
Article:
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Ethical approval: Ethical approval for the primary data collection was granted by the NHS Health Research Authority (HRA), IRAS project ID: 192004, REC reference: 16/WA/0055.

Competing interests: The authors have no competing interests to declare.

Abstract

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KEY WORDS: Gambling problems, screening tools, identification, prevention, primary care

The terms ‘pathological gambling’ and ‘gambling disorder’ describe psychiatric conditions in ICD-10 (World Health Organisation, 1992) and DSM-5 (American Psychiatry Association, 2013), respectively, which are characterised by persistent maladaptive gambling behaviours that precede negative consequences (e.g., severe debt, relationship breakdown). The term ‘problem gambling’ is also used to describe a range of problems which may subsume these psychiatric diagnoses, as well as less severe cases which are nonetheless characterised by some degree of impaired control and significant adverse consequences (Williams & Volberg, 2014). This terminology is informed by public health considerations that acknowledge a spectrum of severity extending from severe levels of problem gambling (for which treatment is appropriate), to problems which are less severe and may be addressed through secondary prevention initiatives (Shaffer & Korn 2002). The latter have been described variously as ‘low-risk’, ‘moderate-risk’ or ‘at-risk’ gambling, and may include sub-diagnostic levels of gambling problems. Notwithstanding ostensible references to low risk, these terms all encapsulate gambling that reflects at least some problematic behaviours or harms, and are estimated to account for 85% of the burden of gambling harm at the population level (Browne et al., 2017).

Gambling problems tend to cluster with other addictive and mental health problems (Lorains et al., 2011), and predict adverse consequences for individuals (e.g., suicidality) (Cowlishaw & Kessler, 2016) and families (e.g., relationship problems, family violence) (Cowlishaw et al, 2016a; Roberts et al., 2018). Although there are psychological therapies for gambling that have demonstrated efficacy (Cowlishaw et al., 2012), help-seeking is rare and usually crisis-driven (Evans & Delfabbro, 2005), and thus tends to occur only *after* occurrences of severe harms. As such, there is a need for prevention initiatives including programmes of identification and response within diverse healthcare environments. These include services for mental health issues that co-occur with gambling problems, such as

substance use (Cowlishaw et al., 2014) and affective disorders (Cowlishaw et al., 2016b), and generalist settings such as primary care (Cowlishaw et al., 2017).

It has been recommended that general practitioners should screen for gambling problems among high risk groups (Sanju & Gerada, 2011), and this approach is aligned with service-level responses to other addictive behaviours such as alcohol use (McCambridge & Saitz, 2017; Coulton et al., 2017). In the UK, for example, there is guidance which recommends that health services should conduct alcohol screening to facilitate the opportunistic delivery of brief alcohol interventions (National Institute for Health & Clinical Excellence, 2010). In the context of primary care, as well as exploring relevance to presenting problems, there is an emphasis on the identification of high risk behaviours, and low severity problems, which may be most responsive to these low intensity interventions (Saitz, 2010). As such, trials have typically addressed heavy or hazardous alcohol use (that confers risk but has not yet resulted in harm) and harmful drinking (defined by current consequences for physical and mental health), while excluding patients who are likely to be alcohol dependent (Saitz, 2010) according to measures like the Alcohol Use Disorders Identification Test (AUDIT) (Babor et al., 2001). The AUDIT has informed the content of brief tools that are sensitive to heavy or hazardous drinking, as well as alcohol use disorder (Bush et al., 1998; Bradley et al., 2007), and thus display advantages over tests that may fail to detect risk and low severity problems (Bradley et al., 1998).

There are several brief screening tools for gambling, ranging from two (Johnson et al., 1997) to four items (Volberg et al., 2011) (see Table 1), that demonstrate promising properties and could be suitable for administration in healthcare settings. These include the Brief Biosocial Gambling Screen (BBGS) (Gebauer et al., 2010), which operationalises some core domains of an addiction 'syndrome', including neuroadaptation (withdrawal), psychosocial characteristics (lying) and social consequences (borrowing money), as well as

the Control, Lying and Preoccupation scale from the National Opinion Research Centre DSM Screen for Gambling Problems (NODS-CLiP) (Toce-Gerstein et al., 2009). These 3-item scales have both shown excellent properties in validation studies (Himeloch et al., 2015; Volberg et al., 2011), but originate from longer measures which operationalise the DSM criteria and have been appraised relative to indicators of severe gambling problems or disorders. Studies have provided less promising findings when comparisons have been made against reference standards including less severe problems with gambling. For example, positive screens defined by the NODS-CLiP have been shown to capture only 43% of 'at risk' gamblers (scoring 1-2 on the NODS) in community-based surveys (Toce-Gerstein et al., 2009), although higher levels (77%) have been observed in other contexts (Volberg et al., 2011).

