC '15, Proceedings of the 14th International Conference on Interaction Design and Children*****, June, 363–366.**

'Parental control software enables parents to support risk management of their children's digital media use. However, tools to support online opportunities are left unexplored. This paper presents an explorative inquiry into stakeholder values related to parental software for young children, using a Value Sensitive Design approach. By studying values, we aim to illuminate design of parental software solutions that are responsive to the issues families find most important. We engaged in value exploration of corporate and parental values, and conducted a workshop with the corporate stakeholders to align stakeholder values. The results highlight the importance of values such as 'control for safety' and 'involvement' in the development of parental software for young children. The contribution of this paper lies in the understanding of stakeholder needs and values concerning software tools that balance online risks and opportunities for young children.'

Ofcom & Yonder (2021). ***User experience of potential online harms within video sharing platforms*****.**

'This report explores a range of websites and apps that people in the UK use to watch and share videos online. Although we refer to the services broadly under the term 'video sharing platforms' (VSPs) and other related terms, this report does not seek to identify which services will fall into Ofcom's regulatory remit, nor to pre-determine whether any particular service we refer to would be classed as a VSP under the regulatory definition. It should be noted that the platforms we discuss in this report operate at different scales. This is a characteristic of the current online landscape and means that each of the VSPs discussed in this report have a different number of users. This reality should be taken into consideration when comparing results from users of smaller VSPs against those from users of larger platforms. In some cases, quantitative analysis for smaller VSPs has been limited by the low sample sizes of users for specific platforms. This has been specified within the footnotes of the report.'

Pavan Kumar Attavar, S., & P. Rani (2018). How children under 10-years access and use digital devices at home and what parents feel about it: Insights from India. ***Global Media Journal: Indian Edition*****, 10(1), 1–25.**

'This study was conducted to assess how children under 10-years access and use digital devices and parental views about it from an Indian context. Using thematic analysis of in-depth semi structured interviews with fourteen parents in Manipal, South India, this study examined three critical areas: a) the extent of ownership, access, and use of digital media by young children in their homes; the activities they indulged in and content they engaged with using digital devices b) parental views and c) the strategies that parents used to manage and monitor young children's digital devices usage. The study found that children under 10-years have

easy and high access to digital devices at home in the form of parents' smartphones. They also owned their own smartphones and game consoles. Young children in Manipal used digital devices to watch videos on YouTube, daily soaps on Hotstar, play games on various game apps, send text and voice messages on WhatsApp, used the voice search to look for desired information, and even shop for books on Amazon. In addition, the study found that children were adept at downloading and installing apps, sharing multimedia files between two devices, and even do media multitasking. Some parents believed that digital devices were beneficial to children and therefore encouraged its use while others did not think so. Parents used digital devices as digital pacifiers and also felt that young children's excessive use of digital devices was a normal development; almost a "generational thing". They managed and monitored children's digital media usage through open conversations, by relying on parental control and passwords; and through clever deception.'

Peeters, S., & Gilmore, A. B. (2013). How online sales and promotion of snus contravenes current European Union legislation. *Tobacco Control*, 22(4), 266–273.

'Context The European Union (EU) Tobacco Products Directive that bans sales of snus (a form of oral tobacco) in EU countries other than Sweden is currently under review. Major tobacco companies favour the ban being overturned. This study aims to explore compliance with the current ban on snus sales and examines the conduct of online snus vendors, including their compliance with two other EU Directives on excise and tobacco advertising and Swedish legislation banning sales of snus outside Sweden. Methods To determine who is currently distributing snus via the internet in the EU, searches were carried out in Google, followed by searches in the WHOIS and Amadeus databases. Five online test purchases of snus were made in each of 10 EU Member States using a standardised protocol. Feedback from the test purchases and further analysis of the websites accessed for test purchases were used to critically examine snus retailers' conduct. Results The majority of online vendors operate from Sweden and target non-Swedish EU citizens. Test purchases were successfully made in all 10 EU Member States; of 43 orders placed, only two failed. Age assurance relied only on self-report. The majority of sales applied Swedish taxes, contrary to EU requirements. Copious sales promotion activities, many price based, are incorporated in these websites contravening the EU regulation, and three test purchases were delivered with gifts. Conclusions Snus is currently being sold on the single market via the internet in contravention of Swedish legislation and three EU Directives. The apparent willingness of the tobacco industry to contravene EU and Swedish legislation and profit from unlawful sales raises questions about their status as stakeholders in consultations on future policy developments. The findings highlight how national and regional tobacco control legislation can be undermined in an increasingly globalised world.'

