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Abstract.

'Cyberspace' has added a dimension to the ecology of the child and should be a starting point for practitioners (including police) to think about digital media in the context of child sexual abuse. While there is no evidence to suggest that online abuse and exploitation is a more serious offence than crimes occurring offline, the behaviours enabled by social media may present a significant risk factor for some children. This paper gives a brief overview of the phenomena and prevalence of online child sexual abuse and exploitation and the role that the Internet may play. This is considered in relation to deterrence, prevention and management of these crimes, and further develops a public health approach to online child abuse and exploitation. Finally, the paper critically considers emerging evidence to support this interaction between the individual and the online environment.

Introduction

This paper critically examines a public health approach to the prevention of online child abuse and exploitation and considers emerging evidence to support this person-situation stance, in which the online environment affects the individual and the individual in turn affects the online environment (Wortley, 2012a). We start with a brief overview of online child abuse and exploitation, which includes the production, dissemination and possession of child sexual abuse materials; online grooming; 'sexting'; 'sextortion'; revenge pornography; commercial sexual exploitation of children; exploitation through online prostitution; and live streaming of sexual abuse through the use of voice over Internet protocols, such as Skype (Quayle, 2016). Many of these forms of sexual abuse and

exploitation involve sexual images of children, taken during sexual abusive behaviour with an adult or peer, through persuading a child to take images, or capturing images with or without the child's knowledge (Quayle and Newman, 2015). These abuses predate the Internet and are not contingent on it, but the way that they present, and their global reach, are shaped and changed by technology.

There is evidence that the prevalence of crimes involving the possession of child sexual abuse images (CSAI) have increased with the rapid growth of the Internet and our ability to access it (Wolak et al., 2012a) meaning that there is a steady rise in the overall volume of images and the number of convictions by law enforcement. These increases took place in the context of growing legislative, judicial, law enforcement and media attention alongside severe sanctions in the US. Wortley (2012b) has suggested that, in the context of online child abuse and exploitation, the Internet is the cause of the problem, rather than simply being a platform that offenders choose to use, and that relying on traditional models of tertiary prevention (strategies used to prevent successive incidents after a crime has been committed, such as arrest and rehabilitation) cannot be the only solution to the problem. Wortley (2012b) also argues that while most men are not preferentially sexually attracted to children, they may be tempted or induced to engage in sexually exploitative behavior given the 'right' situational conditions (Wortley and Smallbone, 2006). To date, prevention of possession or distribution of CSAI has typically focused on understanding the individual and the risk that they pose to society (largely in the form of future sexual offences against a child). However, what has largely been ignored is how environmental cues shape and reinforce this type of offending behavior, particularly cues associated with the Internet. Wortley (2012b) describes this as a person-situation interaction, which opens up possibilities of addressing the situation side of

the equation to deter these crimes, rather than focusing on changing the offender. Understanding and preventing high risk individuals from committing CSAI crimes may, in the long run, not be time or cost effective, and may be short lived with respect to impact (Clarke *et al.*, 2012). Public health models focus on prevention through transforming individuals through changes to the environment. This still recognizes the value of prosecution and treatment, but rather than teaching people to navigate hazards, population approaches seek to remove the hazards altogether.

In 2016, the children's charity Barnardo's completed a survey of five of their sexual exploitation services in the UK (Fox and Kalcan, 2016) which included all children who received support in the previous six months. Seven-hundred and two children took part and 297 disclosed being 'groomed' online (establishing contact with a child, in person or using the Internet or other digital technologies, to enable online or offline sexual contact: Greijer and Doek, 2016) and two-thirds of these had met the perpetrator and were sexually exploited. Most children were female, aged 14-17, and over half of the cases involved multiple perpetrators. This snapshot is not presented as a representative survey, nor does it argue that online forms of abuse and exploitation are overtaking other forms of violence against children. It does, however, suggest that the omnipresence of technology (and its increasing invisibility) mean that we must expand how we think about contexts in which abusive practices can take place. Martin and Alaggia (2013) suggested 'cyberspace' has added a new dimension to the ecology of the child and should be a starting point for practitioners (including police) to think about digital media in the context of child sexual abuse.

This paper provides an overview of the attributes of the online environment that make possible child sexual abuse and exploitation in its various forms. It then moves to a consideration of the scale of the problem before examining the challenges of traditional ways of conceptualising deterrence, prevention and management of online sexual abuse and exploitation, and the ensuing focus on risk. The paper concludes with an overview of person-situation and public health models and then uses Clarke *et al.*'s (2012) matrix to describe interventions as occurring at three levels: primary (aimed at preventing harm from occurring), secondary (aimed at specific groups who are exposed to a risk factor) and tertiary (responding to populations who have been affected by the condition).