TABLE 1

It is likely that there will be clinical benefits to individual patients (which are distinct from population-level or public health benefits) (Heather, 2012; McCambridge & Cunningham, 2007) from situating brief interventions for gambling in generalist healthcare environments, but realising these will require efficient identification tools. The limitations of existing measures for such purposes are understudied, and the objective of this paper is to examine the performance of the NODS-CLiP (Toce-Gerstein et al., 2009) when compared to the Problem Gambling Severity Index (PGSI) (Ferris & Wynne, 2001). While both the NODS-CLiP and the BBGS are in widespread use, only the former had been validated in a health service context (Volberg et al., 2011) when this study was designed. The PGSI was selected as the reference standard since this measure is also widely used in community settings to identify gambling problems across a spectrum of severity, including low severity or 'sub-diagnostic' difficulties (which were the principal focus of this study), as well as severe cases of problem gambling (which subsumes but is not limited to diagnoses of

gambling disorder). This investigation analysed data from a study in general practices (Cowlishaw et al., 2017) and considered properties of a brief measure that is widely used, but has uncertain utility for generalist health care environments.

Method

Participants and procedure

This study took place in eleven general practices in southwest England, including four practices from deprived areas (top 30% for deprivation in England), two in areas of low deprivation (bottom 30%), three practices in a moderate band (middle 40% for deprivation), a student health service and a practice providing specialist care to the homeless. Patients aged over 18 years and attending for any reason were eligible, but were excluded if they were unable to understand English, required immediate medical attention, or were unable to give consent. Patients were approached in waiting rooms before appointments by a research assistant who was affiliated with the study and were asked to self-complete anonymous questionnaires. These were returned in waiting rooms or using pre-paid envelopes, which yielded n = 1,058 questionnaires. Further details are provided elsewhere (Cowlishaw et al., 2017).

Measures

Gambling frequency was assessed using items about lottery or instant win / scratch tickets, play on bingo, casino table games, slot machines and other electronic gambling machines, games of skill, or betting money on sporting events. Items used past year timeframes, along with an item about any other gambling. All patients who reported any past year gambling according to these items were then asked to complete both the NODS-CLiP (Toce-Gerstein et al., 2009) and PGSI (Ferris & Wynne, 2001). The former consists of 3-items (see Table 1) scored on a binary scale (0 = *No*, 1 = *Yes*) that referred to past year

experiences. An affirmative (non-zero) response to any NODS-CLiP item was used to indicate potential gambling problems. The PGSI consists of 9-items scored on 4-point response scales (0 = *Never*, 3 = *Almost always*) that relate to the past year. A criterion of 5+ was used to indicate severe gambling problems, which yields greatest classification accuracy relative to professional ratings of clinically significant cases of problem gambling (Williams & Volberg, 2014). Scores of 1-4 were used as indicators of low to moderate severity problems (which did not meet thresholds for problem gambling).

Data analyses

Data-file preparation and missing data management was conducted using SPSS 21, and has been reported previously (Cowlishaw et al., 2017). Subsequent analyses were conducted using Program R and involved estimation of prevalence using the NODS-CLiP and PGSI. The latter was treated as the reference standard and best available indicator of severe gambling problems (PGSI 5+) and any gambling problems (PGSI 1+). For both indicators, the validity of the NODS-CLiP scale and individual items (which were considered for exploratory purposes) were defined by estimates of sensitivity, specificity, positive predictive values (PPVs) and negative predictive values (NPVs). Capture rates indicated the proportion of patients identified by the NODS-CLiP when considered across levels defined by the PGSI.

Results

Descriptive analyses indicated 3.3% of patients (95% CI = 2.3% to 4.6%; *n* = 35/1058) screening positive for gambling problems using the NODS-CLiP (1+). This compares to 0.9% (95% CI = 0.5% to 1.8%; *n* = 10/1058) which were classified as patients with severe gambling problems (PGSI 5+), and 5.2% (95% CI = 4.0% to 6.8%; *n* = 55/1058) of patients indicating any evidence of gambling problems (PGSI 1+). Table 2 provides estimates of sensitivity, specificity, PPV and NPV for the NODS-CLiP relative to these

classifications. As shown, the NODS-CLiP demonstrated perfect sensitivity for identification of severe gambling problems, along with high specificity and a NPV, but a low PPV. Appraisals of individual NODS-CLiP items provided comparable estimates of sensitivity (PPV) of 80.0% (33.0%), 90.0% (64.0%) and 70.0% (35.0%) for the first, second and third item (see Table 1), respectively. There was lower sensitivity for the NODS-CLiP total scale when the indicator of any gambling problems (PGSI 1+) was the reference standard. Table 2 indicates that a positive score on the NODS-CLiP accurately identified all problem gamblers, but only 20% of patients exhibiting problems that were low to moderate in severity (PGSI 1-4).

