



Problematic Pornography Use: Legal and Health Policy Considerations

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Abstract

Purpose of Review Reports of sexual violence, especially towards women and children, are rapidly increasing. At the same time, rates of problematic pornography use (PPU) are accelerating across the world too. The purpose of this review is to consider the recent research on PPU and its contribution to sexual violence. The article offers guidance to governments on possible health policy interventions and legal actions to prevent the development of PPU and to reduce the incidence of sexual violence in society.

Recent Findings Working from the consumer's point of view, we identify PPU and ask how much pornography is needed to cause PPU. We examine how PPU drives sexual offending in children, adolescents and adults. The impact of PPU on some consumers' behaviour suggests significant links to domestic violence. Sexual strangulation is highlighted as an example. Artificial intelligence algorithms play a key role in the pornography industry and appear to be driving escalation to more violent material, inducing high levels of sexual dysfunction in consumers and creating appetites for viewing child sexual abuse material (CSAM).

Summary Easy access to internet pornography has led to an increase in PPU and sexual violence. Diagnoses and treatments for PPU are examined, as are legal transgressions of a civil and criminal nature arising from PPU. Legal remedies and government policy implications are discussed from the point of view of the precautionary principle. Strategies covered include age verification for pornography, public health campaigns and embedded health and legal warnings for users at the start of pornography sessions along with lessons for pupils about pornography's impact on the brain.

Keywords Problematic pornography use · Age verification · Public health campaign · Precautionary principle · Pornography health warnings · Lesson plans

Introduction

From around 2008, the availability of internet pornography through mobile technology created the ideal conditions of Cooper's triple-A engine, namely, that pornography is accessible, affordable and anonymous [1]. It has led to intensified and accelerated online sexual activity. Today pornography is mostly delivered through the device in one's pocket.

Alongside the rapid spread of internet use, the rate of harms to mental and physical health in frequent users of pornography has been accelerating too [2]. Increasing numbers of users are reporting out of control or problematic pornography use (PPU). The numbers are highly variable and depend heavily on the population described and whether PPU is self-assessed or externally determined [3, 4]. In 2015, data on Spanish university students identified 9% with a risky behaviour profile and pathological use rates of 1.7% in men and 0.1% in women [5]. Within an Australian representative population sample, the number of people reporting negative effects rose from 7% reported in 2007 to 12% in 2018 [6].

PPU not only affects the user but can also influence their behaviour towards others. High levels of PPU affect the way society functions. Over the past decade, a substantial academic literature has developed which indicates clear relationships between the consumption of pornography,

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particularly violent pornography, and the behaviour of men and children towards women and children [7–10]. Pornography use, both in legal and illegal forms, can be a contributing factor in crimes such as the possession of indecent images of children or the consumption of child sexual abuse material (CSAM) [11–16]. It can also increase the likelihood and severity of rape, domestic violence, sexual assault, sharing of personal intimate images without consent, cyber flashing, sexual harassment and online harassment [17–22].

Addictive behaviours of any kind, including to internet pornography, affect a person's ability to control their emotions; their desire to repeat use of the stimulus; to be susceptible to advertising and above all, to inhibit antisocial behaviour such as coercion, harassment and sexual abuse [23–25].

Development of PPU

We consider that the recent study by Castro-Calvo and others gives a good working definition of PPU.

“As for its conceptualization and classification, PPU has been considered as a subtype of Hypersexual Disorder (HD; [26]), as a form of Sexual Addiction (SA; [27]), or as a manifestation of Compulsive Sexual Behavior Disorder (CSBD; [28]) ... As a result, current trends in out-of-control sexual behaviors consider PPU as a subtype of SA/HD/CSBD (the most prominent indeed) rather than as an independent clinical condition [29], and also assume that many patients presenting with SA/HD/CSBD will show PPU as their primary problematic sexual behavior. At a practical level, this means that many patients presenting with PPU will be diagnosed with one of this ‘general’ clinical labels, and PPU will emerge as a specifier within this diagnostic framework” [30].

Within the World Health Organization's framework, PPU can be diagnosed as compulsive sexual behaviour disorder, or as recently suggested by Brand and others, under “Disorders due to addictive behaviours” [31].

