

Estimate of the prevalence of subjects with gambling-related problems requiring treatment: a study in Northern Italy

Raimondo Maria Pavarin¹, Corrado Zenesini² and Angelo Fioritti³

¹Osservatorio Epidemiologico Metropolitano Dipendenze, Dipartimento Salute Mentale e Dipendenze, Azienda USL Bologna, Bologna, Italy

²IRCCS Istituto delle Scienze Neurologiche, Azienda USL Bologna, Bologna, Italy

³Dipartimento Salute Mentale e Dipendenze, Azienda USL Bologna, Bologna, Italy

Abstract

This study analyzes the data related to subjects who for the first time turned to a hospital or to a Public Treatment Service Dedicated to Drug Addicts or to a Community Mental Health Center for problems related to pathological gambling in the metropolitan area of Bologna (Northern Italy) in the period 2000/2015. The aims were to describe characteristics and problems of pathological gamblers (PGs), and to estimate the prevalence of PGs using the capture-recapture method.

Four hundred and ninety-five residents were identified, with an estimate of 1570 PGs and a prevalence of 1.78 per 1000. We highlight a high number of new cases in the period after 2010.

Most patients are males, aged from 40 to 50 years, 12% were born abroad, one in three suffers from other mental disorders, 9% has alcohol dependence, 8% drug dependence. We should point out the low level of education and the high number of unemployed subjects.

Key words

- pathological gambling
- prevalence
- mental health
- alcohol
- substance abuse

INTRODUCTION

The individual, social, and economic costs associated with gambling behaviors are so high that gambling and its related problems have become a significant as well as growing public health issue [1]. Gambling disorders affect 0.5%-7.6% of adults worldwide, although measurement and prevalence varies according to the screening instruments and methods used, and the availability and accessibility of gambling opportunities [2]. In Europe, the prevalence rate for pathological gambling (PG), irrespective of the instruments used, is between 1% and 3.4% [3]; in Italy, it is between 1.3% [4], and 2.2% [5], while 12 376 subjects attended a Public Treatment Service Dedicated to Drug Addicts (in Italy named SERD) in 2014 [6].

As with alcoholics, only a small number of PGs receive appropriate support and treatment [7]. Indeed, a significant percentage of gamblers develop subclinical or clinically relevant gambling problems [8], whereas only a low percentage (estimated at below 10%) actually seek formal treatment in clinic-based programs or attend Gamblers Anonymous [9, 10]. Furthermore, among individuals with a lifelong history of DSM-IV

PG, nearly 40% had not experienced gambling-related problems over the past year, and about one third of individuals with a history of PG eventually recovered, mostly without being given formal treatment [10].

Research suggests that PGs will only seek help when gambling problems become severe [11] and when higher problem awareness and/or external pressure could facilitate treatment access [12]. The low rate of treatment seeking might be due to external barriers to obtaining help (e.g. lack of awareness of services, ignorance of the availability of treatment, geographical distance, existing time commitments, and work and domestic demands) [13], as well as personal factors (e.g. perceived stigma or shame, embarrassment or pride, difficulty in acknowledging the problem and denial, wariness about seeking professional help, or believing that they can handle the problem without outside help) [11].

During the last decade, most European countries have started a process of progressive legalization of gambling which is still a national monopoly [14]. The Italian gambling business is the fourth biggest in the world and the foremost in Europe, with total gross winnings of 17.5 billion Euros in 2012 [15, 16].

In Italy, following the approval by government of the deregulation of gambling [17], some laws have been passed since 2011 whose aim is to guarantee prevention, treatment, and rehabilitation for people affected by PG [18, 19].

PGs can turn equally to a SERD, a Community Mental Health Center (CMHC) or a Hospital (Hos). In these three different sectors, access is voluntary, by primary care physician, by specialist, or by other health-care services and there are no specific inclusion/exclusion criteria.

It is thus necessary, besides the quantification/description of the phenomenon, to study the characteristics of the PGs who request a specific treatment in the different sectors of intervention and to identify a reproducible method to estimate its prevalence.

The aims of this study, which analyzes data related to subjects who for the first time turned to a Hos, a SERD, or a CMHC for problems related to PG were: 1) to describe characteristics and problems of PGs according to the first service that they had turned to; 2) to estimate the prevalence of PGs requiring treatment using the capture-recapture method [20].

