

## Impulsivity, Online Disinhibition, And Risk Taking Among Digital Millennials: Challenges of e-Safety in Industry 4.0

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**ABSTRACT :** *Digital Millennials (i.e., people born from 1980 to 2004) have often been portrayed as quick to embrace emerging technologies. The envisioned future of Industry 4.0 entails the blending of hardware, software, and people to complete work; and given their affinity for digital resources, technology, and social networking applications, the Millennials could be regarded as a much-needed asset in this future workforce. However, systematic research on how this cohort understands and reacts to safety issues surrounding the use of technologies has been lacking. In particular, behaviours such as impulsivity, online disinhibition, and risk-taking among them remain unclear. The present study investigated this gap with a sample of 203 Millennials of various nationality groups. Using the short version of the Urgency, Premeditation, Perseverance, Sensation Seeking, and Positive Urgency (Short UPPS-P) scale, the Revised Online Disinhibition Scale, and the Online Risky Behaviour scale, the results indicated that the most significant predictors of online risk-taking behaviours are lack of premeditation, positive urgency, and toxic disinhibition. Interestingly, though not hypothesised, was gender as a significant predictor of the outcome. The findings implied that these variables might be the most relevant target areas for interventions that could modify risky behaviours in cyberspace. The study's findings are discussed in relation to the key challenges associated with e-safety where the future trends would be heading towards the gig economy and crowd-working.*

**Keywords** – *e-Safety, Impulsivity, Industry 4.0, Millennials, Online Disinhibition, Risk-taking.*

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### 1.0 INTRODUCTION

New developments in data volume, analytics, and mobility have accelerated the Fourth Industrial Revolution or Industry 4.0 and contribute to the formation of new entrepreneurs, start-ups, innovations, and different forms of work. In this Industry where people and machines (both hardware and software) interact as cyber-physical systems (Baldassari & Roux, 2017), the workplace is no longer defined by its physical space nor is it limited to the normal office hours. In fact, the nature of work in Industry 4.0 has considerably changed and is now characterised by the use of online platforms and wireless mobile technologies for work-related tasks (Greis et al., 2012), accessibility of organisation's data via cloud network facilities (Baldassari & Roux, 2017), short-term engagements among employers, workers, and customers (Kalleberg & Dunn, (2016), and a greater emphasis on collaboration as the primary mode of work and play (Greis et al., 2012). These aspects, however, present significant challenges for organisations as they can expose businesses to e-safety threats.

The use of the Internet has become very integral in many companies and organisations as more and more workers are using computers, gadgets, devices, and applications as part of their job. This increased use has concurrently led to concerns about e-safety in the workplace. In general, e-safety refers to the safe practice and responsible use of information communication technology and all electronic devices – this may include the way people are taught about risks online, how they can protect themselves, and to whom they should report worrying activities (Barnard-Wills, 2012, p. 240). While the majority of e-safety concerns have focussed on children or young people, reports and anecdotes have increasingly shown that

issues such as data privacy, security, ownership, governance, and regulatory compliance are also the key concerns for organisations. Nevertheless, many workers may not be aware of these issues; hence, thrusting them into committing risky behaviours, which, in turn, can create vulnerabilities in the organisation's cyber environment. Therefore, knowing how to address these issues has become essential to achieve the maximum benefit from the new and developing technologies without putting the organisations and workers at undue risk. Embedded in every organisation is the "duty to care" (Heads Up, 2019), and this requires organisations to take steps to ensure that an appropriate culture of safety and responsibility is instilled and practised by the entire workforce.

Research on risky behaviours are extensive in the literature - from analysing the process of decision making (Reyna & Farley, 2006) to the attempts at quantifying risky behaviour tendencies for clinical purposes (Reid et al., 2014). However, only a few studies have focused on online behaviours among young adults or the *Digital Millennials*. Risky behaviours can be defined as any actions with potentially undesirable outcomes (Boyer, 2006), and if we extend this definition to online settings, it can be said that many online behaviours can be considered as risky. Lau and Yuen (2013) further conceptualised online risk-taking behaviours or risky behaviours as having three domains, i.e., (1) unauthorised acts such as using pirated softwares or unauthorised passwords, (2) internet stickiness, which refers to the feeling of the need to constantly be connected online, and (3) online plagiarism, for example, submitting assignments with contents or pictures copied from the Internet without acknowledgements, copying assignments, or pasting others' articles in the discussion forum on the Internet without permissions, among others.