How do pornography users develop PPU? The commercial pornography companies are using the same techniques as the rest of the internet industry to make their applications “sticky”. Pornography sites are specifically designed to keep people watching, clicking and scrolling. Consumers view pornography and masturbate to give themselves a powerful neurochemical reward via orgasm. This cycle is a self-reinforcing process of ratcheting up sexual tension. Then, unlike real sex with partners, the internet instantly provides them with entirely novel stimuli to repeat the process again, *ad infinitum* [32]. And unlike solo masturbation without porn, or real sex with partners, many users report extended

sessions, up to several hours at a time, using the technique of “edging”. An experienced pornography consumer's aim is to only release sexual tension when it will have a powerful effect. A person edging can achieve plateaus which are near to orgasm, but rather less excited. By staying in this stimulated, but non-orgasmic zone, they can create a time and space where they can fool their brains that they are engaging in unrestrained frolicking in a real world of beautiful partners, endless orgasms and wild orgies.

Pornography use can generate changes in grey matter in specific parts of the brain which are required to inhibit impulsive action [33]. Researchers at the University of Cambridge found changes to brain structure and function in compulsive pornography users [34]. Subjects' brains responded to images of pornography in the same way as cocaine addicts' brains do to images of cocaine. Addiction-related brain changes impair the ability of a user to put the brakes on impulsive behaviour. For some compulsive pornography users that means an inability to control violent outbursts. It can contribute to domestic violence and other crimes against women and children. PPU impairs the part of the brain dealing with “theory of mind” [35] and appears to affect the ability of a user with PPU to feel compassion for others [36].

How Much Pornography Is Needed to Produce PPU?

The question is how much do users have to watch and for how long before the potential risk turns into demonstrable harm? This is a common but unhelpful question because it ignores the principle of neuroplasticity: the brain is always learning, changing and adapting in response to the environment.

It is not possible to pin-point a specific amount because every brain is different. A German brain scan study (not on addicts) correlated pornography consumption with addiction-related brain changes and less activation to pornography [33].

The reward centre in the brain does not know what pornography is; it only registers levels of stimulation through dopamine and opioid spikes. The interaction between the individual viewer's brain and the chosen stimuli determines whether or not a viewer slips into addiction. The bottom line is addiction is not required for measurable brain changes or negative effects.

Research shows that over 80% of the people seeking treatment for compulsive sexual behaviour disorder have reported an inability to control their use of pornography, despite negative consequences [28, 30, 37–40]. Those include negative effects on relationships, on work and on sexual offending.

One clear challenge is that around puberty the sex hormones drive a young person to seek out sexual experiences. For most people, it is easier to derive sexual experiences via the internet than in real life. Adolescence is also the period

of brain development when young people produce more, and are more sensitive to, pleasure neurochemicals [41]. This interest in and sensitivity to sexual experience combined with easy access to internet pornography makes the upcoming generations more susceptible to PPU than pre-internet generations [42, 43].

The pornography consuming population might be considered on two axes.

The first is based around some measure of the amount of pornography being consumed. Are they consuming sufficient pornography to have the potential to develop a compulsive behaviour or behavioural addiction based on an urge to consume pornography? The clear answer is yes. Pornhub traffic statistics indicate that this company alone served 42 billion pornography sessions in 2019 [44]. In June 2021, the leading peer-support recovery site NoFap.com had 831,000 members who consider spending their leisure time trying to not use pornography is a worthwhile activity [45]. A search on Google Scholar on 18 June 2021 for “problematic pornography use” returned 763 items, indicating that PPU is subject to substantial ongoing investigation.

Separately, there must be a time dimension. Are users sustaining this consumption for long enough to have the addictive or compulsive behaviours embedded in their behaviour? Each person’s brain is unique and there is a wide range of biological, cultural and social variables which could place consumers in the casual-use camp, where their pornography consumption might not have significant effects. However, over time, for some people, there is clear potential to move into the PPU camp.

Identification and Treatment of PPU

Treatment options for PPU were reviewed by Sniewski et al. in 2018 [46]. This study found a weak research base with only one randomised control trial and early studies on a range of behavioural and drug treatments. They did identify the need for better diagnostic tools as building blocks for better treatment. This need has now been met. PPU can now be identified reliably in individuals and across populations. Over the past few years, several tools to identify PPU have been developed, calibrated and widely tested [47]. For example, the Problematic Pornography Consumption Scale is now available in both long [48] and short [49] forms supported by a range of community testing [50, 51]. The reliability of the Brief Pornography Screener has also been demonstrated [52, 53].