TABLE 2

Discussion

This paper demonstrates performance of the NODS-CLiP when considered for purposes of identification in primary care. An affirmative response to any NODS-CLiP item provided high sensitivity and specificity for problem gambling among general practice attenders, but performed weakly when identifying less severe gambling problems. Such results are consistent with studies of longer scales which indicate that while the NODS-CLiP item about preoccupation 'targets' relatively low levels of gambling severity (in Rasch analysis models), the indicators of lying and past attempts at change differentiate better across moderate and high levels of problem gambling, respectively (Molde et al., 2010). Comparable issues seem likely to characterise other scales which have been developed from DSM-based measures (see Table 1), and also include items (e.g., regarding irritability when reducing gambling or family problems related to gambling) that target moderate and severe levels of problem gambling (Miller et al., 2013; Molde et al., 2010). Although recent studies have proposed newer scales including multiple items at lower levels of severity, such as

chasing losses and feeling guilty about gambling, these were nonetheless developed and appraised for purposes of identifying gambling disorders (Challet-Bouju et al., 2016).

Findings of high sensitivity and specificity of the NODS-CLiP for problems at high levels of severity are consistent with prior studies (Himelhoch et al., 2015; Volberg et al., 2011) that also indicate excellent performance for identifying problem gambling. However, these results should be viewed in the context of the low PPV, which is influenced by the low rate of occurrence in this clinical setting, and suggests that screening of large numbers of patients would be required to identify modest numbers of people with severe gambling problems. These values would be higher in contexts where such people are encountered more frequently, such as services for substance misuse (Cowlishaw et al., 2014) and affective disorders (Cowlishaw et al., 2016b), which may thus provide more promising environments for identification. In the context of primary care, however, there is regular involvement in preventative care for many physical or mental health concerns and related behaviours (e.g., alcohol use, physical activity), as well as complex psychosocial issues (e.g., intimate partner violence). As such, there are unique opportunity costs from questioning, whereby asking about gambling may increase the already high burdens of screening and case-finding, and likely preclude inquiries about other issues (even when using brief measures). Such opportunity costs are relevant to consideration of screening tools in primary care which are insensitive to problems that are low to moderate in severity, and also yield generally small numbers of patients with severe gambling problems.

The current findings suggest the need for new measures which are brief and sensitive across the full spectrum of risk and severity of gambling. This includes behaviours that confer risk but have not produced harms, which have been omitted from most existing measures of problem gambling (Rogers et al., 2009). There are preliminary studies suggesting thresholds for gambling participation that may help identify such behaviours

(Currie et al., 2017), but further endeavours are needed to operationalise risk and develop measures that are generalisable across gambling activities (despite the absence of a common metric that is analogous to the standard drink). Such measures can be informed by attempts to develop tools from existing alcohol scales (Rockloff, 2012), including the AUDIT-C, which is sensitive to heavy or hazardous drinking and more severe forms of alcohol use disorder (Bush et al., 1998; Bradley et al., 2007). New measures should be evaluated in terms of sensitivity to less, as well as more severe problems. The former will also require improved understanding of the signs of low severity (or subclinical) gambling symptomatology, and thus further studies which map indicators on a continuum of severity; including those which are not necessarily incorporated in clinical accounts of severe gambling disorders.

Future evaluations of the utility of screening tools in primary care should involve considerations of feasibility and the nature of responses to positive screens. These may include further assessments situated within or outside of primary care, as well as brief or intensive interventions that may be appropriate depending on levels of problem severity. In relation to alcohol, for example, further assessments are recommended only at the severe end of the alcohol spectrum (in order to establish likely dependence) (Babor et al., 2001), and this may highlight the need for referral pathways to specialist services. In the context of lower levels of severity, there are recommendations to deliver brief alcohol interventions after screening and without the need for such assessment (Babor et al., 2001).