Pons-Salvador, G., et al. (2018). Internet use by children aged six to nine: Parents' beliefs and knowledge about risk prevention. *Child Indicators Research*, 11(6), 1983–2000.

'The majority of studies on children's Internet use have focused on children aged 9years or older. However, children start using the Internet at increasingly younger ages, making research on these children necessary. Available studies warn that parents should be aware of the importance of protecting minors when using the Internet. This study focuses on the evaluation of parents' beliefs and knowledge about their 6 to 9-year-old children's Internet use. The sample is composed of 1827 parents who received a specially designed questionnaire. Results of the descriptive analysis show that 78% of children of these ages use the Internet, mainly for homework and games. Most of the parents are aware of the benefits and risks of the Internet, but roughly half of them state that they do not know how to set up content filters or parental control tools, which is rather relevant, taking into account that 40% of these young children are sometimes left alone when online. At this age, some children have already had a bad experience when using the Internet. This study highlights the importance of working with parents and their children from very young ages in order to prevent victimization.'

Prakash, S., et al. (2013). Child security in cyberspace through moral cognition. *International Journal of Information Security and Privacy*, 7(1), 16–29.

'The increasing number of threats in cyberspace has meant that every internet user is at a greater risk than ever before. Children are no exception to this exploitation, incurring psychological and financial stress. Technology is on a persistent pursuit of offering exquisite solution to address the problems associated with children on the cyberspace. With every new product for parental control to secure children, comes a new technique to trespass the same. Consequently it summons an approach to look beyond technology; this paper aims to explore the relevance of moral cognition to decision making capability of children on the internet & the

possibility of minimizing related risks using the observation. The authors establish a correlation between cognitive moral development and the cyber vulnerability level of children of age between 12 and 16 years, based on an empirical research using a comprehensive set of questionnaires and standard tests. The findings also paves path for future researchers to further analyze and implant features in the parental control software that would stimulate moral cognition, thereby redefining parental control software as parental care software.'

Russell, C. A., et al. (2021). Reducing television influences on US adolescents who are high reactance. *Journal of Children and Media*, 12.

'Watching a lot of television (TV), where alcohol consumption is depicted frequently and mostly positively, can enhance teens' drinking intentions. This influence is particularly problematic among high-reactance teens (that is, those with a predisposition to resist adult control). This study documents one strategy parents can use to counteract TV influences: parental presence during the TV viewing experience (co-viewing). Survey data were collected from a nationally representative sample of parents and their children aged 13-17 (N = 396). Parents reported how they monitored their children's TV consumption, and adolescents completed a survey in which they reported the amount of TV they watch, completed a trait reactance scale and indicated their views and intentions regarding drinking. Results revealed that the influence of TV viewing on adolescents' drinking intentions was lower for teens high in trait reactance who grew up with parents who co-view television with them. This did not occur when parents adopted instructive or restrictive communication strategies. The parental monitoring strategy of co-viewing thus emerges as a promising protective approach for a population that has traditionally been considered vulnerable (i.e., high reactance teens).'

Seo, H., & Lee, C. S. (2017). Emotion matters: What happens between young children and parents in a touchscreen world. *International Journal of Communication*, 11, 561–580.

'Young children today are early adopters and frequent users of touchscreen devices. This study explores how parents perceive the role of new media in their families, how and why they regulate children's media use, and how they feel about this process. The study conducts ethnographic interviews with 20 South Korean parents of two-to six-year-olds and observes 10 children in their media use and interaction with parents. We find that parents presumed that touchscreen media wielded a more negative than positive influence on their children. As a result, parents engaged in restrictive and technical mediation, though they often failed to effectively manage their children's media use due to practical challenges. The failure of parental mediation made the parents feel guilty. We suggest a greater need to attend to the contexts and emotions in which parental mediation of children's media use occurs.'