Studies have shown that risk-taking behaviours are associated with impulsivity, i.e., the tendency to act in rapid or unplanned reactions towards internal or external stimuli with diminished regard to consequences (Reynolds et al., 2006). Cyders and Smith (2008) argued that impulsivity is not composed of one construct but is subdivided into five domains. These domains are: (1) negative urgency, i.e., the tendency to make rash decisions under negative emotion, (2) lack of perseverance, i.e., the inability to persist on a task that may be boring or difficult, (3) lack of premeditation, i.e., the tendency to act without consideration of potential consequences, (4) sensation seeking, i.e., tendency to seek excitement and adventure, and (5) positive urgency, i.e., the tendency to act rashly in response to positive affect (Cyders et al., 2007; Whiteside & Lynam, 2001).

Another variable of growing interest in current risk-taking behaviour research is that of *online disinhibition effect* (Suler, 2004) – a phenomenon whereby individuals become socially uninhibited when communicating in online environments or digital mediums. Suler (2004) suggests that online disinhibition involves the dissipation of personal restraints, which may cause unrestricted expressions such as discourteous acts, rude or harsh language, aggressive behaviours, as well as anger, hatred, and threats in online settings. In this form, the online disinhibition is known as toxic disinhibition (Suler, 2004). On the other hand, online disinhibition may also be positive. For example, people may reveal or share personal things like their emotions, fears, and wishes or show a strong will to help others or display unusual acts of kindness or generosity. This is known as benign disinhibition (Suler, 2004).

Millennials are projected to make up 50% of the workforce by 2020, and the U.S. Bureau of Labour Statistics predicts that this generation will become the largest segment of the labour force with participation rate at 75% by 2030 (Mitchell, 2013). There are some variations in how different people define Millennials. The most commonly used definition, however, is by Howe and Strauss (2003) who describe this generation as a general cohort of those born between 1980 and 2004. Although considered to be well-versed in technology and are digitally driven, Millennials are known to be at risk from threats in cyberspace such as online harassment and cyberbullying, exposure to problematic contents, sexual solicitation, identity threats, and internet addiction (Schrock & Boyd, 2008; Whitaker & Bushman, 2009).

Studies such as those by Baumgartner, Valkenburg, and Peter (2010), and White et al. (2018) have shown that the number of Millennials engaging in various types of risky behaviours in online settings and cyberspace is increasing, and the vast majority of these behaviours involved cyberbullying, risky information sharing, sexual soliciting, and risky self-presentation. Because Millennials will make up the largest generation in the workforce, their risky online behaviours are particular concerns of organisations. Their attitudes toward freedom of information, prizing innovation over security and stability, increasing trust in technology, and feelings of security in the virtual world may expose employees and organisations to cyber vulnerabilities, especially those who do not have the adequate resources to protect themselves against unsafe technology use by the Millennial workers (Greis et al., 2012).

Although Industry 4.0 and Industrial Internet of Things (IIoT) offers opportunities for innovation, entrepreneurship, flexibility, and autonomy, they also provide an ideal environment for risk-taking, and workers may be tempted to engage in risky behaviours. This is more so for the Millennials as they are reported to have a lack of awareness of organisational cybersecurity policies (Accenture, 2010) and routinely bypassed their organisation's approvals and policies when using various devices, technologies, and social networking websites at work (Myers & Sadaghiani, 2010). In short, extensive access and indiscriminate use of the internet and technologies by workers can expose businesses to new and higher risks and liabilities, which compels us to investigate further their attitudes and digital behaviours. However, to date, there exist only a few studies on online risk-taking behaviours among adults, especially the Millennials. Nevertheless, evidence in the wider literature in offline settings has suggested that impulsivity (Cyders & Smith, 2008; Ginley et al., 2014) and disinhibiting behaviours (Suler, 2004; Udris, 2016) are positively associated with the tendency to engage in risky behaviours. As such, the present study

explored the relationships between impulsivity, online disinhibiting behaviours, and online risk-taking behaviours among the Millennials. Following the conceptualisation of impulsivity by Cyders et al. (2014), five domains, namely urgency, premeditation, perseverance, sensation seeking, and positive urgency, were examined together with two online disinhibition domains, i.e., benign and toxic disinhibition (Udris, 2016). These variables are then hypothesised to predict online risk-taking behaviours, which consisted of unauthorised acts, internet stickiness, and plagiarism (Lau & Yuen, 2013), as illustrated in Fig. 1.