There are brief gambling interventions which are analogous to some forms of brief alcohol interventions, incorporating psychoeducation and brief advice (e.g., regarding strategies to limit the development of problems, such as setting financial limits and not gambling to make money), and these have been examined in health service environments (Petry et al., 2016) including primary care (Nehlin et al., 2016). There may be considerable merit also in developing gambling interventions with potential effectiveness across the

spectrum of severity, and which blend different intervention approaches within a patient-centred framework, as has been developing in the alcohol field (McCambridge & Rollnick, 2014). There is a general need for further effectiveness research, however, along with additional studies of implementation in health service contexts. The latter may also be informed by literature on health system responses to alcohol which have faced major and ongoing challenges to successful implementation (McCambridge & Saitz, 2017).

Limitations

The sample size was adequate for detecting improved sensitivity of screening for any gambling problems (relative to a null hypothesis and given a prevalence of around 5%) (Bujang & Adnan, 2016), but the lower rate for problem gambling suggested reduced power and greater uncertainty of comparable estimates. The study did not consider thresholds for specificity and consequences of false positives from screening in primary care (there were n = 35 persons with potential problem gambling identified by the NODS-CLiP, and only n = 10 were classified as such by the PGSI), or the nature of appropriate responses to positive screens. There is no gold standard measure of low severity gambling problems, and the PGSI was specified as an imperfect reference standard using a modified criterion of scores from 1-4 (with scores of 5+ used to indicate problem gambling, which also differs from conventional scoring which treats scores of 1-2, 3-7 and 8+ on the PGSI as indicators of low-risk, moderate-risk and problem gambling, respectively). The PGSI also incorporates items which are self-reported and do not address the full range of problematic gambling behaviours or harms. While PGSI classifications approximate the severe end of the continuum of gambling severity, these are not well validated relative to clinician judgements and do not correspond to diagnoses of gambling disorder. Both the NODS-CLiP and PGSI were only administered when patients reported any past year gambling participation.

Conclusions

The NODS-CLiP performs well for purposes of identifying cases of problem gambling, but lacks sensitivity for problems that are low to moderate in severity and may be inappropriate for generalist healthcare settings which prioritise prevention and brief interventions. There is a need for new screening measures which are suitably brief and sensitive across the spectrum of risk and severity, and which can support initiatives for improving identification and responses to gambling problems in health care settings.

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Table

Table 1. Item content for brief gambling screening tools including the NODS-CLiP.

Measure	Items
Lie-Bet Questionnaire (Johnson et al.,1997)	
	Have you ever had to lie to important people about how much you gambled?
	Have you ever felt the need to bet more and more money?
Brief Biosocial Gambling Screen (BBGS) (Gebauer et al., 2010)	
	Have you become restless, irritable or anxious when trying to stop/cut down on gambling?
	Have you tried to keep your family or friends from knowing how much you gambled?
	Did you have such financial trouble as a result of your gambling that you had to get help with living expenses from family, friends or welfare?
NODS-CLiP (Toce-Gerstein et al., 2009)	
	Have you ever tried to stop, cut down, or control your gambling?
	Have you ever lied to family members, friends or other about how much you gamble or how much money you lost on gambling?
	Have there been periods lasting 2 weeks or longer when you spent a lot of time thinking about your gambling experiences, or planning out future gambling ventures or bets
NODS-PERC (Volberg et al., 2011)	
	Have there been periods lasting 2 weeks or longer when you spent a lot of time thinking about your gambling experiences, or planning out future gambling ventures or bets
	Have you every gambled as a way to escape from personal problems? Has there ever been a period when, if you lost money gambling one day, you would return another day to get even?
	Has you gambling every caused serious or repeated problems in your relationships with any of your family members or friends?

Table 2. Properties of the of NODS-CLiP screening tool in comparison with indicators of problem gambling and any gambling problems (including less severe difficulties) when defined by the PGSI.

CLiP 1+ properties	PGSI1+	PGSI 5+
Sensitivity	34.5%	100.0%
Specificity	98.4%	97.6%
PPV	54.3%	28.6%
NPV	96.5%	100.0%
Proportion capture	PGSI = 1-4	PGSI = 5+
Total *n*	45	10
% of sample	4.3%	0.9%
n captured by CLiP	9	10
% captured	20.0%	100%

Identification of gambling problems in primary care: Properties of the NODS-CLiP screening tool