METHODS

Subjects aged over 17 years, who for the first time turned to a Hos, a SERD, or a CMHC, with an ICD-9 (312.31) or ICD-10 (F 63.0) diagnosis correlated to PG, were selected. Personal identifiers were used following the rules of privacy regulation. The period of reference ranges from 01/01/2000 to 12/31/2015; the territory is the metropolitan area of Bologna (Northern Italy).

The data were retrospectively collected from the different digitalized archives: the PG diagnosis in the hospital could have been main or secondary, in the SERD it could have been made at the first contact or in the subsequent periods, in the CMHC it could only be made in coexistence with other psychiatric diagnoses. The date of first access considered in this study refers to the first PG diagnosis.

SERD: At the SERDs, a digital social and health regional folder is used to collect data at the first admission, including personal data, health data, treatments undertaken, ICD-9 (until 2002) and ICD-10 CM (from 2003) diagnoses, and substance abuse.

PG diagnosis is performed on the grounds of a clinical diagnostic evaluation interview with an assessment of the DSM-4 (until 2012) or DSM-5 (from 2013) criteria and the results of the Italian adaptation of SOGS tests [21] or CPGI [22].

The treatments are proposed and agreed upon with the patients and/or the family (individual psychological consultancy, interventions of psychological education, individual psychotherapy, group psychotherapy, family psychotherapy, psychological support groups, referral to self-help groups, treatment with psychotropic drugs in the case of psychiatric comorbidities). Data are available from 1978. Prior to 2000, there were three cases of PGs (one accessed in 1990, one in 1991 and one in 1993), which are not included in this research.

CMHC: The data relating to the Community Men-

tal Health Centers were gleaned from the CMHC information system, implemented for administrative and clinical-epidemiological purposes. The information system retrieves data on demographic characteristics, ICD-9 CM diagnoses, information on each type of treatment provided, and the mental health professionals involved. The diagnosis of PG is made on the grounds of a psychiatric clinical interview with assessment of the DSM-4 (until 2012) or DSM-5 (from 2013) criteria and in particular cases the case is managed by the SERD. The main treatments concern psychological consulting interviews, psychotherapy, involvement of family members, referral to self-help groups, and treatment with psychotropic drugs in the case of psychiatric comorbidity. Data are available from 1994, with the first case of PG being reported in 2000.

Hos: The data relating to Hos discharges were supplied by the IT system of the Bologna Local Health Authority. Based on the ICD-9 classification, subjects with discharges diagnosis (both principal and secondary) of PG were selected [23]. In the case of admission to a psychiatric unit the path is similar to that of the CMHC. In the case of admission to another ward, a psychiatric consultancy is requested and the PG diagnosis is made on the grounds of the psychiatric clinical interview based on a diagnostic evaluation with assessment of the DSM-4 (until 2012) or DSM-5 (from 2013). The main treatments are: psychological consultancy interviews; treatment with psychotropic drugs in the case of psychiatric comorbidity; possible referral to a specialized service (SERD, CMCH) for discharge. Data are available from 2000, with the first case of PG being reported in 2000.

Each person may have contact with several intervention sectors and the information was collected at the first contact. The cases were selected from the IT systems of the SERD (9 health services), CMHC (11 units), and hospitals (10 structures).

All the variables came from the available information recorded in the electronic archives: diagnosis, date of birth, gender, country of birth, residence, drug dependence, alcohol dependence syndrome, mental disorders, contact sector, date of contact.

To identify any other mental disorders, drug dependence, and alcohol dependence syndrome, the cohort was cross-checked with the electronic data available for all subjects referring, respectively, to the CMHC and to the SERD in the metropolitan area of Bologna.

Capture-recapture estimates

The capture-recapture technique is a sampling method used mainly in the biological field and in demographic applications. Originally developed to estimate the dimensions of animal populations when it was not possible to simply count up all the cases [24], capture-recapture methods were then successfully used in the estimation of wild animal survival rates and subsequently also applied to human populations within the scope of medical and social sciences [20].

The capture-recapture (CRC) approach is an indirect method for generating prevalence estimates based on the degree of overlap between two or more distinct

samples of the study population. It has been used to estimate prevalence in many epidemiological scenarios [25, 26], including hard-to-reach populations, such as illegal drug users [27, 28], HIV diagnoses [29], and subjects affected by PG [30]. The number of unobserved individuals is estimated by fitting a log-linear regression model to this overlap [31].

In epidemiology, CRC applications assume that a number of underlying assumptions are met. The first assumption is that the sources must be representative of the population being studied, which has to be a closed one. The second assumption is that the sources should be directly independent; where being detected by one source should not change the likelihood of being detected by another source. With log-linear modeling, this assumption can be relaxed by using interaction terms between the dependent sources [32, 33].