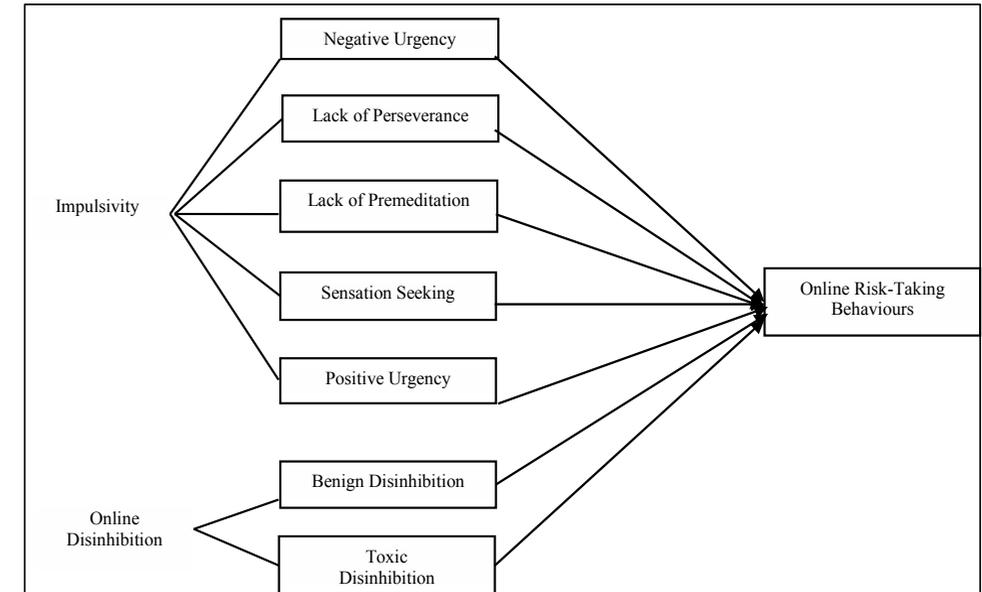


Figure 1 Conceptual Framework of the Study

## 2.0 METHOD

### 2.1 Study Design and Participants

This study used a cross-sectional design in which 203 participants according to the inclusion criteria (i.e., Millennials born from 1980 to 2004) responded to a self-report questionnaire. The mean age of participants was 21.15 years, with age ranged between 19 to 25 years old. The majority of them are Malaysians (44.8%), followed by Indonesians (35%), and other nationalities (20.2%). However, more females (64.5%) responded to the questionnaire compared to males (35.5%).

### 2.2 Materials and Measures

Data were collected through a questionnaire that consisted of two sections. The first section included participants' demographic information, while the second section contained three scales related to impulsivity, online disinhibition, and online risk-taking behaviours. Impulsivity was measured by the short version of the Urgency, Premeditation, Perseverance, Sensation Seeking, and Positive Urgency (Short UPPS-P) scale by Cyders et al. (2014). This scale, which is rated on a four-point Likert scale ranging from 1 (*Agree Strongly*) to 4 (*Disagree Strongly*), has 20 items with four items in each domain, namely negative urgency, lack of perseverance, lack of premeditation, sensation seeking, and positive urgency. Total subscale scores were used for data analyses, with higher scores indicating a higher presence of the respective impulsive behaviour. Adequate internal consistencies were obtained for all subscales, i.e., negative urgency (Cronbach's  $\alpha = .53$ ), lack of perseverance (Cronbach's  $\alpha = .61$ ), lack of premeditation (Cronbach's  $\alpha = .75$ ), sensation seeking (Cronbach's  $\alpha = .75$ ), and positive urgency (Cronbach's  $\alpha = .78$ ).