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Abstract

INTRODUCTION: There are several brief screening tools for gambling that possess promising psychometric properties but have uncertain utility in generalist health care environments which prioritise prevention and brief interventions. This paper describes an examination of the NODS-CLiP screening tool, in comparison to the Problem Gambling Severity Index (PGSI), when used to operationalise gambling problems across a spectrum of severity. METHODS: Data were obtained from *n* = 1,058 primary care attendees recruited from eleven practices in England who completed various measures including the NODS-CLiP and PGSI. The performance of the former was defined by estimates of sensitivity, specificity, positive predictive values (PPVs) and negative predictive values (NPVs), when PGSI indicators of problem gambling (5+) and any gambling problems (1+), respectively, were reference standards. RESULTS: The NODS-CLiP demonstrated perfect sensitivity for problem gambling, along with high specificity and a NPV, but a low PPV. There was much lower sensitivity when the indicator of any gambling problems was the reference standard, with capture rates indicating only 20% of patients exhibiting low to moderate severity gambling problems (PGSI 1-4) ~~that~~ were identified by the NODS-CLiP. CONCLUSIONS: The NODS-CLiP performs well when identifying severe cases of problem gambling, but lacks sensitivity for less severe problems and may be unsuitable for~~have modest utility in~~ settings which prioritise prevention and brief interventions. There is a need for screening measures which are sensitive across the full spectrum of risk and severity, and can support initiatives for improving identification and responses to gambling problems in health care settings such as primary care.

KEY WORDS: Gambling problems, screening tools, identification, prevention, primary care

The terms ‘pathological gambling’ and ‘gambling disorder’ describe psychiatric conditions in ICD-10 (World Health Organisation, 1992) and DSM-5 (American Psychiatry Association, 2013), respectively, which are characterised by persistent maladaptive gambling behaviours that precede negative consequences (e.g., severe debt, relationship breakdown). The term ‘problem gambling’ is also used to describe a range of problems which may subsume these psychiatric diagnoses, as well as less severe cases which are nonetheless characterised by some degree of impaired control and significant adverse consequences (Williams & Volberg, 2014). This terminology is informed by public health considerations that acknowledge a spectrum of severity extending from severe levels of problem gambling (for which treatment is appropriate), to problems which are less severe and may be addressed through secondary prevention initiatives (Shaffer & Korn 2002). The latter have been described variously as ‘low-risk’, ‘moderate-risk’ or ‘at-risk’ gambling, and may include sub-diagnostic levels of gambling problems. ~~The term ‘problem gambling’ describes a broader spectrum of harms, which may include those that are less severe (Korn & Shaffer, 1999) and described variously as ‘low-risk’, ‘moderate-risk’ or ‘at-risk’ gambling.~~ Notwithstanding ostensible references to low risk, these terms all ~~all~~ encapsulate gambling that reflects at least some problematic behaviours or harms, and are estimated to account for 85% of the ~~total~~ burden of gambling harm at the population level (Browne et al., 2017).

Gambling~~These~~ problems tend to cluster with other addictive ~~behaviours~~ and mental health problems (Lorains et al., 2011), and predict adverse consequences for individuals (e.g., suicidality) (Cowlishaw & Kessler, 2016) and families (e.g., relationship problems, family violence) (Cowlishaw et al, 2016a; Roberts et al., 2018). Although there are psychological therapies for gambling that have demonstrated efficacy (Cowlishaw et al., 2012), help-seeking is rare and usually crisis-driven (Evans & Delfabbro, 2005), and thus ~~thus~~ tends to occur only *after* occurrences of severe harms. As such, there is a need for prevention

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initiatives ~~which~~ includinge programmes of identification and response within diverse healthcare environments. These ~~latter~~ ~~may~~ include~~subsume~~ services for mental health issues that ~~commonly~~ co-occur with gambling problems, such as~~including~~ substance use (Cowlishaw et al., 2014) and affective disorders (Cowlishaw et al., 2016b), and~~as well as~~ generalist settings such as primary care (Cowlishaw et al., 2017).

It has been recommended that general practitioners should screen for gambling problems among high risk groups (Sanju & Gerada, 2011), and this approach is aligned with service-level responses to other addictive behaviours such as alcohol ~~mis~~use (McCambridge & Saitz, 2017; Coulton et al., 2017). In the UK, for example, there is guidance which recommends that health services should conduct alcohol screening to facilitate the opportunistic delivery of brief alcohol interventions (National Institute for Health & Clinical Excellence, 2010). In the context of primary care, as well as exploring relevance to presenting problems, there is an emphasis on the identification of high risk behaviours, and ~~relatively~~ low severity problems, which may be most responsive to these low intensity interventions (Saitz, 2010). As such, trials have typically addressed heavy or hazardous alcohol use (that confers risk but has not yet resulted in harm) and harmful drinking (defined by current consequences for physical and mental health), while excluding patients who are likely to be alcohol dependent (Saitz, 2010) according to measures like the Alcohol Use Disorders Identification Test (AUDIT) (Babor et al., 2001). The AUDIT has informed the content of brief tools that are sensitive to heavy or hazardous drinking, as well as alcohol use disorder~~abuse or dependence~~ (Bush et al., 1998; Bradley et al., 2007), and thus display advantages over tests that may fail to detect risk and low severity problems (Bradley et al., 1998).