The role of the Internet

This section of the paper provides a brief overview of the role that the Internet may play in online child sexual abuse and exploitation by affording opportunities for people with a sexual interest in children to commit offences. Finkelhor (2014) argued that problems encountered in relation to digital technologies are not unique to that environment but are extensions of social interaction or media consumption. However, digital 'affordance' (the clues in the environment that indicate possibilities for action or makes possible an action: Gibson, 1979), force us to think about the relationship between Internet design and usage, which is associated with both risks and opportunities. The Internet has increased access and availability to content and people, alongside offering perceived anonymity (Cooper, 2009) and resulting disinhibition (Davidson and Gottschalk, 2011). However, technology affords distinctive opportunities to offend (Taylor and Quayle, 2006), and, for adolescents to take sexual risks (Staksrud *et al.*, 2013; Noll *et al.*, 2009; Sengupta and Chaudhuri, 2011) particularly through social media, affecting an individual's behaviour, mood and ways of

thinking (Davidson and Gottschalk, 2011; Guitton, 2013; Quayle *et al.*, 2014). Livingstone and Smith (2014) identified affordances of specific online sites and services as an important risk factor for harm to young people. For example, Mitchell *et al.*'s (2010) survey of US law enforcement indicated that social media were used to initiate sexual relationships, allow communication between victim and offender, provide and disseminate information and pictures about the victim, and contact the victim's friends. Social media might be said to 'afford' opportunities for offending where the focus is on the interaction between design and use. Staksrud *et al.* (2013) refer to privacy settings, where affordances shape practice, in that privacy settings distinguish between public, private, or semi-private communications. Nevertheless, users also shape affordances: children and adults setting up multiple profiles on social media to project different selves to different audiences.

Prevalence of online abuse and exploitation.

Estimating the scale of a problem is important in determining what resources and strategies are needed to prevent or disrupt a given crime. While it would appear that crimes involving online sexual abuse and exploitation are increasing, the data that we have with which to support this is limited and the strongest studies in this area are now quite old. Estimates of the prevalence of these crimes, have relied on general population surveys of children (e.g. Fisher *et al.*, 2015) and law enforcement data (e.g. Wolak *et al.*, 2012a), largely related to production and possession of child abuse images and online grooming and solicitation cases (a recent review is provided by Wagner *et al.*, 2018). Little is known about the prevalence of, for example, sextortion cases or live streaming of sexual abuse. The largest data sets come from the US longitudinal National Juvenile Online Victimization Study (NJOV: Walsh *et al.*, 2012) collected at three time points (2000, 2006, 2009) over two phases: a postal survey

of law enforcement agencies and telephone interviews. Between 2000 and 2006 there was a substantial increase in arrests, with approximately half related to image possession. Arrests for image production increased by 30% between 2000 - 2006 and doubled 2006 - 2009. This reflected a large increase in offenders known to their victims (family and acquaintance offenders) and production associated with 'youth-produced sexual images', taken by children 17 and under, and which met the US legal definition of child pornography (also referred to as sexting). Most of those arrested were adults who had solicited images from a minor, and many victims were adolescent and known offline to the person arrested. In 2009, 37% of arrests were adults who had taken images of minors, and 39% where minors had been enticed to produce images of themselves (Wolak et al., 2012b).

The 2009 data indicated that most victims were aged 13-17, and more than half of those arrested had committed a contact sexual-offence documented in the images taken. Wolak et al. (2012b) described most of these offences as 'non-violent', in that children were persuaded or pressured into the activity, rather than forced, although in 2009, 45% of cases involved penetrative sex. Trends in arrests for possession suggested that most arrested offenders had images of children aged 6-12, female and depicted sexual penetration of a child. In the UK, McManus and Almond (2014) indicated that convictions for taking, making or distributing child abuse images increased by 35% from 2005/2006 to 2012/2013, with 2515 offences reported 2012/2013 for possession. However, a reliance on criminal justice data is certain to under-represent the scale of the problem and it is impossible to determine how many people are accessing CSAI online because many offences go undetected (Bryce and Fraser, 2014). Ease of access to CSAI afforded by the Internet has created a significant global problem.

Consequently, there has been a considerable drive to deter access to, and viewing of CSAI online, from governments, law enforcement and industry.

Deterrence, prevention and management of online sexual abuse and exploitation.