Shapka, J. D., & and Law, D. M. (2013). Does one size fit all? Ethnic differences in parenting behaviors and motivations for adolescent engagement in cyberbullying. *Journal of Youth and Adolescence*, 42(5), 723–738.

'Cyberbullying has become a growing concern for adolescents. This study examined differences in cyber- aggression for 518 Canadian adolescents of either East Asian or European descent (61 % female; M age = 15.24; SD = 1.68). Associations between parenting behaviors (parental control, parental solicitation, and child disclosure) and engagement in cyber-aggression, as well as motivations for engaging in cyber-aggression were explored. Adolescents completed self-report questionnaires about their engagement in cyberbullying, perceptions of their parents' behaviors about their online activities, their motivations for cyberbullying (reactive vs. proactive), as well as several other relevant psychosocial and demo- graphic variables (e.g., sex, age, Canadian born, mother's education level, using a computer in a private place, and average amount of time spent online). Regression analyses showed that East Asian adolescents were less likely to engage in cyberbullying. In addition, higher levels of parental control and lower levels of parental solicitation were linked more closely with lowered reported levels of cyber-aggression for East Asian adolescents relative to their peers of European descent. In addition, East Asian adolescents were more likely to be motivated to engage in cyber-aggression for proactive reasons than reactive reasons, with the opposite found for adolescents of European descent. A significant 3-way interaction suggested that this pattern was more pronounced for East Asian males relative to East Asian females. Findings are discussed in terms of cultural differences based on the doctrines of Confucianism and Taoism.'

Soldatova, G. U., et al. (2020). Digital socialization of adolescents in the Russian Federation: Parental mediation, online risks, and digital competence. *Psychology in Russia: State of the Art*, 13(4), 191–206.

'Background. Digital socialization is understood to be mediated by all available digital technological processes for mastering and appropriating a social experience online. Understanding of this new type of socialization requires studying parental mediation strategies for children's online activity, as well as the level of digital literacy of both children and parents, including through the prism of adolescents' confrontation with online risks. Objective. To study digital socialization and the role of parents in this process; to reveal relationships between parental user activity, mediation, and digital competence, and adolescents' user activity, digital competence, and experience of online risks. Design. The study was conducted on the basis of the EU Kids Online 2017–2019 survey methodology. The sample consisted of 1,553 schoolchildren aged 12–17 and 1,219 parents of adolescents the same age, all from the Russian Federation. Results. The findings show that parents underestimate the online risks faced by adolescents, especially the most common communication and content online risks. Adolescents often do not notice parental "restrictive" and "active" mediation of their online activities. Adolescents' request for parental help with their online difficulties depends not on the parents' digital competence, but on their active mediation. In following parental active mediation and safety mediation strategies, adolescents are more likely to face online risks, but at the same time they use active coping strategies. The negative relationship between the adolescents' digital competence and parental restrictive mediation and technical control suggests that excessive control and limitations hinder the development of knowledge and skills in the safe mastering of the Internet. Conclusion. The digital gap between adolescents and parents is observed both in confrontation with online risks and awareness of this experience, and in the application of parental mediation strategies. Parental active mediation provides stronger digital socialization and more constructive ways of coping with the threats of the digital world — online risks, which are the consequence of deep immersion into this world.'

Sonck, N., et al. (2013). Determinants of internet mediation: A comparison of the reports by Dutch parents and children. *Journal of Children and Media*, 7(1), 96–113.