There are several brief screening tools for gambling, ranging from two (Johnson et al., 1997) to four items (Volberg et al., 2011) (see Table 1), that demonstrate promising

properties and could be suitable for administration in healthcare settings. These include the Brief Biosocial Gambling Screen (BBGS) (Gebauer et al., 2010), which operationalises some core domains of an addiction 'syndrome', including neuroadaptation (withdrawal), psychosocial characteristics (lying) and social consequences (borrowing money), as well as the Control, Lying and Preoccupation scale from the National Opinion Research Centre DSM Screen for Gambling Problems (NODS-CLiP) (Toce-Gerstein et al., 2009). These 3-item scales have both shown excellent properties in validation studies (Himeloch et al., 2015; Volberg et al., 2011), but originate from longer measures which operationalise the DSM criteria and have ~~also~~ been appraised relative to indicators of severe gambling problems or disorders. Studies have provided less promising findings when comparisons have been made against reference standards ~~that~~ includ~~e~~ing less severe problems with gambling. For example, positive screens defined by the NODS-CLiP have been shown to capture only 43% of 'at risk' gamblers (scoring 1-2 on the NODS) in community-based surveys (Toce-Gerstein et al., 2009), although higher levels (77%) have been observed in other contexts ~~were identified in a study of brief gambling interventions~~ (Volberg et al., 2011).

TABLE 1

It is likely that there will be clinical benefits to individual patients (which are distinct from population-level or public health benefits) (Heather, 2012; McCambridge & Cunningham, 2007) from situating brief interventions for gambling in generalist healthcare environments, but realising ~~any~~ these~~such benefits~~ will require efficient identification tools. The limitations of existing measures for such purposes are understudied, and the objective of this paper is to examine the performance of the NODS-CLiP (Toce-Gerstein et al., 2009) when compared to the Problem Gambling Severity Index (PGSI) (Ferris & Wynne, 2001). While both the NODS-CLiP and the BBGS are in widespread use, only the former had been validated in a health service context (Volberg et al., 2011) when this study was designed. ~~;~~

Tthe PGSIlatter was selected as the reference standard since this measurebeing is also widely used in community settings tofor identification ofy gambling problems across a spectrum of severity, (including low severity or 'sub-clinicaldiagnostic' difficulties (which were the principal focus of this study), as well as severe cases of problem gambling (which subsumes but is not limited to diagnoses of gambling disorder)). This investigation analysed data from a recent study in general practices (Cowlishaw et al., 2017) and considered properties of a brief measure that is widely used, but has uncertain utility for generalist health care environments.

Method

Participants and procedure

This study took place in eleven general practices in southwest England, including four practices from deprived areas (top 30% for deprivation in England), two in areas of low deprivation (bottom 30%), three practices in a moderate band (middle 40% for deprivation), a student health service and a practice providing specialist care to the homeless. Patients aged over 18 years and attending for any reason were eligible, but were excluded if they were unable to understand English, required immediate medical attention, or were unable to give consent. Patients were approached in waiting rooms before appointments by a research assistant who was affiliated with the study and were asked to self-complete anonymous questionnaires. These were returned in waiting rooms or using pre-paid envelopes, which yielded n = 1,058 questionnaires. Further details are provided elsewhere (Cowlishaw et al., 2017).

Measures

Gambling frequency was assessed using items about lottery or instant win / scratch tickets, play on bingo, casino table games, slot machines and other electronic gambling machines, games of skill, or betting money on sporting events. Items used past year

timeframes, along with an item about any other gambling. All pPatients who reported any past year gambling according to these items were then asked toed complete bothd the NODS-CLiP (Toce-Gerstein et al., 2009) and PGSI (Ferris & Wynne, 2001). The former consists of 3-items (see Table 1) scored on a binary scale (0 = *No*, 1 = *Yes*) that referred to past year experiences. An affirmative (non-zero) response to any NODS-CLiP item was used to indicate potential gambling problems. The PGSI consists of 9-items scored on 4-point response scales (0 = *Never*, 3 = *Almost always*) that relate to the past year. A criterion of 5+ was used to indicate severe gambling problemsfor problem gambling, which yields greatest classification accuracy relative to professional ratings of clinically significant cases of instances of problem gambling (Williams & Volberg, 2014). Scores of 1-4 were used as indicators of low to moderate severity problems (which did not meet thresholds for problem gambling).