While it would appear that a substantial number of online child sexual abuse crimes are being committed, the response to this has largely been on identification, arrest and prosecution of offenders, rather than on deterrence. A publication by the NSPCC (Jutte, 2016) called for action to tackle the demand for, and supply of, sexual abuse images. The report acknowledged the collaborative work of stakeholders, including the IT industry, to block and remove illegal content, but concluded that sharing information about what measures work, and which are less effective, cannot be optional. Her suggestion that law enforcement could not 'arrest their way' (p43) out of the problem, was echoed by UK Chief Constable Simon Bailey, the National Police Chiefs Council lead on child protection, who was reported as saying that police were struggling to cope with the huge numbers of people looking at indecent images of children online and should focus their resources on those who were high-risk offenders (Guardian, 2017) as a way of managing these crimes. This diversion of resources to target those at high risk of a contact offence provoked considerable debate as to what strategies would then be used (if any) with those offenders deemed to be at lower risk. However, while there is some evidence that having a specialised law enforcement task force does increase the number of investigations and the number of arrests for possession (Marcum *et al.*, 2010) there is no evidence that providing more resources acts as a deterrent to future offending.

Paternoster and Simpson (1993) argued that crimes can be deterred but not prevented, although prevention can flow from deterrence. A prison sentence, for example, means that for a given duration, an offender is prevented from committing a crime in public and this specific deterrence becomes coterminous with prevention. Kennedy (2008) suggested that criminal sanctions have multiple functions: they act as punishment, fulfil the need for justice, express public standards and priorities, and incapacitate or control. This places deterrence at the centre of criminal justice aspirations to prevent crime (Nagin *et al.*, 2015). According to deterrence theory, crime occurs when the expected rewards outweigh the anticipated risks: increasing risk will prevent most crimes in most circumstances. However, not all offenders have the capacity or will to perform this risk calculation (Jacobs, 2010). It may be that reductions in the frequency, duration and severity of crime linked to deterrents are crime-contingent and, in part offset by offenders becoming more engaged in criminal networks and more willing to take risks as they perceive their adaptations to avoid arrest as effective (Moeller *et al.*, 2016). However, Henzey (2011) has argued that the current enforcement paradigm is not adequately deterring the production, distribution and possession of online child abuse and exploitation material. The increase in these crimes in the US took place despite growing legislative, judicial, law enforcement and media attention and in the context of increased sanctions where, for a first-time offender, a conviction for possession of 'child pornography' would carry a sentence of 0-10 years in federal custody (Hobson, 2015).

Little is known about how we might distinguish the effects of punishments and sanction threats on people convicted for production or possession of online abuse and exploitation images (specific deterrence) and the effect on the public (general deterrence) (see Piquero

et al., 2011). Nor have we differentiated between objective (actual risks of punishment and apprehension) and subjective sanctions (individual perceptions of certainty, severity, and celerity of punishment) on the probability of an individual to offend (Paternoster, 1987).

Finally, there is need to distinguish between sanction threats preventing criminal involvement completely (absolute deterrence) and punishment threats reducing the frequency and severity of individual offending (restrictive deterrence) (Jacobs, 2010).

According to Gibbs (1975), restrictive deterrence applies to offenders who commit an act of crime at least once and is concerned primarily with reduction in the frequency of offending.

However, the preoccupation of law enforcement and politicians in relation to online offenders has not been so much on deterrence of future image-possession offences, but the offenders potential escalation to contact sexual offences against children.

Online offenders and risk.

This preoccupation by law-enforcement and media with the risk of people who commit online crimes against children having a history of undetected contact offences, or an increased risk of future offences against children to whom they have access to, is understandable. Most studies of online abuse and exploitation have focused on the individual offender to help understand the personal characteristics and motivations of offenders who view indecent images of children (Seto *et al.*, 2011) and to prioritise which offenders pose the greatest risk (and presumably offences which we need to prevent). This has led to the development of specific risk appraisal tools, such as KIRAT (Kent Internet Risk Assessment Tool: Long *et al.*, 2016) and CPORT (Child Pornography Offender Risk Tool: Seto and Eke, 2015). Many of these offender-focused studies ask questions about the ways that 'online offenders' may be similar or different to contact offenders against children

(Babchishin *et al.*, 2015) and conclude that online offenders are different. They show greater psychological barriers to offending, higher levels of empathic concern and poorer self-management, socio-affective deficits (Henry *et al.*, 2010), and obsessive-compulsive disorder and loneliness (Marshall *et al.*, 2012). Sexual images of children also appear to meet needs relating to problems with attachment relationships and intimacy in online offenders (Armstrong and Mellor, 2016) along with early sexual experiences (Wood, 2011). Reports of less interpersonal warmth (Jung *et al.*, 2013; Magaletta *et al.*, 2014) may not signal a dislike of interpersonal relationships but a lack of social skills, making close relationships uncomfortable and anxiety provoking. However, the presence of self-control and supportive marital relationships may act as protective factors (Clevenger *et al.*, 2016).