'This article empirically examines if parents apply new types of mediation for the internet, using data from the Dutch EU Kids Online project. The high internet penetration in the Netherlands makes this study especially relevant because almost all parents and children use the internet. Factor analyses applied to reports by parents and children (aged 9-16) revealed four mediation types that are comparable for both groups: active safety mediation, restrictive content mediation, restrictive technical mediation, and monitoring. Demographics (age, gender, education, family size), measures of internet usage, and parental views towards internet use were analysed as determinants of the parental mediation types. Parents monitored younger children in particular, more often actively mediated girls and more often restricted children's internet use in larger families. The use of virtually all mediation types was related to children's diversity in internet use and the parents' view on the benefits of their involvement.'

Starkey, L., et al. (2019). How do 10-year-old New Zealanders participate in a digital world? *Information Communication & Society*, 22(13), 1929–1944.

'This article reports findings from a study that examined how pre-adolescent children, age 9-11 years participate in the digital world. Children from 14 different communities across New Zealand were interviewed in focus groups to explore their experience of using digital devices and the Internet. The findings indicate that the differences in use and participation were influenced predominantly by their family and their teacher and the similarities across the sample were a reflection of a type of pre-teen culture. The children in the study were consuming content from websites, creating and sharing digital artefacts and gaming. Interactions with online social networks were restricted to family and friends. The findings suggest that there are age-based stages for learning how to participate effectively in the digital world that may be context specific. For young people transitioning into social media, this includes developing online identity and how to interact appropriately within digital environments.'

Tomczyk, L., et al. (2018). *Digital piracy among adolescents: Scale and conditions.* Pedagogical University of Krakow, Institute of Educational Studies.

'The objective of the paper is to diagnose scale and mechanisms determining digital piracy among

young people in Poland. This type of risky online behaviour is insufficiently covered by research into issues of media education. The research was carried out between January and April 2016, in a group of 1137 school students. So far, these are the most extensive analyses conducted in Poland. The survey was also used to identify mutual relationships between: frequency of downloading files from illegal sources, knowledge about technical solutions regarding piracy, parental control in the area of new media usage, styles of using digital devices, problematic use of the Internet and use of Facebook. The most important findings reveal that occasional piracy occurs in the biggest group of respondents, whereas several percent of the interviewed students regularly download files. Parental control is one of the factors that prevent this type of behaviour. Male adolescents have much more knowledge about piracy and download files from illegal sources more regularly than girls.'

Unger, J. B., & Bartsch, L. (2018). Exposure to tobacco websites: Associations with cigarette and e-cigarette use and susceptibility among adolescents. *Addictive Behaviors*, 78, 120–123.

'Introduction: Exposure to tobacco advertising is a risk factor for tobacco use and susceptibility among adolescents. Although tobacco company websites are ostensibly targeted to adults, some youth access these websites and are exposed to tobacco-related content. Methods: This study analysed data from the Population Assessment of Tobacco and Health (PATH) survey to estimate the prevalence of exposure to tobacco websites and the associations between website exposure and tobacco product use and susceptibility among adolescents in the United States. Results: Although only 2.3% of youth had ever visited a tobacco company website, youth who visited tobacco company websites were 3.2 times more likely to have used cigarettes and 3.0 times more likely to have used e cigarettes in the past month, relative to those who had not visited a tobacco website. Among never-users, those who had visited tobacco company websites were 2.4 times more likely to be susceptible to cigarettes and 2.9 times more likely to be susceptible to e-cigarettes. Conclusions: Results indicate that more effective regulations are needed to prevent youth from accessing tobacco websites. Stricter age assurance procedures on websites could minimize exposure to tobacco websites by youth.'

Vaala, S. E., & Bleakley, A. (2015). Monitoring, mediating, and modeling: Parental influence on adolescent computer and internet use in the United States. *Journal of Children and Media*, 9(1), 40–57.