Online disinhibition was measured using the Revised Online Disinhibition Scale (Udris, 2016). This scale consisted of 11 items, with seven items measuring benign disinhibition and four items measuring toxic disinhibition. The response scale is based on a four-point Likert scale, ranging from 0 (*Disagree*) to 3 (*Agree*), with higher scores representing higher

disinhibiting behaviour. Reliability of both subscales was good with Cronbach's alphas of .78 for benign disinhibition and .73 for toxic disinhibition. Finally, online risk-taking behaviours were measured using the Online Risky Behaviour Scale (Lau & Yuen, 2013). This scale is a 10-item self-report measure consisted of three subscales, namely unauthorised activities, internet stickiness, and plagiarism. All items were scored on a five-point Likert-type response scale, ranging from 1 (*Strongly Disagree*) to 5 (*Strongly Agree*). Both the total score and subscale scores can be computed. However, only the total scores for online risk-taking behaviours are reported in this study. A higher total score indicates a higher tendency that an individual may engage in online risky behaviours. In this study, the Cronbach alpha for this scale was .812. The questionnaire was administered in English because the participants were Millennials who had a minimum of a secondary school degree and thus are expected to have an adequate understanding of the language.

**2.3 Procedures**

Ethics approval was obtained from the Research, Publication, and Innovation Ethics Committee of the Department of Psychology, International Islamic University Malaysia before data collection began. Prior to the commencement of the study too, the authors of the three scales were contacted, and permissions were granted to use the scales in this study. The data collection involved two phases. In the first phase, a pilot study was conducted to improve the questionnaire and to refine the data collection process. Participants in this phase ( $n = 6$ ) indicated that the questionnaire was understandable and that only minor layout changes were required. The questionnaire was then revised accordingly. To increase the response rate, the main data collection was carried out using both paper and online survey forms. A written description of the study was provided in both forms, and all participants gave their consent to participate in this study. The data collection process lasted for two weeks, and at the end of the study, a lucky draw was held. The selected participants received a token as an appreciation for their participation in this study.

**3.0 RESULTS**

All analyses were conducted using IBM SPSS version 23.0. Data were checked for the assumptions underlying multiple regression before performing the analyses, and the results showed that with  $n = 203$  in this study, the recommended sample size of 106 calculated using Tabachnick and Fidell's (2014) formula of  $n > 50 + 8m$  (where  $m =$  number of predictors) was met. In addition, the residuals are normally distributed, the variances of the residual terms were homoscedastic, and the residuals at each level of predictors have similar variance after inspecting the normal probability plots and residuals scatterplots. No variance inflation factor (VIF) values larger than 10, and no Tolerance values lower than 0.1 as recommended in Field (2013) are detected - indicating that multicollinearity was not a concern. Finally, the assumption of independent errors was met wherein the Durbin-Watson values for all predictors are close to 2, as recommended by Field (2013). Altogether, these results showed that the data were appropriate for conducting multiple regression analyses.

First, descriptive statistics were computed for all variables of interest and the results are presented in TABLE 1. With an  $n = 203$ , there were no missing data on any variable except positive urgency where four male participants did not answer all questions in this scale. These missing data were only about 2% of the whole sample, which is very small, and thus, did not affect the analyses and findings of this study. Next, two hierarchical multiple regressions were conducted to test impulsivity and online disinhibition as predictors of online risk-taking behaviours following the framework depicted in Fig. 1.

**Table 1 Descriptive statistics of all variables**

No.	n	Predictors														Outcome	
		Negative Urgency		Lack of Perseverance		Lack of Pre-meditation		Sensation Seeking		Positive Urgency <sup>§</sup>		Benign Disinhibition		Toxic Disinhibition		Online Risk-Taking Behaviours	
		M	SD	M	SD	M	SD	M	SD	M	SD	M	SD	M	SD	M	SD
Male	72	10.14	2.16	7.18	1.88	7.61	1.98	12.07	2.71	9.59	2.94	11.67	4.74	3.28	3.08	25.89	6.97
Female	131	9.93	1.87	7.26	1.77	7.86	1.93	11.56	2.35	9.31	2.41	11.50	4.30	1.86	2.23	22.51	6.36
Total	203	10.01	1.98	7.23	1.81	7.77	1.95	11.74	2.49	9.40	2.60	11.56	4.45	2.37	2.65	23.71	6.77

<sup>§</sup>Note: For Positive Urgency: Male = 68, Female = 131. This missing data were less than 5% and were handled through listwise deletion.