There is an overlap between offenders that produce and exchange images and those who solicit images as part of their online engagement with minors (Quayle and Newman, 2016) along with wide variation in sexual preoccupation with images and motivation to offend, particularly in relation to contact offences (Merdian *et al.*, 2014). However, stereotypes, particularly in relation to assumptions about all members of this offence group having a sexual orientation towards pre-pubescent children (paedophiles), being exclusively adult males and strongly motivated to offend (Finkelhor, 2009) are widespread, and this may undermine the importance of diversity in their sexual behaviour and motivation to offend, and the implications for the forms that deterrence may take and their application to offenders.

Person-situation approaches and public health models.

The final section of this paper argues for a change of direction in how deterrence is approached. Rather than responding to crimes once they have happened, person-situation approaches and public health models argue for a proactive initiative in shaping the environment in such a way as to reduce the likelihood of offending, or reoffending. In doing so we expand the matrix provided by Clarke *et al.* (2012) to look at prevention across three levels: Primary, secondary and tertiary. Within each of these levels we examine the evidence of deterrence activities in relation to children, offenders and the Internet as the 'environment'.

Research on risk assessment, prioritisation and management have largely focused on individuals who have been charged, or convicted, of offences. Exceptions are the Dunkelfeld project (Schaefer *et al.*, 2010) and online survey data from Dombert *et al.*, (2015) of 8,718 German men from the general population. Rather than high risk populations being the focus, Wortley (2012) has argued for a different theoretical approach to the prevention of online abuse and exploitation crimes, seeing them as the result of a person-situation interaction rather than a result of the psychological characteristics of the individual. To date, there has been little consideration of this by either politicians or law enforcement.

Kenny and Wurtele (2012) provide an ecological approach to child sexual abuse prevention, which is compatible with person-situation approaches and emphasises that behaviors happen within a context. Bidirectional transactions between human beings and the systems in which they interact moves away from examining only individual-level activities to systematic strategies to change macrosystem characteristics, such as legislation and social norms. Parks *et al.*, (2010) suggested that at this broadest context, levels of prevention

include: influencing policy and legislation, changing organizational practices, fostering coalitions and networks, educating providers, promoting community education, and strengthening individual knowledge and skills. Wurtele and Kenny (2016) suggest such an approach in relation to technology-related sexual solicitation of youth and described cyber-safety websites and educational programmes, resources and information for parents and caregivers.

Situational prevention of online abuse and exploitation requires strategies that reduce, for example, opportunities for accessing children, as well as illegal images, by making the activity less rewarding, more difficult, and riskier (Leclerc *et al.*, 2015). This takes a whole population, rather than a risky population, approach. It does not require us to make assumptions about deviant subgroups and acknowledges the uncomfortable reality that interest in sexual media of minors might be higher than is seen in the known offender population (Dombert *et al.*, 2016). A situational prevention approach (Clarke, 1997; Cornish and Clarke, 2003) is congruent with public health models. It is designed to prevent a problem before it occurs and is directed at environments that afford opportunities for unwanted behaviour. In addition to increasing efforts, increasing risk and reducing rewards, later models of this approach included two additional strategies: reducing provocations and removing excuses. These move the focus back to the offender by targeting motivation to offend. Farrell (2010) suggested the 'situational' approach aims to reduce society's harms and improve quality of life by modifying the design of products, systems and environments, which can range from simple and cheap measures to complex, expensive technologies. In the context of child abuse, society is gradually developing an extensive repertoire of situational responses, from routine practices such as accompanying children, mandatory

employee background checks, teaching parents and teachers how to recognise sexual grooming, monitoring Internet chat rooms, glass panels in office doors and supervision of spaces that children use, such as swimming pool changing rooms (Wortley, 2006). This has also extended into the digital environment (Taylor & Quayle, 2006). Wurtele and Kenny (2012) give, as an example, the Boy Scouts of America's social media guidelines, which make clear that all communication between adult leaders and scouts be via public, not private, social media channels.

Clarke et al. (2012) have advocated a further person-situation approach in public health models, which have been employed in relation to child maltreatment (Herrenkohl *et al.*, 2016), interpersonal violence (McCaughey and Cermele, 2017) and child sexual abuse and exploitation (Letourneau, *et al.*, 2014; Mian and Collin-Vézina. 2017). Public health approaches use strategies that are population based, multidisciplinary, evidence based, and iterative, with evidence reviewed and programs and interventions modified accordingly (Herrenkohl *et al.*, 2016). The model seeks to identify specific risk and protective factors for the problem in question, and engages in population-level strategies that reduce (or remove) the size, strength, or scope of the risk factor(s). Where risk factors are already evident for subgroups of the population, interventions reduce the impact of the risk factors and maximise the protective factors. In so doing, the problem's impact is minimised. Public health interventions may include individual-led strategies, but do prioritise change that can occur at the population level as this has greater potential to have widespread effects. Individual approaches which target high-risk individuals are clearly important. For example, the Dunkelfeld Programme (Beier and Neutze, 2012) was designed to provide treatment for people within the community who were seeking help to prevent offending against children

both online and offline (primary prevention), or from committing further offences (secondary prevention). The target group therefore consisted of people, troubled by their sexual preferences or behaviour involving pre- and pubescent children.