'Proliferating internet-accessible media have altered the home context, raising questions about parental influence on youth computer/internet use. This study examines parents' monitoring, internet mediation, and modeling behaviors as predictors of adolescents' computer/internet use among 629 US adolescents and their parents. Parents' time spent with computers was positively associated with teens' computer time, and parents' engagement in seven internet activities (e.g., IM/chat) also predicted teens' engagement in those activities. Greater general parental monitoring of adolescents predicted less teen engagement in IM/chat, social networking site use, video streaming, and multiplayer online games, while parental tracking of internet use predicted more teen IM/chat. Older teens spent more time with computers and in various internet activities and reported lower rates of general parental monitoring and parental internet mediation. Findings suggest that parents act as models for their children's internet use. Additionally, general parental practices not specific to media may affect youths' media behaviors as well.'

van Hoof, J. J. (2016). The effectiveness of ID readers and remote age assurance in enhancing compliance with the legal age limit for alcohol. *European Journal of Public Health*, 27(2), 357–359.

'Currently, two different age assurance systems (AVS) are implemented to enhance compliance with legal age limits for the sale of alcohol in the Netherlands. In this study, we tested the operational procedures and effectiveness of ID readers and remote age assurance technology in supermarkets during the sale of alcohol. Following a trained alcohol purchase protocol, eight mystery shoppers (both underage and in the branch's reference age) conducted 132 alcohol purchase attempts in stores that were equipped with ID readers or remote age assurance or were part of a control group. In stores equipped with an ID reader, 34% of the purchases were conducted without any mistakes (full compliance). In stores with remote age assurance, full compliance was achieved in 87% of the cases. The control group reached 57% compliance, which is in line with the national average. Stores with ID readers perform worse than stores with remote age assurance, and also worse than stores without any age assurance systems. For both systems, in addition to effectiveness, public support and user friendliness need to be investigated. This study shows that remote age assurance technology is a promising intervention that increases vendor compliance during the sales of age restricted products.'

van Hoof, J. J., et al. (2010). Shop floor compliance with age restrictions for tobacco sales: Remote versus in-store age assurance. *Journal of Adolescent Health*, 46(2), 197–199.

'To compare traditional in-store age assurance with a newly developed remote age assurance system, 100 cigarette purchase attempts were made by 15-year-old "mystery shoppers." The remote system led to a strong increase in compliance (96% vs. 12%), reflecting more identification requests and more sale refusals when adolescents showed their identification cards.'

Wardhana, S., et al. (2017). User interface design model for parental control: Application on mobile smartphone using user centered design method. *5th International Conference on Information and Communication*.

'This study presents a content control application usage on smartphones which can improve collaboration between children and parents. The importance of the parents' role is to provide a comprehension regarding the content of the application to children will make good communications between parents and children. So, the children can think and make decisions on something that they face. Parental control application is made to control and limit the use of applications on smartphones by children. But the existing application has a problem on the user interface. They designed just only show the same features that the application block by the parents and are not designed to involve children in the process of selecting applications. Thus, the chance of parents to help children understand the contents of the application could possibly be missed. Because the user interface is closely related to the tasks performed by users, the user interface has a role in a parental control application design. To build a good parental control application, it is necessary convenience when a user interacts with the application system. This is a consideration in this study that focused on the user interface. Design methods that will be used in designing the user interface is User Centered Design (UCD). UCD is a method in designing user interface design with a focus on what the user needs. This method will help research to provide user data that parents and children directly, so the search process more accurate data is obtained. UCD has a life cycle stage design, so the design is made to be better. The result of this research is obtained parental control application user interfaces that provide children's freedom in choosing the content of applications and needs of parents in educating children regarding the content of the application being used so parents can educate a child.'

Williams, R. S., et al. (2017). Cigarette sales to minors via the internet: How the story has changed in the wake of federal regulation. *Tobacco Control*, 26(4), 415–420.