Data analyses

Data-file preparation and missing data management was conducted using SPSS 21, and has been reported previously (Cowlishaw et al., 2017). Subsequent analyses were conducted using Program R and involved estimation of prevalence using the NODS-CLiP and the PGSI. The latter was treated as the reference standard and best available indicator of severe problem gambling problems (PGSI 5+) and any gambling problems (PGSI 1+). For both indicators, the validity of the NODS-CLiP scale and individual items (which were considered for exploratory purposes) were defined by estimates of sensitivity, specificity, positive predictive values (PPVs) and negative predictive values (NPVs). Capture rates indicated the proportion of patients identified by the NODS-CLiP when considered across levels defined by the PGSI.

Results

Descriptive analyses indicated 3.3% of patients (95% CI = 2.3% to 4.6%; *n* = 35/1058) screening positive for gambling problems using the NODS-CLiP (1+). This compares to 0.9% (95% CI = 0.5% to 1.8%; *n* = 10/1058) which were classified as patients with severe gambling problem ~~gambler~~s (PGSI 5+), and 5.2% (95% CI = 4.0% to 6.8%; *n* = 55/1058) of patients indicating any evidence of gambling problems (PGSI 1+). Table 2 provides estimates of sensitivity, specificity, PPV and NPV for the NODS-CLiP relative to these classifications. As shown, the NODS-CLiP demonstrated perfect sensitivity for identification of severe ~~problem~~ gambling problems, along with high specificity and a NPV, but a low PPV. Appraisals of individual NODS-CLiP items ~~(see Table 1)~~ provided comparable estimates of sensitivity (PPV) of~~ranging from~~ 8~~7~~0.0% (3~~5~~.0%) ~~to~~, 90.0% (64.0%) and 70.0% (35.0%) for the first, second and third ~~and third~~ item (see Table 1), respectively ~~(details available from first author)~~. There was lower sensitivity for the NODS-CLiP total scale when the indicator of any gambling problems (PGSI 1+) was the reference standard. Table 2 ~~also~~ indicates that ~~capture rates for the NODS-CLiP when considered across severity levels defined by the PGSI. As shown,~~ a positive score on the NODS-CLiP accurately identified all problem gamblers, but only 20% of patients exhibiting problems that were low to moderate in severity (PGSI 1-4).

TABLE 2

Discussion

This paper ~~provides an illustrative~~ demonstrat~~ion of~~es performance of the NODS-CLiP when considered for purposes of identification in primary care. An affirmative response to any NODS-CLiP item provided high sensitivity and specificity for problem gambling among general practice attenders, but performed weakly when identifying less severe gambling problems. Such results are consistent with studies of longer scales which indicate that while the NODS-CLiP item about preoccupation 'targets' relatively low levels of

gambling severity (in Rasch analysis models), the indicators of lying and past attempts at change differentiate better across moderate and high levels of problem gambling, respectively (Molde et al., 2010). Comparable issues seem likely to characterise other scales which have been developed from DSM-based measures (see Table 1), and also include items (e.g., regarding irritability when reducing gambling or family problems related to gambling) that target moderate and severe levels of problem gambling (Miller et al., 2013; Molde et al., 2010). Although recent studies have proposed newer scales including multiple items at lower levels of severity, such as chasing losses and feeling guilty about gambling, these were nonetheless developed and appraised for purposes of identifying gambling disorders (Challet-Bouju et al., 2016).

Findings of high sensitivity and specificity of the NODS-CLiP for problems at high~~er~~ levels of severity are consistent with prior studies (Himelhoch et al., 2015; Volberg et al., 2011) that also indicate excellent performance for identifying problem gambling. However, these results should be viewed in the context of the low PPV, which is influenced by the low rate of occurrence in this clinical setting, and suggests that screening of large numbers of patients would be required to identify modest numbers of people with severe gambling problems~~problem gamblers~~. These values would be higher in contexts where such ~~problem gamblers~~people are encountered more frequently, such as services for substance misuse (Cowlishaw et al., 2014) and affective disorders (Cowlishaw et al., 2016b), which may thus provide more promising environments for identification. In the context of primary care, however, there is regular involvement in preventative care for many physical or mental health concerns and related behaviours (e.g., alcohol use, physical activity), as well as complex psychosocial issues (e.g., intimate partner~~domestic~~ violence~~ and abuse~~). As such, there are~~, and thus~~ unique opportunity costs from questioning. ~~(~~whereby asking about gambling may increase the already high burdens of screening and case-finding, and likely preclude inquiries

about other issues (, even when using brief measures). Such opportunity costs are relevant to consideration of screening tools in primary care which are insensitive to problems that are low to moderate in severity, and also yield generally small numbers of patients with severe gambling problems problem gamblers.