Statistical analysis

All continuous and categorical variables were analyzed with a Student's *t*-test and a chi-squared test, respectively.

To analyze the profiles of the PGs with mental disorders, a multivariate analysis was performed using the logistic regression and the odds ratio was calculated along with the respective 95% confidence intervals [34].

A three-source analysis was performed by fitting eight log-linear models to the data arranged in 23 contingency tables [31]. These analyses were performed using Stata's user-written "recap" functionality. To account for possible interactions between the three sources, eight different models were compared in the analysis. The simplest one is the independent model, then there are three models that allow for an interaction between two of the sources. There are models with two pair-interactions present and the so-called saturated model, which adjusts for interaction between all three pairs of sources [35]. The 95% confidence intervals (95% CI) were calculated according to Regal and Hook [36].

The choice of the final model is based on the likelihood ratio test statistic (G^2), a test based on the likelihood ratio, which expresses how many times more likely the data are under one model than the other; the Akaike Information Criterion (AIC) and the Bayesian Information Criterion adapted by Draper (BIC), which are functions of the likelihood ratio statistic in that they estimate the quality of each model, relative to each of the other models introducing a penalty term for the number of parameters in the model [37, 38]. The best models are chosen, being those with lowest AIC and BIC scores.

Data analyses were performed using the STATA 14.1 statistical software program.

RESULTS

In the period from 01/01/2000 to 12/31/2015, 495 subjects, residents in the metropolitan area of Bologna, attended a health facility because of PG for the first time.

Table 1 reports the characteristics of the incident cases in relation to the first-referral service: 403 subjects (81.4%) turned to a SERD, 70 (14.1%) to a CMHC,

and 22 (4.4%) to a Hos. Over the whole period, some people turned to several services (7%), 85% turned to a SERD, 15% to a CMHC, and 6% to a hospital.

Characteristics at first admission

Mean age at first admission was 48.4 years, 21% were female, and 12.3% non-natives. Among the non-natives, we note subjects born in Romania, Albania, and Morocco. The highest percentage of patients was in the 41-50 years age group. Females were distinguished by higher mean age, particularly for the percentage of patients aged more than 50 years. Admissions had steadily risen over time, but it should be noted that 70% occurred after 2011.

As regards socio-economic variables, available only for attendance at SERDs and to CHHCs, relating to the educational level it was reported that 14% had only completed primary school, 46% middle school, 23% had a high school diploma, and 4% were graduates. In relation to marital status, 36% were single, 36% married, 15% separated or divorced, 5% widows or widowers. With regard to professional status, 50% were employed, 21% unemployed, 18% were receiving a retirement or invalidity pension.

Overall, at least one subject in three had other mental disorders, among which we should highlight depression and neurotic and somatoform syndromes being more common among females, while 10% had alcohol dependence syndrome and 7.7% drug dependence, which was more common among males.

SERD: Most of the SERD clients had their first admission after 2011. In 11% of the cases the PG diagnosis had not been made at the first contact, but in the subsequent years.

By comparison with other sources, they are younger on average, with a higher percentage of non-natives and of males (Table 1). One in three was also suffering from mental disorders, particularly depression, 10% had alcohol dependence syndrome, 3% cocaine dependence, 2% heroin dependence, and 1% cannabis dependence. In 85% of the cases the individuals had undergone a therapeutic schedule or were undergoing treatment, while 15% had instead requested consultancy. Among the subjects' registered contact with the service lasted an average of 410 days. By the end of the follow-up, 22% had completed the therapeutic program and had been discharged, 41% had an ongoing therapeutic program, while 37% had given up before program completion. They had all been submitted to medical health check-ups and had received various forms of socio-educational support, 50% had undergone psychological interviews/assessment, and 15% had been treated with pharmacological therapies.

Data from the digital social and health folders show that 12% had only primary school education and 5% were graduates; 50% were employed and 21% retired; 20% were widowed, separated, or divorced.