Lewczuk et al. noted “It is possible that individuals who have a strong preference for non-mainstream explicit content, such as paraphilic pornography or scenes containing a high amount of violence, can be worried about one’s own preferences and seek treatment for this reason” [54]. Bóthe and others found that high-frequency pornography use may

not always be problematic [55]. It depends on the individual and is influenced by many factors [56].

Some individuals recognise that they are not able to stop the behaviour on their own, even if they are motivated to do so. This leads them to seek professional assistance from family doctors, sex therapists, relationship counsellors and recovery coaches [57, 58]. Some individuals join self-help groups in online forums or in 12-step communities. Around the world, we see a mix of strategies ranging from complete abstinence to harm reduction approaches [59].

On pornography recovery websites (www.nofap.com; rebootnation.org), male users report that when they quit pornography and their brains eventually resensitise or heal, their compassion for women returns. At the same time, many mental health issues like social anxiety and depression, and physical health problems such as sexual dysfunction, reduce or disappear [36]. More academic research on recovery websites is recommended as little has been published [60].

PPU and Risks for Adults

When contrasting the frequency of pornography use with the severity of PPU, Bóthe et al. found that PPU had positive, moderate links to sexual function problems in males and females in both community and clinical samples [61]. Men with PPU may develop sexual problems such as pornography-induced erectile dysfunction (PIED), delayed ejaculation and anorgasmia [36, 62–64].

There are now some studies looking at the links between PPU and a few specific developmental or mental health disorders. In 2019, Bóthe and colleagues looked at attention deficit hyperactivity disorder (ADHD) as one of the most prevalent comorbid disorders in hypersexuality. They found that ADHD symptoms might play an important role in the severity of hypersexuality between both sexes, but “ADHD symptoms might only play a stronger role in PPU among men but not women” [65].

There is some research pointing to difficulties that people with autistic spectrum disorder (ASD) have in regard to social and sexual interactions which can contribute to sexual offending behaviour [66]. Currently, the association between ASD and the viewing of CSAM is poorly recognised and inadequately understood both by the general public as well as by clinical and legal professionals. However, at present, we have not identified any specific literature linking PPU and ASD beyond a recent case study [35].

PPU and Sexual Offending in Children and Young People

Use of pornography by children (under 18s) has additional impacts. It changes the way young people learn to do sex and

tends to result in an earlier sexual debut. This then becomes a risk factor, as an earlier sexual debut makes young people more likely to engage in antisocial behaviour [30, 67, 68] and more likely to commit child-on-child sexual abuse [69, 70].

In England and Wales, between 2012 and 2016 there was a 78% rise in child-on-child sexual abuse cases reported to the police [71]. In Scotland in the same period, there was 34% rise in such offences, prompting the Solicitor General to set up an expert group to investigate the causes. In their report published in January 2020, they state that “Exposure to pornography is increasingly being identified as a contributory factor in the emergence of Harmful Sexual Behaviour” [25].

In Ireland in 2020, two young teenage men were convicted of the murder of 14-year-old Ana Kriegel. They had massive amounts of violent pornography on their smartphones [72]. Is there a link? The police believed so.

The vast majority of child-on-child sexual abuse cases are perpetrated by boys on girls within the family. Incest or so-called “faux incest” is one of the most popular genres of pornography available [73].

Unfettered access to online pornography is influencing the minds of children and young people and preparing them for adulthood with sexual tastes shaped by the most violent, coercive and risky forms of sexual activity. For example, there is research for adolescent boys that showed an “intentional exposure to violent x-rated material over time predicted an almost sixfold increase in the odds of self-reported sexually aggressive behaviour” [17]. Also, there is research indicating a notable spike in first perpetration of sexual violence appearing at age 16 years [18].

Australian research by McKibbin et al. in 2017 [69] on harmful sexual behaviour carried out by children and young people found that it accounts for about half of all child sexual abuse perpetration. The research identified three opportunities for prevention based on interviews with the young perpetrators: reform their sexuality education; redress their victimisation experiences; and help their management of pornography.