Such interventions are resource-intensive and require sustained effort to respond to future high-risk individuals, while population strategies attempt to create a safer Internet, by making it harder for offenders to contact children online, reducing the number of online sexual images of children, and by making access more difficult. These types of long-lasting change, even where small, might have significant impacts in preventing exploitation when implemented across large populations (Clarke *et al.*, 2012). Public health interventions target the 'host' (the person or population with the condition), 'agent' (the organism causing the condition) and 'environment' (the place where the host and agent connect or interact) (Haddon, 1980; Runyan, 1998). Haddon's "Matrix" describes interventions as occurring at three levels: primary (aimed at preventing harm from occurring), secondary (aimed at specific groups who are exposed to a risk factor) and tertiary (responding to populations who have been affected by the condition) (McMahon, 2000). Clarke *et al.* (2012) applied this model to child sexual abuse and exploitation crimes. Within the matrix, they identified children as 'host', offenders as 'agent' or 'vector', and the Internet as the 'environment'. Table one gives examples of interventions in relation to online abuse and exploitation of children, which is followed by a discussion of the limited evidence base. Primary, secondary and tertiary intervention strategies are considered in relation to children, offenders and the Internet.

Table 1.

Pre-event strategies: primary prevention.

The NSPCC report 'Preventing Child Sexual Abuse' (Brown and Saied-Tessier, 2015) discussed a public health approach involving social change from all elements of society to effect primary prevention of CSA. The report refers to the Lucy Faithfull Foundation initiative, which provides a database of intervention approaches across different levels of the prevention matrix (Lucy Faithfull Foundation, 2018a). Brown and Saied-Tessier (2015) examined the evidence for what works across several primary intervention approaches, including: education programmes for children, parents, carers, and professionals; relationship-based interventions (targeting by-standers); situational crime prevention community programmes; and societal-level interventions (media campaigns). While there is some support for the position that educating children helps them identify dangerous situations and prevents abuse, Topping and Barron (2009) found little evidence in their systematic review of education programmes of any change in children's behaviour (including levels of disclosure). Jones *et al.*, (2014a) reviewed 31 meta-analyses of prevention education programmes (including substance abuse, risky sexual behavior and delinquency) and concluded that the key to success was active, skill-based lessons, focused on research evidence of causal and risk factors, and provided with adequate dosage. Jones, Mitchell and Walsh's (2014b) content analysis of four Internet Safety Education Programmes indicated that most were not incorporating proven education strategies and lacked any strong evidence base. They also challenged whether messages would be better delivered through broader youth safety prevention programs versus stand-alone lessons. There is limited evidence of what works for parents, carers and professionals in relation to CSA, and to date there have been very few evaluations of effectiveness in relation to online safety.

The role of parental supervision in preventing online harm is also equivocal, in part because harm is often conflated with risk. Sasson and Mesch (2014), in a sample of 495 children aged 10-18, found that after controlling for age, gender, time spent online and online activities, only restrictive parental supervision had a significant effect on cyber-aggression. However, this form of supervision was associated with an increase in adolescent risky online behaviour. Perceived peer approval of risk-taking reduced the effect of parental restrictions. Helsper *et al.*, (2013) indicated, from the EU Kids Online data, concern that both too much parental protection through restrictions, and the lack of support for children's online use, might in fact lead to higher levels of harm when risk is encountered.

The evidence of primary prevention strategies in relation to adults at risk of offending is promising but poorly developed. This focus on education is a recurrent theme in promoting Internet safety (e.g. Moreno *et al.*, 2013; Wurtele and Kenny, 2016), however, while education of children is unlikely to have a direct impact on offender behaviour, directing education campaigns at the general public may (through for example, online information), impact on potential and actual offenders in seeking help (e.g. the recent campaign by Stop It Now (BBC, 2017) and the Dunkelfeld Project in Germany: Beier *et al.*, 2009), and the ability of others within both the offender's and the victim's immediate social environment to interrupt this activity. Online self-help material for people worried about their thoughts and behaviours has been available for some time through Stop It Now and more recently has been translated and piloted by Save the Children, Finland (Häikiö and Uusoksa, 2016). Their website, based on the original www.croga.org material, aimed to increase self-awareness of potential offenders and to help them control problematic behaviour. Since the development

of the Finnish-language version, there has been a large amount of traffic to the site and an evaluation of its effectiveness is currently underway.