CMHC: From the CMHC information system it emerges that for 84% of the cases at first access there was a diagnosis of PG only. In the other cases a psychiatric diagnosis (depression, mania and emotive disorders, neurotic and somatoform syndromes, other disor-

Table 1
Pathological gambling: characteristics at the first admission

	Total	SERD	CMHC	Hos	P	Males	Females	P
Subjects	495	403	70	22		391	104	
Period								
2000-2003	4.4	2.0	4.6	18.6	< 0.0001	5.1	1.9	0.230
2004-2007	9.3	7.0	22.7	18.6				
2008-2011	16.0	13.9	9.1	30.0				
2012-2015	70.3	77.2	63.6	32.9				
Mean age (%)	48.4	48.0	50.6	49.6	0.490	46.6	54.9	< 0.0001
18-30 years	8.1	8.9	4.6	4.3	0.578	9.5	2.9	< 0.0001
31-40 years	21.0	20.1	18.2	27.1		23.8	10.6	
41-50 years	28.1	27.5	36.4	28.6		30.2	20.2	
51-60 years	22.8	24.1	22.7	15.7		20.7	30.8	
>60 years	20.0	19.4	18.2	24.3		15.9	35.6	
Female (%)	21.0	19.6	45.5	20.0	0.016	-	-	0.555
Non-natives (%)	12.3	12.9	4.6	11.4	0.799	13.0	9.6	
Drug dependence (%) (ICD 9 code 304)	7.7	8.4	18.2	-	0.008	9.2	1.9	0.013
Cocaine (ICD 9 code 304.2)	3.2	4.0	-	-	0.151	3.8	1.0	0.141
Heroin (ICD 9 code 304.0)	2.0	2.5	-	-	0.312	2.3	1.0	0.388
Cannabis (ICD 9 code 304.3)	0.6	0.7	-	-	0.709	0.5	1.0	0.599
Alcohol dependence syndrome (%) (ICD 9 code 303)	9.5	10.4	13.6	2.9	0.109	10.0	7.7	0.480
Mental disorders (%)	30.5	29.8	77.3	20.0	< 0.0001	26.9	44.2	0.001
Depression	10.3	11.4	18.2	1.4	0.018	7.7	20.2	< 0.0001
Neurotic and somatoform syndromes	8.7	9.4	13.6	2.9	0.138	7.4	13.5	0.052
Personality and behavioral disorders	4.7	3.0	18.2	10.0	< 0.0001	4.6	4.8	0.930
Schizophrenia and other functional psychoses	3.2	3.2	13.6	-	0.007	3.8	1.0	0.141
Mania and bipolar affective disorders	1.6	1.5	4.6	1.4	0.537	1.5	1.9	0.780

SERD: Public Treatment Service Dedicated to Drug Addicts; CMHC: Community Mental Health Center; Hos: Hospital.

ders caused by substances and other mental problems) coexisted.

Twenty-three percent of the patients had primary school education and only 1% were graduates; 44% had a regular job; 19% were either widowed, separated, or divorced.

Hos: Among the subjects whose first source of access was a hospital, a higher percentage of females can be observed (Table 1), of subjects with illegal substance use, and those with mental disorders (77%), particularly depression, personality disorders, and psychoses (Table 1).

About eight patients in ten were admitted to a psychiatric unit and 5% to an oncology unit, with a 10-day average hospital stay. Forty-five percent of the admissions were emergencies, with 27% direct access, 27% referred by a specialist, and 14% primary care physician, while 14% self-discharged.

In 36% of the cases PG was the main discharge diagnosis and in 64% it was the secondary. In these cases, the main diagnoses were episodic mood disorders, schizophrenia, personality disorders, substance abuse or addiction, adjustment disorders, and anxiety disorders.

Multivariate analysis

To construct the profile of clients with mental disorders, a multivariate analysis was performed using a logistic regression. The variables used were sex, age group, period of first admission (<2011, ≥2011), service of first admission for PG, alcohol dependence syndrome, drug dependence. The results are displayed in Table 2.

The analysis reveals a statistically significant higher likelihood for subjects who turned to a hospital for the first time, but there does not appear to be any correlation with the period of the first admission. Furthermore, females and subjects aged between 51 and 60 years stand out.

It should be noted that alcohol dependence was statistically significantly higher in the univariate analysis.

Estimate of the prevalence of subjects with PG

In the whole period and in the last period (2011-2015), the best models were those with interaction between Hos and CMH: these sources were not independent but the dependence was relaxed by this interaction term included in the model. These models provide an