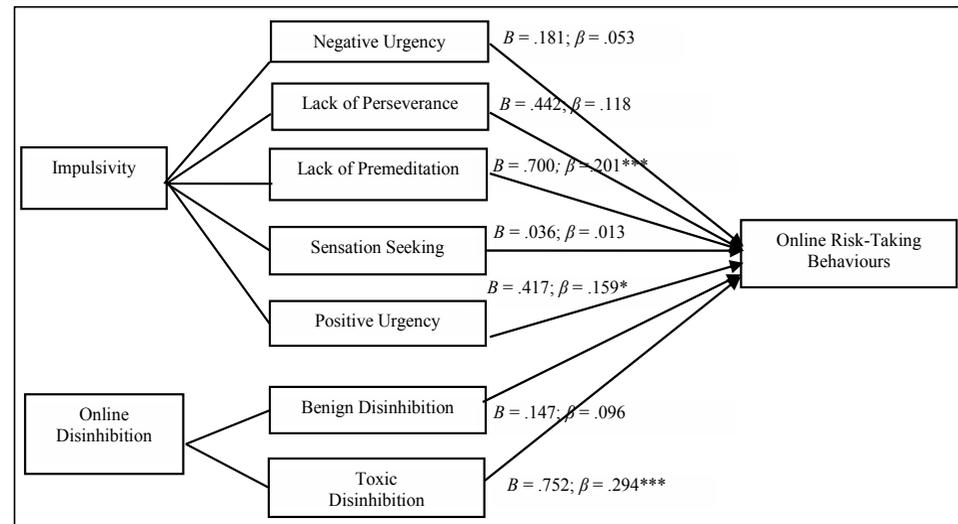
In the first hierarchical multiple regression, we examined which impulsivity predictors (i.e., negative urgency, lack or perseverance, lack of premeditation, sensation seeking, and positive urgency) significantly contributed to the variances in online risk-taking behaviours. Gender, age, and nationality were entered into the regression model in Step 1 to control for the potential influence of these demographic variables on the outcome. The results showed that only gender ( $\beta = -.230, p = .002$ ) significantly contributed in predicting online risk-taking behaviours ( $R = .265, R^2 = .070, R^2change = .070, F(3, 195) = 4.89,$

$p = .003$ ). Then, negative urgency was entered in Step 2. Again, gender is significant ( $\beta = -.224, p = .001$ ) while other predictors were not statistically significant in this model ( $R = .290, R^2 = .084, R^2change = .014, F(4, 194) = 4.46, p = .002$ ). Next, lack of perseverance was entered in Step 3, and a similar pattern of results is obtained with gender ( $\beta = -.243, p = .001$ ) and lack of perseverance ( $\beta = .163, p = .021$ ) being the significant predictors, with  $R = .330, R^2 = .109, R^2change = .025, F(5, 193) = 4.73, p = .001$ . In Step 4, lack of premeditation was entered, and resulted in an increase of  $R^2$  with 3.3% variation in online risk-taking behaviours is explained by gender ( $\beta = -.249, p = .001$ ) and lack of premeditation ( $\beta = .195, p = .007$ ). A significant overall model was also obtained ( $R = .377, R^2 = .142, R^2change = .033, F(6, 192) = 5.295, p = .001$ ). Next, sensation seeking was entered in Step 5, resulting in the same significant predictors of gender ( $\beta = -.247, p = .001$ ) and lack of premeditation ( $\beta = .201, p = .006$ ). Model 5 is also statistically significant ( $R = .380, R^2 = .144, R^2change = .002, F(7, 191) = 4.59, p = .001$ ). Finally, at Step 6, all predictors were entered, and the addition of positive urgency yielded a significant model ( $R = .409, R^2 = .167, R^2change = .023, F(8, 190) = 4.76, p = .001$ ). Results also showed that gender ( $\beta = -.241, p = .001$ ), lack of premeditation ( $\beta = .201, p = .006$ ), and positive urgency ( $\beta = .159, p = .023$ ) remained statistically significant even when other predictors were entered into the regression equation. Results of these analyses are summarised in TABLE 2 and Fig. 2 below.