There are some positive indicators in relation to Internet monitoring, moderation and reporting of problematic content or behaviour. These technical solutions change the Internet environment. An example is a new development by the Canadian Centre for Child Protection of a tool (Arachnid) to detect images and videos based on confirmed digital fingerprints of illegal content and combat the growing proliferation of child sexual abuse material on the Internet. This innovative tool is claimed to detect content at a speed considerably faster than current methods. They report that the automated crawler helps reduce the online availability of child sexual abuse material through its identification and issuing of a notice to the hosting provider requesting its removal. Over a six-week period the tool detected over 40,000 unique images of child sexual abuse and exploitation (Cybertip.ca, 2018.) However, to date it is unclear whether these notices were actioned by law enforcement or if this impacts on offending behaviour.

Disruption tactics, such as blocking efforts by Google and Microsoft, resulted in a 67% drop over 12 months in web-based searches for abuse images compared with no blocking activities from Yandex (Steel, 2015). Such disruption tactics reduce the number of images available through simple searching, which is important as the presence of easily available indecent images, and high levels of Internet use, are risk factors in Internet offending (Babchishin *et al.*, 2015). For some, image-related offences are not solitary activities but occur within a social context both in relation to website searching (Westlake & Bouchard, 2016) as well as p2p networks (Wolak *et al.*, 2014) which may provide a good indication of for whom (and how) deterrents may be targeted.

Public awareness campaigns by the Dunkelfeld project (Beier and Neutze, 2012) and Stop It Now to encourage people to seek help before offences are carried out resulted in dramatic increases in help-seeking behaviour, and evidence from Germany of an increase in self-referrals for treatment. The German Google AdWords-advertisements of the Dunkelfeld project started in Jan. 2012, and the English version in July 2012. Until the end of February 2016, advertisements were placed more than 29,000,000 times, resulting in more than 370,000 clicks on both websites (Beier, personal communication). There is also evidence of the role of helplines as a form of help-seeking behaviour (e.g. Gorts *et al.*, 2016) along with primary prevention programmes such as the Dunkelfeld initiative for both adults (Beier *et al.*, 2015) and adolescents (Beier *et al.*, 2016). Raising awareness about sexual abuse and exploitation images of children has also targeted both the advertising and media industry. Examples include the report on ‘corporate paedophilia’ from the Australia Institute (Rush and La Nauze, 2006) in relation to advertising and marketing companies using sexualized images of children, and from Save the Children Denmark of images in the ‘grey area’ (including ‘child-modeling’ images: Pihl *et al.*, 2014) and tools developed by German initiative I-kiz to restrict sexual exploitation of regular family photos or model pictures (Save the Children, 2018). To date, there has been little formal evaluation in relation to these initiatives.

Event strategies (secondary intervention).

In 2015/16 Childline UK reported over 11,000 counseling sessions to children about online issues including viewing harmful or distressing content, sharing sexual content (sexting), grooming and sexual exploitation, online bullying and internet safety (NSPCC, 2016). One third of these were reports of online sexual abuse. Reports were also made to hotlines by

the public who had encountered online media or behaviour that they thought depicted child abuse and exploitation. The UK Internet Watch Foundation (IWF) in 2016 identified 59,550 reports of illegal content. In an analysis of 264 reports to the Canadian hotline (Cybertip.ca) of confirmed online grooming, one third of the children demonstrated resistance to suspects, and despite persistent sexually explicit behaviour, they terminated the contact (Quayle and Newman, 2016). There were various ways that this was achieved from disclosing what had happened to another person, through to simple strategies such as blocking or deleting the suspect. Almost one third of these reports were made by the victims.

Activity over the last ten years by the US Financial Coalition Against Child Pornography, involving banks, credit card companies, electronic payment networks, third-party-payments companies, and Internet services companies, resulted in a 55% drop in the number of commercial child abuse image websites reported to the U.S. CyberTipline (ICMEC, n.d.). Websites offering child abuse images now frequently direct buyers away from traditional payment methods such as credit cards. Instead, they recommend more complicated alternatives that may dissuade potential purchasers. The IWF (2016) reported the identification and removal of 57,335 webpages containing child sexual abuse images or videos, having links to the imagery or advertising it. They produce a list of webpage addresses hosted abroad for companies who want to block or filter them to protect their users and to prevent repeat victimisation. This list is updated twice a day, and both removes and adds identified URLs. The IWF (2016) also sends Virtual Currency Alerts where they identify Bitcoin wallets associated with child sexual abuse imagery, enabling Internet Service Providers to act to disrupt this activity. In the 2003 UK police set up Operation PIN, which

included forces in Canada and Australia, which established online portals which appeared to offer child abuse and exploitation images. This was one of the first attempts to deter these crimes, as when attempts were made to access images a pop up message informed them that they had attempted to access illegal material, that their IP address had been seized and that they could face prosecution (BBC, 2003). More recently EUROPOL established the Police2Peer initiative which makes available, on peer to peer networks, images that appear to be of children being abused, coming from someone with a sexual interest in children. Attempts to download such a file, or make their illegal files available on the network, results in either a file without any content or pictures of police officers informing the person of the risks they are taking (EUROPOL, 2017). Similar initiatives with the goal of making search more difficult, have been used, for example by Microsoft, who in 2003 began to provide pop-up messages associated with search terms known to be linked with illegal content.