Table 2
Mental disorders: logistic regression analysis

		Univariate			Multivariate		
		OR	95% CI	P	OR	95% CI	P
Sex	Male	1	Referent		1	Referent	
	Female	2.16	1.38-3.38	0.001	1.80	1.10-2.94	0.018
Age at first admission	18-30 years	1	Referent		1	Referent	
	31-40 years	1.99	0.75-5.25	0.166	2.04	0.74-5.60	0.168
	41-50 years	2.29	0.89-5.88	0.085	1.98	0.74-5.31	0.172
	51-60 years	4.04	1.57-10.38	0.004	3.71	1.39-9.94	0.009
	> 60 years	2.58	0.98-6.79	0.054	2.27	0.82-6.27	0.112
Period of first admission	< 2011	1	Referent		1	Referent	
	≥ 2011	1.36	0.85-2.18	0.204	1.37	0.82-2.31	0.228
First admission for pathological gambling	SERD	1	Referent		1	Referent	
	CMHC	0.59	0.32-1.10	0.097	0.69	0.36-1.32	0.258
	Hos	8.02	2.89-22.23	< 0.0001	7.29	2.56-20.75	< 0.0001
Alcohol dependence syndrome	No	1	Referent		1	Referent	
	Yes	1.98	1.07-3.64	0.029	1.81	0.94-3.50	0.258
Drug dependence	No	1	Referent		1	Referent	
	Yes	1.54	0.78-3.04	0.214	1.43	0.67-3.05	0.358

SERD: Public Treatment Service Dedicated to Drug Addicts; CMHC: Community Mental Health Center; Hos: Hospital.

estimate, respectively, of 1570 PGs (95% CI [1217, 2135]), with a prevalence of 1.78 per thousand residents ranging from 1.69 to 1.87 for the whole period, and of 1154 PGs (95% CI [811, 1826]), with an incidence of 1.33 new cases per thousand residents ranging from 1.25 to 1.41 for the last period (Table 3).

DISCUSSION

The results of this study highlight a growing demand for treatment addressed not only to addiction services, but also to psychiatric and hospital services, based on the increase in the SERD attendance from 2011.

Using the data of the SERD, Hos, and CMCH patients, we estimated a prevalence of 1.78 PGs per thousand residents aged over 17 years for the whole period, with a high number of new cases in the last period (2011-2015).

Most of the patients are males, aged from 40 to 50 years, one in three suffers from mental disorders (especially depression), 12% were born abroad, 10% have alcohol dependence syndrome, and 8% have drug dependence. As regards the socio-economic conditions, while taking into account the 20% missing cases, we should point out the low level of education, the high presence of unemployed subjects, and married or formerly married people.

Patients' characteristics change with regard to the service of first contact. Indeed, among SERD clients we find subjects with an age at first access that is on average lower and a higher percentage of non-natives. Among the Hos clients we observe a higher percentage of females, subjects with mental disorders, alcohol de-

pendence syndrome, and drug dependence.

From the multivariate analysis, there emerges a request for treatment due to PG in subjects with mental disorders that was more likely for females and for people aged between 50 and 60 years.

Both the estimate of the prevalence and some characteristics of those subjects and the relationship with other problematic issues confirm findings previously reported in the European literature. From the studies, it indeed emerges that PG was more likely to occur among male, single or divorced people, with alcohol abuse [39], non-natives [40], unemployed [41], and was highly comorbid with other mental disorders and drug or alcohol dependence [2].

Furthermore, many studies show that PG patterns are irregularly distributed among the population, in particular it is possible to demonstrate a PG pattern twice as high for men and inversely proportional to the level of education [42]. Prevalence rates of PG among females were found to be less than half, when compared with males [43]. Among the PGs seeking treatment, males were more likely to be younger, white, and employed than females. In addition, compared to women, men showed an earlier age of onset of gambling behavior, a higher gambling involvement, and preferred specific forms gambling. Female gamblers were more anxious and depressed, while men were more likely to use alcohol and illicit drugs [8].

While considering that for some authors the use of treatment-seeking samples may lead to incorrect conclusions about gender differences [44], the results of our study only partially confirm what has been reported

Table 3
Log-linear analyses with different dependencies between sources

Period	Model	G ²	P-value	AIC	BIC	Cases*	n*	N*	95% CI*
2011-2015	2. HOS*CMHC, SERD	0.04	0.98	-3.96	-3.85	375	779	1154	811-1826
2000-2015	2. HOS*CMHC, SERD	0.32	0.85	-3.68	-3.58	548	1022	1570	1217-2135

Model with interaction between Hos and CMH.

G²: likelihood ratio test statistics; AIC: Akaike Information Criterion; BIC: Bayesian Information Criterion adapted by Draper.

Cases*: number of cases reported to three sources; n*: estimate of the number of cases not reported to any source; N*: total estimate (n* + number of cases reported to 3 sources); 95% CI: 95% confidence interval for N*.