**Table 2 Prediction of Online Risk-Taking Behaviours from Impulsivity Domains**

Predictors	R <sup>2</sup>	R <sup>2</sup> change	B	SE B	β	
Step 1	.070	.070***	Gender	-3.299	1.063	-.230***
Age			.029	.309	.007	
Nationality			.638	.669	.071	
Step 2	.084	.014	Gender	-3.213	1.059	-.224***
Age			.062	.308	.014	
Nationality			.626	.665	.070	
Negative Urgency			.411	.237	.119	
Step 3	.109	.025*	Gender	-3.486	1.054	-.243***
Age			.075	.304	.017	
Nationality			.272	.675	.030	
Negative Urgency			.374	.235	.109	
Lack of Perseverance			.610	.262	.163*	
Step 4	.142	.033***	Gender	-3.570	1.037	-.249***
Age			.092	.300	.021	
Nationality			.402	.666	.045	
Negative Urgency			.278	.234	.081	
Lack of Perseverance			.366	.273	.098	
Lack of Premeditation			.678	.250	.195***	
Step 5	.144	.002	Gender	-3.536	1.040	-.247***
Age			.081	.300	.019	
Nationality			.368	.669	.041	
Negative Urgency			.284	.235	.083	
Lack of Perseverance			.413	.282	.110	
Lack of Premeditation			.699	.253	.201***	
Sensation Seeking			.132	.196	.048	
Positive Urgency			.417	.182	.159*	
Step 6	.167	.023*	Gender	-3.454	1.029	-.241***
Age			.130	.298	.030	
Nationality			.378	.662	.042	
Negative Urgency			.181	.237	.053	
Lack of Perseverance			.442	.279	.118	
Lack of Premeditation			.700	.250	.201***	
Sensation Seeking			.036	.198	.013	
Positive Urgency			.417	.182	.159*	

Note: β values are the standardised regression coefficients of the regression analysis. \*\*\* $p < .001$ , \* $p < .05$ .



**Figure 2 Unstandardised (B) and standardised (β) regression coefficients in the final model of the relationship between impulsivity and online disinhibition predictors and online risk-taking behaviours**

In the second hierarchical multiple regression, online disinhibition predictors (i.e., benign and toxic) were examined with online risk-taking behaviours as the outcome. Similar steps were followed whereby gender, age, and nationality were entered into the regression model in Step 1, followed by benign disinhibition in Step 2, and toxic disinhibition in Step 3. The results showed that Model 1 was significant,  $F(3, 199) = 4.217, p = .006$  ( $R = .244, R^2 = .060, R^2\text{change} = .060$ ) with gender ( $\beta = -.219, p = .004$ ) as the significant predictor. Model 2 was also statistically significant,  $F(4, 198) = 5.008, p = .001$ , with both gender ( $\beta = -.206, p = .006$ ) and benign disinhibition ( $\beta = .181, p = .009$ ) were significant predictors of online risk-taking behaviours. Together, these predictors accounted for a total of 9.2% of the variance ( $R = .303, R^2 = .092, R^2\text{change} = .032$ ). Finally, Model 3,  $F(5, 197) = 7.577, p = .001$ , showed that the addition of toxic disinhibition explains around 16.1% of the variance of online risk-taking behaviours ( $R = .402, R^2 = .161, R^2\text{change} = .069$ ). When all predictors were considered jointly in the same regression model, gender remained a significant predictor of online risk-taking behaviours ( $\beta = -.164, p = .023$ ). However, benign disinhibition was no longer a significant predictor ( $\beta = .096; p = .164$ ) in this Model. Interestingly, toxic disinhibition was found to be a significant predictor of online risk-taking behaviours ( $\beta = .294; p = .001$ ) even when other predictors were controlled. These results are summarised in Fig. 2 and TABLE 3.