In terms of targeting the social environment, probably the most concerted effort to try and harmonise laws and practices concerning child sexual abuse and exploitation images has come from the International Center for Missing and Exploited Children (ICMEC). Since 2006 they have been publishing reports analysing the presence and adequacy of country-specific laws and developed 'model legislation' that can be used by other countries and adapted according societal or cultural norms. This encourages countries to make 'child pornography' illegal; criminalise computer-facilitated offences; criminalise simple possession (without having to demonstrate intention to distribute images); require Internet Service Providers (ISPs) to report suspected 'child pornography' to law enforcement or to another relevant agency; and to require ISPs to develop and implement data retention and preservation provisions. In 2006 only 27 countries had enacted legislation, a number that by 2016 had

risen to 82 (ICMEC, 2016). These reports are both accessible and widely cited and have no doubt played an important part in legislative and practice changes.

Post-event strategies (tertiary prevention).

Assistance and recovery programmes for children who have been subjected to online abuse and exploitation have been slow to develop, and focus largely on professional challenges (e.g. von Weiler *et al.*, 2010) due to the perceived permanence of images of abuse and exploitation (Wells and Mitchell, 2007) and the knowledge that these images may be viewed and used by others. Most children are referred to counselling centres or therapists through youth welfare services, other public services or the police, and interventions are largely based on trauma treatment models to stabilise victims and to facilitate disclosure and recovery (e.g. Leonard, 2010; Martin 2014a, 2014b). For victims, feelings of loss of control may be associated with anger, self-blame and humiliation (Martin 2014a; 2014b; Slane, 2015; Cooper, 2011) and can enhance victim trauma in addition to that from sexual abuse (e.g. Say *et al.*, 2015). To date, there is a limited evidence base concerning the effectiveness of victim support. Jansen's (2011) Danish research, based on 28 children (four boys, 24 girls), aged 11-16 years compared with a control group of non-ICT-related sexual abuse children (n=405) indicated that the approach most commonly used for online abuse was a combination of family therapy, narrative practice and trauma-focused therapy. Importantly, for Jansen (2011) online victimisation is distinctive due to persistent feelings of connectedness to the offender, responsibility and shame, because young people may have self-presented in a sexualised way and as willing participants. Similar observations have been made about commercially sexually exploited children (Hickle & Hallett, 2016).

There is evidence of the effectiveness of police activity, particularly proactive policing (e.g. Operation Latisse in 2016 where Police Scotland seized 30 million indecent images and charged 77 people: Adams, 2016) although it is unclear what level of public awareness is of this activity. There is also limited evidence of treatment of offenders. However in 2006, a UK-accredited treatment programme was developed (iSOTP) and clinical impact was assessed following completion of pre and post-psychometric assessments by 264 convicted offenders (Middleton *et al.*, 2009). This indicated improvements in socio-affective functioning and a decrease in pro-offending attitudes. Other treatment developments in the UK, such as Inform and Inform Plus, developed by The Lucy Faithful Foundation, provide a structured psychoeducation programme for Internet offenders (Lucy Faithful Foundation, 2018b). Gillespie *et al.*'s (2015) evaluation of eleven Inform Plus groups suggested they enabled participants to face being arrested and/or convicted, helped them develop a greater understanding of their offending behaviour and how to establish a non-offending life. Delmonico and Griffin (2008) also outline additional assessment and treatment strategies. However, many Internet offenders and treatment providers face challenges of addressing both deviant sexual interests and behaviors while managing cases within more generic sex offender treatment programmes (Quayle and Hayes, 2014).

It is relevant to ask why most men do not seem to progress to offline offences and may desist from future offending. Process models (e.g. Quayle and Taylor, 2003) acknowledge that a fraction (the size of which is impossible to quantify) of people who download abuse and exploitation images are likely to stop doing so at some point. This may be because the images as stimuli are no longer arousing, or because their behaviour is part of a wider interest in all forms of sexual materials, including 'extreme' pornography (Elliott and Beech,

2009). However, some people clearly struggle with their sexual feelings and behaviours and will try to avoid situations that facilitate accessing related content (Goode, 2010) or opt for using monitoring software to manage their behaviour (Elliott *et al.*, 2010).