Hos: Hospital; CMHC: Community Mental Health Center; SERD: Public Treatment Service Dedicated to Drug Addicts.

by the Italian studies [4-5]. Indeed, while confirming that subjects who have a higher prevalence of PG are males, divorced, with primary school education alone, and alcohol dependence, there are differences as regards the prevalence in the general population, whose estimate is at least ten times higher in previous studies.

Some findings have also shown that potentially problem/at-risk gamblers more frequently had a higher income, and at least one parent who had gambling problems [4]. These are nonetheless studies conducted among the general population, based on self-reported data and with the use of different PG instruments, whereas our study is only based on incident cases of subjects who have received a PG diagnosis from a health facility.

As regards the trends, it is worth pointing out that our study demonstrated an increase in the number of new subjects who had requested treatment for PG starting from 2011, suggesting that this could be linked both to an increase in the supply of treatment and to the number of cases in the general population, but with the data at our disposal we are unable to provide an exhaustive answer.

This study presents some limitations that reduce the generalizability of the results and further research is required involving specifically targeted studies. The data used are those available from first admission and so much information is lacking. The number of PGs might

be underestimated in that as our data are retrospective, there may be errors of coding and the diagnosis might have been omitted or not have been transcribed in the digitalized folder. Furthermore, it has not been possible to consider data concerning different gambling habits, the use of tobacco, and of other substances, since they were not retrieved uniformly by the operators.

CONCLUSIONS

In conclusion, we wish to emphasize that this is the first Italian study in which the prevalence of PGs is estimated using the data of subjects who turned to the health care services.

Such information contributes to a more accurate description of the phenomenon in Italy. Indeed, albeit with data limited to a specific geographical area, the methodology proposed allows us to identify several sources and is also useful in quantifying a possible demand for specific treatments provided by the health services.

Conflict of interest statement

There are no potential conflicts of interest or any financial or personal relationships with other people or organizations that could inappropriately bias conduct and findings of this study.

Received on 2 August 2017.

Accepted on 13 October 2017.

REFERENCES

1. Suurvali H, Hodgins D, Toneatto T, Cunningham J. Treatment seeking among Ontario problem gamblers. Results of a population survey. *Psychiatr Serv* 2008;59(11):1343-6. DOI:10.1176/ps.2008.59.11.1343
2. Williams RJ, Volberg RA, Stevens RMG. The population prevalence of problem gambling: methodological influences, standardized rates, jurisdictional differences, and worldwide trends: report prepared for the Ontario Problem Gambling Research Centre and the Ontario Ministry of Health and Long Term Care, 2012. Available from: www.uleth.ca/dspace/handle/10133/3068.
3. Calado F, Griffiths MD. Problem gambling worldwide: an update and systematic review of empirical research (2000-2015). *J Behav Addict* 2016;(5)4:1-22. DOI: 10.1556/2006.5.2016.073
4. Barbaranelli C, Vecchione M, Fida R, Podio-Guidugli S. Estimating the prevalence of adult problem gambling in Italy with SOGS and PGSI. *J Gambl Issues* 2013;28:1-24. DOI: 10.4309/jgi.2013.28.3
5. Bastiani L, Gori M, Colasante E, Siciliano V, Capitanucci D, Jarre P, Molinaro S. Complex factors and behaviors in the gambling population of Italy. *J Gambl Issues* 2013;29(1):1-13. DOI: 10.1007/s10899-011-9283-8
6. Dipartimento Nazionale Politiche Antidroga. *Relazione Annuale al Parlamento sullo stato delle dipendenze*. Roma: DPA; 2015. Available from: www.politicheantidroga.gov.it/attivita/pubblicazioni/relazioni-al-parlamento/relazione-annuale-2015/presentazione.aspx.
7. Erbas B, Buchner UG. Pathological gambling: prevalence, diagnosis, comorbidity, and intervention in Germany. *Dtsch Arztebl Int* 2012;109(10):173-9. DOI: 10.3238/arztebl.2012.0173
8. Ronzitti S, Lutri V, Smith N, Clerici M, Bowden-Jones H. Gender differences in treatment-seeking British pathological gamblers. *J Behav Addict* 2016;5(2):231-8. DOI: 10.1556/2006.5.2016.032
9. Suurvali H, Cordingley J, Hodgins DC, Cunningham J. Barriers to seeking help for gambling problems. A review