'Objective To assess how easily minors can purchase cigarettes online and online cigarette vendors' compliance with federal age/ID assurance and shipping regulations, North Carolina's 2013 tobacco age assurance law, and federal prohibitions on the sale of non-menthol flavoured cigarettes or those labelled or advertised as 'light'. Methods In early 2014, 10 minors aged 14-17 attempted to purchase cigarettes by credit card and electronic check from 68 popular internet vendors. Results Minors received cigarettes from 32.4% of purchase attempts, all delivered by the US Postal Service (USPS) from overseas sellers. None failed due to age/ID assurance. All failures were due to payment processing problems. USPS left 63.6% of delivered orders at the door with the remainder handed to minors with no age assurance. 70.6% of vendors advertised light cigarettes and 60.3% flavoured, with 23.5% and 11.8%, respectively, delivered to the teens. Study credit cards were exposed to an estimated $7000 of fraudulent charges. Conclusions Despite years of regulations restricting internet cigarette sales, poor vendor compliance and lack of shipper and federal enforcement leaves minors still able to obtain cigarettes (including 'light' and flavoured) online. The internet cigarette marketplace has shifted overseas, exposing buyers to widespread credit card fraud. Federal agencies should rigorously enforce existing internet cigarette sales laws to prevent illegal shipments from reaching US consumers, shut down non-compliant and fraudulent websites, and stop the theft and fraudulent use of credit card information provided online. Future studies should assess whether these agencies begin adequately enforcing the existing laws.'

Williams, R. S., et al. (2015). Electronic cigarette sales to minors via the internet. *JAMA Pediatrics*, 169(3), 6.

'IMPORTANCE Electronic cigarettes (e-cigarettes) entered the US market in 2007 and, with little regulatory oversight, grew into a $2-billion-a-year industry by 2013. The Centers for Disease Control and Prevention has reported a trend of increasing e-cigarette use among teens, with use rates doubling from 2011

to 2012. While several studies have documented that teens can and do buy cigarettes online, to our knowledge, no studies have yet examined age assurance among Internet tobacco vendors selling e-cigarettes. OBJECTIVE To estimate the extent to which minors can successfully purchase e-cigarettes online and assess compliance with North Carolina's 2013 e-cigarette age-assurance law. In this cross-sectional study conducted from February 2014 to June 2014, 11 nonsmoking minors aged 14 to 17 years made supervised e-cigarette purchase attempts from 98 Internet e-cigarette vendors. Purchase attempts were made at the University of North Carolina Internet Tobacco Vendors Study project offices using credit cards. MAIN OUTCOME AND MEASURE Rate at which minors can successfully purchase e-cigarettes on the Internet. RESULTS Minors successfully received deliveries of e-cigarettes from 76.5% of purchase attempts, with no attempts by delivery companies to verify their ages at delivery and 95% of delivered orders simply left at the door. All delivered packages came from shipping companies that, according to company policy or federal regulation, do net ship cigarettes to consumers. Of the total orders, 18 failed for reasons unrelated to age assurance. Only 5 of the remaining 80 youth purchase attempts were rejected owing to age assurance, resulting in a youth buy rate of 93.7%. None of the vendors complied with North Carolina's e-cigarette age-assurance law. CONCLUSIONS AND RELEVANCE Minors are easily able to purchase e-cigarettes from the Internet because of an absence of age-assurance measures used by Internet e-cigarette vendors. Federal law should require and enforce rigorous age assurance for all e-cigarette sales as with the federal PACT (Prevent All Cigarette Trafficking) Act's requirements for age assurance in Internet cigarette sales.'

Williams, R. S., et al. (2020). Age assurance and online sales of little cigars and cigarillos to minors. *Tobacco Regulatory Science*, 6(2), 152–163.

'Objectives: In our cross-sectional study, we aimed to determine age assurance and sales of little cigars and cigarillos (LCCs) online to underage teens. Methods: We selected 100 popular Internet Little Cigar and Cigarillo Vendors (ILVs) for order attempts. From August to December 2015, we supervised 14 teens 14-17 years old making order attempts for LCCs. Results: Of the 91 valid orders attempted, we received 89. For the valid orders attempted, 9.9% of ILVs used no age assurance strategies at all, 84.6% used less effective forms of age assurance, and 50.5% used more effective ones. Only one order was blocked during the order attempt and only one attempt was made to verify age at delivery. Most (79.8%) deliveries were left at the door and only 2 order attempts were rejected because of age assurance strategies, resulting in a successful or valid buy rate of 97.8%. Conclusions: Our study demonstrated that ILVs selling LCCs were not making adequate efforts to verify the age of their customers, at the point-of-sale or point-of-delivery, facilitating easy access by minors. Few ILVs utilized age assurance strategies that prevented online sales of LCCs to underage teens.'