Impacts on Behaviour

Prevention of PPU is better than cure. It is cheaper, good for society, safer for couples and better for the mental and physical health of individuals. Prevention applies equally to reducing burdens caused by PPU in the criminal justice system. Where an individual has PPU, their ability to forecast negative consequences arising from their behaviour is impaired, as is their ability to rein in impulsive behaviour. Such impulsive behaviour includes engaging in violent sexual behaviour.

If the health care and legal costs for dealing with PPU begin to rise exponentially, as they currently seem to be because hundreds of millions of people are using pornography, it will become an important policy issue for governments. For example, in 2020, pornography websites were the 8th, 10th, 11th and 24th most visited locations for internet users in the UK [74]. Over 10% of the world population uses pornography each day. Half of all UK adult males visited Pornhub.com during September 2020—for women the figure was 16% [75].

No one predicted the 2020 COVID-19 pandemic, but use of internet pornography, including by men, children and young people bored at home, rose dramatically during the past year. This was aided by free access to the otherwise paid-for premium sites of the large pornography provider Pornhub [76, 77]. Domestic violence charities have reported a staggering rise in complaints of domestic violence [78]. Easy access to internet pornography sites has likely been a contributing factor [79]. Pornography use has many effects and this is why a medical as well as a social science approach is essential to tackling this source of public health and legal risk.

Increasing numbers of men are being found guilty of violence against women where pornography consumption was implicated. Literature linking pornography use to sexual offending, sexual aggression and abuse is now strong [62, 80, 81].

What constitutes violence within pornography, particularly violence against women? This is a much-contested space well mapped by radical feminist commentators [7–10]. The continuum ranges from light slaps and pulling someone’s hair through to activities such as strangulation. For example, in recent years, the police have reported a huge increase in cases of non-fatal strangulation, one of the more popular themes found in pornography today. Recent research describes “a range of injuries caused by non-fatal strangulation that can include cardiac arrest, stroke, miscarriage, incontinence, speech disorders, seizures, paralysis, and other forms of long-term brain injury” [82]. Strangulation “...is also a significant marker of future risk: if a woman has been strangled, the chance of her subsequently being murdered rises eightfold” [83].

Where it gets complicated is that strangulation could be something that an individual requests. Some Bondage, Domination, Sadism, Masochism (BDSM) activities are based on desire for reduced oxygen at the point of orgasm to enhance sexual arousal. Then again, one person may strangle another during sex without their consent, because they are violent and sadistic. Data for Gen Z on BDSM and rough sex is concerning. Twice as many young women as men said that rough sex and BDSM is something they prefer to watch [84]. And if they watch it in pornography, they can be influenced to mirror this behaviour in real life. If women are asking to

be strangled to achieve a bigger sexual high, what impact might this have on a legal defence of consent? This is an example of the normalisation of pornography use by women.

The UK Government's "Domestic Violence Bill" seeks to clarify the law by restating, in statute, the broad legal principle established in the case of *R v Brown*, that a person cannot consent to actual bodily harm or to other more serious injury or, by extension, to their own death.

"No death or other serious injury – whatever the circumstances – should be defended as 'rough sex gone wrong' which is why we are making it absolutely clear that this is never acceptable. Perpetrators of these crimes should be under no illusions – their actions will never be justifiable in any way, and they will be pursued rigorously through the courts to seek justice for victims and their families." Justice Minister Alex Chalk [85].

It is clear from the extensive research that there is a link between domestic abuse, general violence against women and pornography use [7–10]. There are, no doubt, many contributing factors to this link, but the evidence suggests that compulsive use of internet pornography can affect the brain and impair the decision-making faculties of a compulsive user over time.

Hook-up culture in many countries is the social norm for young people today. However, the lack of effective government intervention on violence against women has resulted in some young women taking steps themselves to highlight the prevalence of sexual harassment on campuses and in schools. Websites such as "Everyone's Invited" (everyonesinvited.uk) document increasing numbers of women reporting rapes or sexual assaults which have not been adequately dealt with by either educational authorities or the police. It is conceivable that young men with PPU are being coercive towards partners despite a lack of consent, thereby leading to accusations of sexual assault or rape.