- of the empirical literature. *J Gambl Stud* 2009;25(3):407-24. DOI: 10.1007/s10899-009-9129-9
10. Slutske WS. Natural recovery and treatment-seeking in pathological gambling. Results of two US national surveys. *Am J Psychiatr* 2006;163(2):297-302. DOI: 10.1176/appi.ajp.163.2.297
 11. Suurvali H, Hodgins DC, Cunningham JA. Motivators for resolving or seeking help for gambling problems: A review of the empirical literature. *J Gambl Stud* 2010;26(1):1-33. DOI: 10.1007/s10899-009-9151-y
 12. Braun B, Ludwig M, Slecza P, Bühringer G, Kraus L. Gamblers seeking treatment: who does and who doesn't? *J Behav Addict* 2014;3(3):189-98. DOI: 10.1556/2006.5.2016.032
 13. Gainsbury S, Hing N, Suhonen N. Professional help-seeking for gambling problems: awareness, barriers and motivators for treatment. *J Gambl Stud* 2014;30(2):503-19. DOI: 10.1007/s10899-013-9373-x
 14. Littler A. The regulation of gambling at European level. The balance to be found. *ERA Forum* 2007;8(3):357-71. DOI:10.1007/s12027-007-0027-2
 15. Parlamento italiano. *Dati sulla raccolta da gioco d'azzardo in Italia nel 2015*. Roma: Camera dei Deputati; 2016. Available from: www.camera.it/leg17/824?tipo=A&anno=2016&mese=05&giorno=04&view=&commissione=06#data.20160504.com06.allegati.all00020.
 16. Di Bella E, Gandullia L, Leporatti L. The impact of gambling on government budget. A European Comparison with a Focus on Italy. *Int Econ* 2015;68(2):187-212. Available from: <https://ideas.repec.org/a/ris/ecoint/0751.html>.
 17. Sirianni G. Il gioco pubblico dal monopolio fiscale alla regolamentazione, nella crisi dello Stato sociale. *Diritto pubblico* 2012;18(3):801-36. DOI: 10.1438/74204
 18. Parlamento italiano. *Il gioco d'azzardo patologico e la tutela dei minori*. Roma: Camera dei deputati; 2015. Available from: www.camera.it/leg17/561?appro=app_tutela_minori.
 19. Italia - Regione Emilia Romagna. *Gioco d'azzardo: rischi e cura*. Bologna: Regione Emilia-Romagna; 2016 Available from: <http://salute.regione.emilia-romagna.it/dipendenze-patologiche/gioco-dazzardo>.
 20. Hook EB, Regal RR. Capture-recapture methods. *Lancet* 1992;339(8795):742. DOI: [http://dx.doi.org/10.1016/0140-6736\(92\)90639-K](http://dx.doi.org/10.1016/0140-6736(92)90639-K)
 21. Guerreschi C, Gander S. Versione Italiana del South Oaks Gambling Screen (SOGS) di Lesieur HR, Blume SB. In: C. Guerreschi (Ed.). *Giocati dal gioco. Quando il divertimento diventa una malattia: il gioco d'azzardo patologico*. Milano: San Paolo; 2002. p. 137-42.
 22. Colasante E, Gori M, Bastiani L, Siciliano V, Giordani P, Grassi M, Molinaro S. Assessment of the psychometric properties of Italian version of CPGI. *J Gambl Stud* 2013;29(4):765-74. DOI:10.1007/s10899-012-9331-z
 23. McNeely J, Gourevitch MN, Paone D, Shah S, Wright S, Heller D. Estimating the prevalence of illicit opioid use in New York City using multiple data sources. *BMC Public Health* 2012;12:443. DOI: <https://doi.org/10.1186/1471-2458-12-443>
 24. Petersen CGJ. The yearly immigration of young plaice into the Limfjord from the German Sea. *Report of the Danish Biological Station* 1896;6:1-48.
 25. Chao A, Tsay PK, Lin SH, ShauWY, Chao DY. The applications of capture-recapture models to epidemiological data. *Stat Med* 2001;20(20):3123-57. DOI: 10.1002/sim.996
 26. Khodadost M, Yavari P, Khodadost B, Babaei M, Sarvi F, Khatibi SR, Barzegari S. Estimating the esophagus cancer incidence rate in Ardabil, Iran. A capture-recapture method. *Iran J Cancer Prev* 2016;9(1):1-6. DOI: 10.17795/ijcp-3972
 27. Pavarin RM, Salsi A, Savioli V. Stima della prevalenza di tossicodipendenti nella città di Bologna nel 1997 e analisi del sommerso. *Boll farmacod alcoolismo* 1998;3:7-11. Available from: www.unicri.it/min.san.bollettino/bullettin_it/bull1998.htm.