Probably the most ambitious, and for victims the most important, intervention has been the identification and removal of child sexual abuse images as a means of changing the Internet environment. The development of Microsoft's PhotoDNA which was first released to vetted organization in 2009 with the goal and detecting and reporting online abuse and exploitation images (Microsoft, 2018). It uses known images held by organisations such as the National Center for Missing and Exploited Children (NCMEC). The PhotoDNA cloud service hashes and converts identified images into numerical values that are matched against the known hashes. The hashing process is a mathematical algorithm which produces a hexadecimal numeric value relating to binary data. A hash value is a small, convenient number used to track or sort an arbitrary block of data. Each image file hash value is represented by a unique string of 32 characters, effectively without visible order, sequence, or connection to the actual file name or content of the image (Quayle and Jones, 2011). By creating unique 'hashes' of child abuse and exploitation images, the process of detecting and removing illegal content is made more efficient and content can be identified and removed quickly allowing law enforcement to focus on images that are new and are of children who have not yet been identified. PhotoDNA can distinguish and flag images even if they have been altered. Microsoft recently reported the use of PhotoDNA by a Canadian social media company 'to detect exploitive profile photos as they're being uploaded, so the company can immediately remove them, report them to law enforcement and remove the user's account' (Ith, 2015). Thorn (2016) estimated that in the previous year, because of

PhotoDNA, the technology industry was able to disrupt the distribution of over 4 million images, a four-fold increase over 2014.

Enforcement of laws and adequate child protection policies have been central to tertiary prevention aimed at social environment norms. Jeney (2015) provides an overview of existing legislation at European Union, member states and the international level related to online child sexual abuse. In addition, the study examines the role of law enforcement agencies in combatting online child sexual abuse and takes account of other initiatives, such as the Global Alliance against child sexual abuse online. Jeney (2015) concluded that there is a need to revisit the blocking/removing of child sexual abuse content and the registration of sex offenders, or other solutions, to ensure that cross-border movement does not eradicate a criminal past. From a law-enforcement policy formulation she noted the importance of victim identification to eradicate the availability of sexual images, infiltration by law enforcement, access to retained data by ISPs, and management of convicted offenders. Of importance, there is also an emphasis on child-friendly justice, which provides protection, assistance and support to child victims by trained staff throughout the investigation and prosecution of online child sexual abuse offences. In addition, court procedures need to be monitored and adapted on a regular basis. She concluded that, 'Any policy formulation should necessarily involve law enforcement authorities, agencies working in the field of social services and with children, the ICT industry, private and nongovernmental stakeholders, so as to ensure a multidisciplinary and multiagency approach, which is of utmost importance for effectively combatting child sexual abuse online' (p48). Quilter (2016), in her review of the scope and limits of criminal law on sexual violence in the digital age, also concluded that while the intervention of criminal law is important, attention

should be paid to policies and practices of educators, law enforcement, service providers, online communities and social media to promote equal and ethical digital citizenship.

Conclusion.

Over the last 20 years we have seen a high level of collaboration between law enforcement, industry, child protection services, prison and probation services, educational organisations, families, financial services and civil society, alongside charities, government and non-government organisations to work towards preventing and managing online abuse and exploitation of children. It is this cross-disciplinary, multi-stakeholder approach that has been so effective in increasing awareness, limiting access, reducing content and offering support to victims as well as those worried about their thoughts and compulsions and helping manage those who have committed an offence. Population strategies seek to remove the underlying causes of these offenses: an unsafe Internet environment and low levels of deterrence for potential offenders. These kinds of long-lasting change, even if they are small, can have significant impacts in preventing exploitation when implemented across large populations. Rather than just teaching children how to avoid the dangers posed by sexual predators and making prevention the responsibility of the child victims, they argue that society must work towards creating a safer, healthy world for children. As Internet access reaches more children in poverty and in developing countries, the importance of this approach is even more profound. To date, there is limited evidence about 'what works' which clearly needs addressing to ensure that we do not engage in costly and time-intensive activities which may not be successful. However, a person-situation perspective provides a coherent approach that potentially involves all stakeholders.

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Table 1. Public health matrix of online abuse and exploitation (adapted from Clarke et al. (2012)).

	Host (children)	Vector (offenders)	Physical environment (Internet)	Social environment (norms/policies)
Pre-event (preventing image distribution)	Awareness raising & education Parental supervision	Counselling for adults at risk of offending. Self-help programmes.	Internet monitoring Report mechanisms. Chat moderation.	Media campaigns. Pressure on advertising and media industry.
Event (reducing negative impact)	Helplines for reporting. Treatment referrals.	Financial restrictions on image purchase. Increasing difficulty of access.	Pop-up warnings and adds linked to known search terms. Increasing difficulty of access.	ISP codes of practice. Co-ordination of laws and penalties.
Post-event (reducing negative outcomes)	Assistance and recovery programmes	Prosecution of offenders. Treatment.	Identification and removal of images. Hotlines.	Enforcement of laws. Adequate child protection policies.