The development of "slutpages", particularly in the USA, is an example of self-generated pornography where women are exposed to another form of pornography-inspired exploitative behaviour [86].

PPU and Escalation

Internet pornography operates as a de facto form of sex education from which young users in particular internalise the activities they see as a form of "sexual script". There are two factors that make the sexual scripts more powerful in changing pornography consumers' behaviour. First, individuals with an underlying predisposition towards violence are more likely to act out what they view [87]. Second, all consumers are vulnerable to the way the artificial intelligence (AI)

algorithms used on commercial websites manipulate consumers to escalate to viewing more intensely arousing forms of pornography. The effectiveness of the algorithms in driving escalation is demonstrated by the way pornography users can recognise that their tastes change over time; thus, in this European study, "Forty-nine percent mentioned at least sometimes searching for sexual content or being involved in OSAs [online sexual activities] that were not previously interesting to them or that they considered disgusting" [37].

AI algorithms can drive consumers in either of two directions. On the one hand, they teach viewers' brains, unconsciously, to crave stronger, more violent imagery. On the other hand, they drive consumers towards a focus on sexual activities with younger people. Thus, we have escalation to violent behaviour and/or towards the consumption of child sexual abuse material. People with PPU have developed brain changes that increase cravings for more stimulating, perhaps high-risk material and a diminished capacity to inhibit their use of it [11–14, 35, 38, 63].

Over time the process of escalation can lead to the consumption of illegal pornography, including child sexual abuse material [13–16]. CSAM consumption is illegal throughout the world. Within CSAM there is also a continuum of material and consumer behaviours. It ranges from viewing existing historical recordings which can proliferate endlessly across the dark web despite the best efforts of law-enforcement to remove them, through to live-streaming where consumers pay other people to rape children while they watch. This live-stream material will almost certainly end up in circulation on the dark web too [88–91].

Since the advent of high-speed internet, there has been an astonishing increase among young men in the rates of sexual dysfunction in partnered sex. This has led to the term "porn-induced erectile dysfunction" (PIED) [63]. A proportion of men with PPU can no longer become aroused, even with pornography. On the pornography recovery websites, some men have reported that having developed erectile dysfunction, they needed the potent stimulus of extreme or perhaps illegal pornography such as CSAM in order to become aroused at all.

Legal Remedies and Health Policy Considerations

PPU is a disorder that can be prevented. Individuals cannot develop PPU without consuming pornography. However, given the current state of technology, no government can hope to impose an effective pornography ban. Human libido and the marketplace will always defeat any move in that direction.

The reality is that levels of pornography consumption are continuing to increase around the world. Many of the consequences of PPU have long gestation periods, so we can confidently predict that the negative health and legal impacts outlined above will continue to grow until many years after the world reaches peak pornography, the time when the number of pornography consumers begins to decline. In this section, we explore some health and legal tools available to government and civil society that have potential to begin to reverse this trajectory, for instance, use of the precautionary principle, age verification, school education programmes, public health campaigns and specific health warnings.

There are many opportunities for interventions or nudges to minimise engagement in potentially addictive behaviours. These have worked for tobacco where some countries such as Australia have seen smoking rates fall by over 70% [92]. Ideally, legislation and government health and social policy should support such softer interventions. After all, the consumption of adult pornography by adults is currently legal in most jurisdictions [60].

In contrast, the use of CSAM by adults is illegal. Criminal justice agencies around the world seek out CSAM and those who use it. International law enforcement aims to completely cut off the supply of CSAM. Overall the suppression of CSAM has been relatively successful, but that may not remain the case. Effective policing has had the effect of driving the market onto the dark web and sometimes to social media. What can governments do when technology giants such as Facebook introduce end-to-end encryption that will make it virtually impossible for legal authorities to identify and remove CSAM from their platforms and hold perpetrators to account?

Precautionary Principle

To the best of the authors' knowledge, pornography has never been tested scientifically to prove that it is a safe product or that pornography consumption is a risk-free activity across an entire population. As noted above, research within the behavioural addiction science community suggests that individuals can, at statistically significant levels, develop a compulsive, or even an addictive, disorder through out-of-control pornography use. It appears that all genres of pornographic content can ultimately lead to some consumers developing PPU. This seems to apply to pornography consumers, independent of their age, gender, sexual orientation or other social factors.