Williams, R. S., & and Ribisl, K. M. (2012). Internet alcohol sales to minors. *Archives of Pediatrics & Adolescent Medicine*, 166(9), 808–813.

'Objectives: To determine whether minors can successfully purchase alcohol online and to examine age assurance procedures at the points of order and delivery. Design: A cross-sectional study evaluated underage alcohol purchase attempts from 100 popular Internet vendors. Setting: The study was conducted at the University of North Carolina at Chapel Hill, July 14-27, 2011. Participants: Eight 18- to 20-year-old individuals participated. Outcome Measures: Rates of successful sales to minors and use of age assurance procedures at order and delivery were determined. Results: Of the 100 orders placed by the underage buyers, 45% were successfully received; 28% were rejected as the result of age assurance. Most vendors (59%) used weak, if any, age assurance at the point of order, and, of 45 successful orders, 23 (51%) used none. Age assurance at delivery was inconsistently conducted and, when attempted, failed about half of the time. Conclusions: Age assurance procedures used by Internet alcohol vendors do not adequately prevent online sales to minors. Shipping companies should work with their staff to improve administration of age assurance at delivery, and vendors should use rigorous age assurance at order and delivery. Further research should determine the proportion of minors who buy alcohol online and test purchases from more vendors to inform enforcement of existing policies and creation of new policies to reduce youth access to alcohol online.'

Wisniewski, P., et al. (2015). 'Preventative' vs. 'reactive': How parental mediation influences teens' social media privacy behaviors. Paper presented at the Proceedings of the 18th ACM Conference on Computer Supported Cooperative Work and Social Computing.

'Through an empirical, secondary analysis of 588 teens (ages 12 – 17) and one of their parents living in

the United States, we present useful insights into how parental privacy concerns for their teens and different parental mediation strategies (direct intervention versus active mediation) influence teen privacy concerns and privacy risk-taking and risk-coping privacy behaviors in social media. Our results suggest that the use of direct intervention by itself may have a suppressive effect on teens, reducing their exposure to online risks but also their ability to engage with others online and to learn how to effectively cope with online risks. Therefore, it may be beneficial for parents to combine active mediation with direct intervention so that they can protect their teens from severe online risks while empowering teens to engage with others online and learn to make good online privacy choices.'

Wisniewski, P., et al. (2017). Parents just don't understand: Why teens don't talk to parents about their online risk experiences. Paper presented at the 2017 ACM Conference on Computer Supported Cooperative Work and Social Computing (CSCW '17).

'Past research has shown that parents tend to underestimate the frequency with which their teens experience online risks. However, little is known about whether and how teens communicate with their parents when online risks do occur. In a two-month, web-based diary study of 68 teen-parent pairs, participants provided separate accounts of the teens' weekly online risk experiences. We found that most teens had little or no communication with their parents regarding their online risk experiences, and parents and teens shared very different perceptions and reactions when risks were reported, helping explain why communication was so poor. We discuss the implications of our results and make recommendations for how researchers and designers may work to improve the state of family communication regarding adolescent online risks in the future.'

Wisniewski, P., et al. (2014). Adolescent online safety: The 'moral' of the story. Paper presented at the CSCW 2014.

'Adolescence is characterized by heightened risk-taking and independence from parents; these tendencies seem to be magnified by the opportunities afforded through online interactions. Drawing on Kohlberg' s Cognitive Moral Development (CMD) theory, we conduct a qualitative study of 12 parent-adolescent dyads that examines the interplay between parenting behaviors and adolescent moral development. We show an association between adolescent moral judgment and online behavior, and we illustrate how parenting style and mediation strategies influence teens' moral growth and decision making about online behaviors. We also note that parental mediation strategies are moderated by parents' digital literacy: reduced digital literacy is associated with more restrictive or indulgent strategies; while more digitally competent parents are more likely to monitor and mediate their teen's behaviors as they engage online. We also found that experience, not restriction, facilitates the teen's moral growth.'

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