 28. Espelt A, Domingo-Salvany A, Sánchez-Niubód A, Marí-Dell'Olmoa M, Brugal M T. Estimating trends in the prevalence of problematic cocaine use (1999-2008). *Gac Sanit* 2015;29(5):353-7. DOI: <http://dx.doi.org/10.1016/j.gaceta.2015.05.008>
 29. Héraud-Bousquet V, Lot F, Esvan M, Cazein F, Laurent C, Warszawski J, Gallay A. A three source capture-recapture estimate of the number of new HIV diagnoses in children in France from 2003-2006 with multiple imputation of variable of heterogeneous catchability. *BMC Infect Dis* 2012;12:251. DOI: 10.1186/1471-2334-12-251
 30. Pavarin RM, Marani S, Turino E, Limonta N, Sanchini S, Colaninno M. Stima della prevalenza di soggetti con gioco d'azzardo patologico nell'area metropolitana di Bologna e analisi del sommerso. *IJA* 2012;2(3-4):98-102.
 31. Fienberg SE. Multiple recapture census for closed populations and incomplete 2k contingency tables. *Biometrika* 1972;59:591-603. Available from: www.jstor.org/stable/2334810?seq=1#page_scan_tab_contents.
 32. Hook EB, Regal RR. Effect of variation in probability of ascertainment by sources ("variable catchability") upon "capture-recapture" estimates of prevalence. *Am J Epidemiol* 1993;137(10):1148-66. DOI: <https://doi.org/10.1093/oxfordjournals.aje.a116618>
 33. Hook EB, Regal, R R. Capture-recapture methods in epidemiology: methods and limitations. *Epidemiol Rev* 1995;17(1):243-64. DOI: <https://doi.org/10.1093/oxfordjournals.epirev.a036192>
 34. Clayton D, Hills M. *Statistical models in Epidemiology*. Oxford: Oxford University Press; 1993.
 35. An Der Heiden M. *Stata module to perform capture-recapture analysis for three sources with goodness-of-fit based confidence intervals*. College Station: Stata Corp; 2007. Available from <http://ideas.repec.org/c/boc/bocode/s456859.html>
 36. Regal RR, Hook EB. Goodness-of-fit based confidence intervals for estimates of the size of a closed population. *Stat Med* 1984;3(3):287-91. DOI: 10.1002/sim.4780030310
 37. Draper D. Assessment and propagation of model uncertainty. *J R Stat Soc Series B Stat Methodol* 1995;57(1):45-70. Available from: www.jstor.org/stable/2346087.
 38. Hook EB, Regal RR. Validity of methods for model selection, weighting for model uncertainty, and small sample adjustment in capture-recapture estimation. *Am J Epidemiol* 1997;145(12): 1138-44. DOI: <https://doi.org/10.1093/oxfordjournals.aje.a009077>
 39. Wardle H, Moody A, Spence S, Orford J, Volberg R, Jontangia D, Griffiths M, Hussey D, Dobbie F. *The British gambling prevalence survey 2010*. Available from: www.gamblingcommission.gov.uk/PDF/British%20Gambling%20Prevalence%20Survey%202010.pdf.
 40. Meyer G, Hayer T, Griffiths M. Problem gambling in Europe: Challenges, prevention, and interventions. New York: Springer Science & Business Media; 2009.
 41. Sassen M, Kraus L, Bühringer G, Pabst A, Piontek D, Taqi Z. Gambling among adults in Germany. Prevalence, disorder and risk factors. *Sucht* 2011;57(4):249-57. DOI: 10.1002/mpr.354
 42. Shaffer HJ, LaBrie RA, LaPlante DA, Nelson SE, Stanton MV. The road less travelled: Moving from dis-

- tribution to determinants in the study of gambling epidemiology. *Can J Psychiatry* 2004;49(8):504-16. DOI: 10.1177/070674370404900802
43. Blanco C, Hasin DS, Petry N, Stinson FS, Grant BF. Sex differences in subclinical and DSM-IV pathological gambling: results from the National Epidemiologic Survey on Alcohol and Related Conditions. *Psychol Med* 2006;36(07):943-53. DOI: 10.1017/S0033291706007410
44. Slutske WS, Piasecki TM, Deutsch AR, Statham DJ, Martin NG. Telescoping and gender differences in the time course of disordered gambling: evidence from a general population sample. *Addiction* 2015;110(1):144-51. DOI: 10.1111/add.12717