There are preliminary studies of brief gambling interventions when situated in health service settings (Petry et al., 2016), but comparative effectiveness research is needed. The current findings suggest the need for widespread implementation of low intensity interventions will also require new brief measures which are brief that and possess sensitivity across the full spectrum of risk and severity of gambling. This includes behaviours that confer risk but have not produced harms, which have been omitted from most existing measures of problem gambling (Rogers et al., 2009). There are preliminary studies suggesting thresholds for gambling participation that may help identify such behaviours (Currie et al., 2017), but further endeavours are needed to operationalise risk and develop measures that are generalisable across major gambling activities (despite the absence of a common metric that is analogous to the standard drink). Such measures canshould be informed by prior attempts to develop tools from existing alcohol scales (Rockloff, 2012), including the AUDIT-C, which is sensitive to heavy or hazardous drinking and more severe forms of, as well as to alcohol use disorderabuse or dependence (Bush et al., 1998; Bradley et al., 2007). New measures, and these should be evaluated in terms of sensitivity to less, as well as more severe problems. The formerlatter will also require improved understanding of the signs of low severity (or subclinical) gambling symptomatology, and thus further studies which map indicators on a continuum of severity; including those which are not necessarily incorporated in clinical accounts of severe gambling disorders.

Future evaluations of the utility of screening tools in primary care should involve considerations of feasibility and the nature of responses to positive screens. These may

include further assessments situated within or outside of primary care, as well as brief or intensive interventions that may be appropriate depending on levels of problem severity. In relation to alcohol, for example, further assessments are recommended only at the severe end of the alcohol spectrum (in order to establish likely dependence) (Babor et al., 2001), and this may highlight the need for referral pathways to specialist services. In the context of lower levels of severity, there are recommendations to deliver brief alcohol interventions after screening and without the need for such assessment (Babor et al., 2001).

There are brief gambling interventions which are analogous to some forms of brief alcohol interventions, incorporating psychoeducation and brief advice (e.g., regarding strategies to limit the development of problems, such as setting financial limits and not gambling to make money), and these have been examined in health service environments (Petry et al., 2016) including primary care (Nehlin et al., 2016). There may be considerable merit also in developing gambling interventions with potential effectiveness across the spectrum of severity, and which blend different intervention approaches within a patient-centred framework, as has been developing in the alcohol field (McCambridge & Rollnick, 2014). There is a general need for further effectiveness research, however, along with additional studies of implementation in health service contexts. The latter may also be informed by literature on health system responses to alcohol which have faced major and ongoing challenges to successful implementation (McCambridge & Saitz, 2017).

Limitations

The sample size was adequate for detecting improved sensitivity of screening for any gambling problems (relative to a null hypothesis and given a prevalence of around 5%) (Bujang & Adnan, 2016), but the lower rate for problem gambling suggested reduced power and greater uncertainty of comparable estimates. The study did not consider ~~acceptable~~ thresholds for specificity and ~~the likely~~ consequences of false positives from screening in

primary care (there were *n* = 35 persons with potential problem gambling identified by the NODS-CLiP, and only *n* = 10 were classified as such by the PGSI), or the nature of appropriate responses to positive screens. There is no gold standard measure of low severity gambling problems, and the PGSI was specified as an imperfect reference standard using a modified criterion of scores from 1-4 (with scores of 5+ used to indicate problem gambling, which also differs from conventional scoring which treats scores of 1-2, 3-7 and 8+ on the PGSI as indicators of low-risk, moderate-risk and problem gambling, respectively). The PGSI also incorporates items which are self-reported and do not address the full range of problematic gambling behaviours or ~~gambling-related~~ harms. While PGSI classifications approximate the severe end of the continuum of gambling severity, these are not well validated relative to clinician judgements and do not correspond to diagnoses of gambling disorder. Both the NODS-CLiP and PGSI were only administered when patients reported any past year gambling participation.

Conclusions

The NODS-CLiP performs well for purposes of identifying ~~established~~ cases of problem gambling, but lacks sensitivity for problems that are low to moderate in severity and may be inappropriate for~~have modest utility in~~ generalist healthcare settings which prioritise prevention and brief interventions. There is a need for new screening measures which are suitably brief and sensitive across the spectrum of risk and severity, and which can support initiatives for improving identification and responses to gambling problems in health care settings.

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