**Table 3 Prediction of Online Risk-Taking Behaviours from Online Disinhibition Domains**

	Predictors	R <sup>2</sup>	R <sup>2</sup> change	B	SE B	β
Step 1	Gender	.060	.060***	-3.083	1.053	-.219***
	Age			.054	.305	.013
	Nationality			.438	.657	.050
Step 2	Gender	.092	.032***	-2.905	1.040	-.206***
	Age			.059	.300	.014
	Nationality			.657	.652	.075
	Benign Disinhibition			.275	.104	.181***
Step 3	Gender	.161	.069***	-2.314	1.012	-.164*
	Age			.030	.290	.007
	Nationality			-.072	.654	-.008
	Benign Disinhibition			.147	.105	.096
	Toxic Disinhibition			.752	.186	.294***

Note: β values are the standardised regression coefficients of the regression analysis.  
 \*\*\* $p < .001$ , \* $p < .05$ .

#### 4.0 DISCUSSION

This study aimed at providing information on attitudes toward e-safety among the Millennials whose involvement and engagement are fostered in an increased reliance on technology. This aim is achieved by examining their attitudinal responses on impulsivity, online disinhibition, and online risk-taking behaviours. Results showed that the most significant impulsivity predictor of online risk-taking behaviours is lack of premeditation, which is in line with the literature that has demonstrated a consistent relationship between the two variables. For example, in their meta-analytic review, Berg et al. (2015) indicate that lack of premeditation predicts or correlates with risky behaviours such as increased frequency of alcohol or substance use, reactive aggression, suicidality, and non-suicidal self-injuries. One plausible explanation for this result is that lack of premeditation might be based on poor consideration of consequences that resulted from low levels of executive control (Phillippe et al., 2010), low self-control (Latzman & Vaidya, 2013), or high tolerance for punishment from maladaptive or risky behaviours (Berg et al., 2015). This inability to reflect on the consequences of an action, could, in turn, lead to making decisions without insight into possible choices or consideration of past outcomes.

Besides lack of premeditation, positive urgency is another significant impulsivity predictor of online risk-taking behaviours found in this study. This result is interesting because the concept of positive urgency was included only recently in the impulsive behaviour model, and thus, minimal research evidence is available (Berg et al., 2015). Nevertheless, in the few studies where this variable has been investigated, positive urgency has been demonstrated to be associated with problematic alcohol or substances use, problematic gambling, and borderline personality disorder traits (Berg et al., 2015; Cyders et al., 2010). Berg et al. (2015) posit that positive urgency may stem from an immediate desire to engage in highly rewarding activities. Since positive urgency is a measure that relates to emotional state, two possible explanations have been put forward by Berg et al. (2015). First, it is likely that affect has a key role in triggering impulsive behaviours, and second, individuals with poor emotion regulation skills might display various forms of impulsive behaviours. Therefore, Berg et al. (2015) suggested that negative and positive affectivity, as well as emotion regulation skills, need to be controlled to fully understand the nature of the relationship between urgency and risk-taking behaviours. Following from this suggestion, one promising avenue of future research may be to examine the cognitive or neural mechanisms underlying both urgency domains (Berg et al., 2015; Cyders et al., 2014).

Our results on toxic disinhibition as a significant online disinhibition predictor of online risk-taking behaviours are also consistent with the existing literature. This suggests that those who adhere to a more toxic disinhibition effect are more likely to engage in risky behaviours. Earlier research by Suler (2004) and Joinson (2007) has attributed the antecedents of toxic online disinhibition to anonymity, invisibility, asynchronicity, solipsistic introjection, dissociative imagination, and minimisation of status and authority. Later research has added new antecedents of disinhibition such as subjective norm and inner containment (Wu, Lin, & Shih, 2017) as well as perceived lack of repercussions (Udris, 2014). Of particular interest is the explanation provided in a recent study by Voggeser, Singh, and Göritz, (2018), which suggests that failure at self-control may lead to failure of noticing social cues, which, in turn, could lead to toxic communication patterns. The challenge of verifying the role and contribution of these antecedents to explaining disinhibiting behaviours is beyond the scope of this study. However, understanding these antecedents can result in the formulation and development of better policies and technologies, especially the ones related to legal, education, cybersecurity, telecom, and mobile applications.