The pornographic content supplied by commercial entities over the internet has been demonstrated to have a wide range of effects which can lead consumers to develop PPU. The argument that most people find pornography consumption safe does not remove the legal duty on the commercial pornography industry to not injure consumers, especially

those who have a potential or actual vulnerability to develop PPU: adolescents or people with neurological differences or impairments. By contrast, governments have a duty to protect their citizens. The demonstration of short-term safety in a consuming population does not remove potential liability for causing harms that only appear in the longer term. After all, the defence of no immediate or obvious harm was used by the tobacco industry. This was ultimately overturned by research demonstrating harms with very long gestation periods.

Where there is a link between the consumption of pornographic content and the development of an identifiable disorder, specifically compulsive sexual behaviour disorder, then is there scope for a class action against the content supplier based on product liability legislation? This deserves further investigation.

Even without eliminating pornography consumption, there are a range of potential ways to reduce risks at the population-wide and individual levels. We will now discuss four promising approaches, age verification, education programmes, public health campaigns and mandatory health warnings.

Age Verification

Children and young people are the most vulnerable to internet addiction of all kinds, due to the malleable nature of their brains at this critical stage of development during adolescence. This is the period of life when most mental health conditions and addictions develop. The academic literature makes it clear that pornography use has significant impacts on adolescent development [17, 18, 93–95]. As the recent review by Gassó and Bruch-Granados said “pornography consumption by youth has been linked to the exacerbation of paraphilias, an increase in sexual aggression perpetration and victimization, and...to an increase in online sexual victimization” [96].

With adolescents, we have to focus on prevention of PPU as well as helping those who have already become snared by pornography use, so that going forward, they will not act out sexual violence on those around them nor develop sexual dysfunctions. Age verification legislation is a key step towards this.

Age verification technologies are well developed and in use in many jurisdictions for products including tobacco, alcohol, gambling, solvents and weapons. They have great potential for mitigating risks to children and young people from pornography consumption [97]. Age verification technology does not totally eliminate risks to children from pornography consumption, but it has the potential to vastly reduce the levels of access to risky material, without having a particularly onerous or negative impact across the rest of society.

School Education Programmes

It has been recognised that age verification legislation alone would not be sufficient to restrict the use of pornography by young people and that sex education is an important additional pillar. For many young people, pornography has become a key source of informal sex education, usually by default. Formal sex education tends to focus heavily on reproductive biology and the issue of consent. While consent is very important, it fails to deal with the impact of pornography on the mental and physical health of users, many of whom are virgins and not engaged in partnered sex. It would be more helpful if children were taught about internet pornography as a supernormal stimulus and its impact on the brain.

Pornography education programmes can have multiple goals, only some of which may be helpful. Pornography literacy programmes have become popular [98], taking the line that pornography is fantasy sex which is safe to view provided that users recognise that it is not real. The weakness of this approach is that it ignores the fact that both the sex and any violent behaviour shown are real rather than simulated. It also fails to account for the brain changes generated by pornography consumption and the associated risks of harms to mental and/or physical health. There are now schools' [99, 100] and parents' programmes [101] that incorporate pornography harm awareness which aligns with the public health approach.

Recent experimental research in Australia by Ballantine-Jones sheds light on the sorts of impacts that education can generate, as well as exposing some limits. It concluded that:

“The program was effective at reducing a number of negative effects from pornography exposure, sexualised social media behaviours, and self-promoting social media behaviours, using the three strategies of didactic education, peer-to-peer engagement, and parental activities. Compulsive behaviours impeded efforts to reduce pornography viewing in some students, meaning additional therapeutic help may be required to support those struggling to produce behaviour change. Additionally, an adolescent's engagement with social media may produce excess narcissistic traits, affecting self-esteem, and altering their interaction with pornography and sexualised social media behaviours” [102].

Public Health Campaigns

In 1986, the US Surgeon General's workshop on pornography and public health delivered a consensus statement about the impacts of pornography. In 2008, Perrin et al. [103] proposed a range of public health education measures to reduce

harms across society, without gaining much traction. Today the potential risks they warned about have been realised, with the development of PPU and its associated harms.

However, Nelson and Rothman [104] are right that pornography use does not meet the standard definition for a public health crisis. But this does not mean that pornography is not a worthy issue for public health interventions. In general, the research supports the notion that pornography consumption leading to PPU is unlikely to be fatal for most consumers. However, we do not know how far the levels of depression experienced by some people with PPU may have led to suicide, the rates of which have risen significantly in recent years among young men, the main users of pornography. Further research into this correlation is required.

Problematic pornography use also appears to be contributing to higher levels of fatalities from domestic violence or pornography-related violence against women. Here, we do not see identifiable harm or mortality for the pornography consumers themselves, but as something arising from the subsequent actions of those consumers. It is enough that PPU may be a contributing factor in harm to women and children for us to consider as a society how we can try to reduce or eliminate these violent urges in men [105].

It is not necessary to demonstrate causality in all circumstances before we employ the precautionary principle and look to mitigate society-wide harms by eliminating known drivers of antisocial behaviour in pornography users. This approach already applies to alcohol and passive smoking.

From the public health point of view, it makes sense to find and implement ways to reduce men's desire to access violent pornography which has the potential to fuel domestic violence and violence against women and children.

Health Warnings for Pornography Users

Health warnings within pornography websites are potentially powerful tools for reducing the harm from pornography use. The concept is to provide the consumer with a nudge to remind them of potential risks associated with pornography through a message at the beginning of every commercial pornography viewing session.

Product warnings have been used with tobacco products over an extended period and have proven to contribute in a positive way to reducing cigarette consumption [92, 106, 107]. The Reward Foundation launched this concept for pornography labelling at the Coalition to End Sexual Exploitation conference in Washington D.C. in 2018 [108]. We recommend video, rather than text warnings, as they are in keeping with the medium consumers are using. The system of IP addresses used by the internet allows a government to legislate for its health warnings to be applied within a specific territory.

The main technological Achilles heel for the use of IP addresses to control access in a specific geography is the use of virtual private networks (VPNs). VPNs allow consumers to pretend to be somewhere else. In turn, this workaround could be overcome by using a cross-check with the Global Positioning System (GPS) to confirm the location of the mobile device. While not fool-proof, over 80% of pornography sessions world-wide occur on mobile devices [44], most of which will have GPS turned on. There are various technical options for the true location to be identified by the commercial pornography supplier, including the HTML Geolocation API [109]. The key opportunity here is not to focus on any particular technical solution, rather to note that there are existing, mature technologies available which could be implemented at negligible cost if legislators considered them necessary.

As a proof of concept, in 2018, we worked with graphic design students at Edinburgh College of Art to create exemplar videos, each 20 to 30-s long. These were intended to play at the start of a legal pornography viewing session, delivering the consumer a health warning. The six best videos created by the class were compiled and shown at the Washington Conference [108]. The brief in this student exercise was to focus on the impact of pornography on the viewer's sexual health, particularly for men. It would be equally valid to create videos focusing on the potential of pornography to incite violence against women and children and to warn against the dangers of escalating to CSAM. An effective scheme would have many different messages available, allowing them to appear in a sequence which could heighten their impact.

The state of Utah in the USA became the first legal jurisdiction to enact such a system, when they opted for text-based labels [110].

There is scope to pass the costs of creating such schemes onto the commercial pornography suppliers. A government needs to appoint a regulator to enforce the process of commissioning the videos and supplying the appropriate messages to discourage excessive pornography use. Delivering the messages can be fully automated on the commercial pornography companies' websites. The cost of doing this would be minimal. It would be simply a price that commercial pornography suppliers would have to pay for access to a particular consumer market.

Conclusion

In most jurisdictions around the world, pornography is legal, or else sits in a grey zone where some aspects may be legal and others illegal. In many jurisdictions, the law and government policy simply have not kept pace with the

technological and social changes that have accompanied the boom in internet-based pornography consumption. The pornography industry has lobbied hard to achieve and maintain this very light regulatory environment [7–10].

There is ample scope for government and policy makers to give more protection to citizens and hold technology companies, in particular pornography companies, accountable for the harms from their products. PPU may not be a disorder which can be eliminated, but with good governance and widespread public education it does not need to become an epidemic.

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Compliance with Ethical Standards

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