Although not hypothesised, gender emerged as a significant predictor of online risk-taking behaviours in both regression analyses conducted. This is another striking result because there is evidence in the literature that gender does play an important role in explaining risky behaviours. For example, studies by Chiou and Wan (2006), Jensen et al., (2002), Kim and Kim (2012), Lau and Yuen (2013), as well as Leung and Lee (2012) reported that males tend to engage in riskier online behaviours such as sexual self-disclosure, online aided academic cheating, use of unauthorised softwares, and Internet addiction than do females. Similar results are obtained in the present study as we found male Millennials reported more online risk-taking behaviours compared to females (see Table 1).

This study is not without its limitations, and we acknowledge that several aspects warrant a careful interpretation of the results. First, with an unequal number of genders and a higher count of female respondents in this study, there will always be a possibility of gender differences that may influence the results. Furthermore, the majority of the participants in this study are from collectivistic cultures, and according to Martin (2011), people in these cultures tend to be somewhat high in uncertainty avoidance; hence, lowering the willingness to report or commit unethical behaviours. Therefore, care must be exercised when it comes to generalising the findings to the broader population. Second, as in other survey-based research, social desirability bias may ensue. Bernardi (2006) conducted a study involving people from various countries and found that the tendency of giving socially desirable responses decreased as the demography shifts into a more individualistic one. In other words, when faced with sensitive questions, there is a possibility of participants with a collectivistic orientation giving socially desirable responses instead of accurate answers. Here, the issue would be again on the extent of generalisation that could be made out of the study's results.

Lastly, there is no clear demarcation line when it comes to impulsivity and disinhibition. Previous studies (e.g., Reid et al., 2014) have argued that impulsivity is a complex construct with numerous approaches to measuring it. This is also the

case with disinhibition. Despite having different conceptual and operational definitions, both online and offline disinhibition may have converged somewhere along the lines, and to separate the two, studying only the phenotypical measure of disinhibition would not suffice. Hence, further studies using different types of measurements that can tap into various aspects of disinhibition are recommended. In short, future studies should take into consideration all these aspects, especially with regard to accounting for potential influencing variables such as culture, gender, and the dynamic nature of online interaction. Therefore, more research is needed to clarify how these variables may influence risk-taking behaviours.

## 5.0 CONCLUSION

This study was conducted because of the dearth of work on the Millennials' attitudes and online behaviours, particularly in the context of Industry 4.0 and the Industrial Internet of Things (IIoT). The findings showed that lack of premeditation, positive urgency, and toxic disinhibition are the aspects of impulsivity and online disinhibition that demonstrated the strongest associations with online risk-taking behaviours. It may, therefore, be suggested that these variables are the most relevant target areas for interventions that could modify risky behaviours in cyberspace, particularly where the future trends would be heading towards the gig economy and crowd-working. What remains unclear, however, is the nature of each variable's unique contribution to the broad psychopathology such as to conduct disorders, obsessive disorders, and psychosomatic disorders in these settings. Therefore, future studies should examine the contributions of these variables in the context of a wide range of covariates including socioeconomic factors and different types of gig economy workers. It is also worth examining the implications of these new forms of employment for occupational safety and health, both physically and mentally, as well as exploring the regulations, systems, and mechanisms that fit this fast-paced, unstable, unpredictable, yet socially-connected work environments.

The findings on gender are most interesting because although the number of male participants is less than females in this study, their online risk-taking behaviour ratings are still markedly significant. This result suggests that while interventions are essential for both genders, additional efforts to focus on male Millennial workers are required given their higher propensity to engage in risky behaviours than females. To this end, potential awareness and behavioural training interventions that are gender-specific are recommended and worth further experimentation and development. Taken these results together, this study has provided some insight into how Millennials perceive and behave online or in cyberspace. Future works are welcomed to further deliberate these issues and contribute to the existing body of knowledge on the online attitudes and behaviours of the Millennials in occupational and professional settings.

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