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Population Attributable Risk of Unintentional Poisoning in Iranian Children

Erfan Ayubi[1], *Kamyar Mansori [2] , Hamid Soori [3], Salman Khazaei [4], Ali Gholami [5], Abdolhalim Rajabi [6], Farhad Moradpour [6]

[1]PhD Candidate of Epidemiology, Department of Epidemiology, School of Public Health, Shahid Beheshti University of Medical Sciences, Tehran, Iran. [2] PhD Candidate of Epidemiology, Department of Epidemiology, Kurdistan University of Medical Sciences, Sanandaj, Iran. [3] Professor, Safety Promotion and Injury Prevention Research Center, Shahid Beheshti University of Medical Sciences, Tehran, Iran. [4] PhD Candidate of Epidemiology, Department of Epidemiology & Biostatistics, School of Public health, Hamadan University of Medical sciences, Hamadan, Iran. [5]PhD Candidate of Epidemiology, Department of Public Health, School of Public Health, Neyshabur University of Medical Sciences, Neyshabur, Iran. [6]PhD Candidate of Epidemiology, Department of Epidemiology, School of Public Health, Iran University of Medical Sciences, Tehran, Iran.

Abstract

***Background*:** It is introduced that unintentional childhood poisoning can be as result of child home environment and characteristics of parents. This study aimed at quantifying the adjusted population attributable risk percentage of risk factor of unintentional childhood poisoning.

***Materials and Methods*:** The hospital based case- control included 140 consecutive poisoned children who admitted to the Loghman Hospital between March 2013 and July 2014 in Tehran- Iran. The cases were matched with 280 control based on age (within a calliper of six month), gender, and date of hospital attendance. A standardized questionnaire including characterises of unintentional poisoning and its risk factors was completed in a structured interview for cases and controls. We estimated the adjusted odds ratios (OR) and population attributable risks (PAR) of unintentional childhood poisoning, PAR is proportion of poisoning that could have been avoided by the intervention on the modifiable risk factors.

***Results*:** Narcotic poisoning was most common type of poisoning among cases (58.6%) and among them accidental methanol ingestion was most (74.7%). The adjusted PARs for lack of attention to labels of poisoning products and availability to them were 54% and 41% respectively, also these figures for children with addicted parents and paternal smoking were 57% and 54% for, respectively.

***Conclusion*:** Children with addicted parents were more vulnerable for unintentional poisoning. For substantial reduction of unintentional poisoning, the preventive interventions should focus on modification of child's home environment, improvement of safety behaviours and health literacy of parents, especially in addicted parents.

***Key Words*:** Children, Epidemiologic methods, PAR, Poisoning, Risk factors.

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Corresponding Author:

Kamyar Mansori, Department of Epidemiology, Kurdistan University of Medical Sciences, Sanandaj, Iran.

Email: kamyarmansori@yahoo.com

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1. INTRODUCTION

Unintentional childhood poisoning is a concern public health in developed and developing countries (1, 2). It is fourth cause of injury and one of important determinant of emergency hospital admissions in children (3-6). About 24% of disability-adjusted life years (DALY) in children under 5 years old is related to poisoning (7). Many studies have been conducted about unintentional poisoning risk factors including chemical product such as kerosene, petrol, insecticides or household cleaning, and narcotics (8-11) socioeconomic gradient, parent with mental illness (12) and parental education (13, 14). In Iran like other developing countries, in recent years ingesting drugs and ingesting oil have been identified as the one of unintentional poisoning risk factors (15, 16), but sufficient information about other risk factors related to child's home environment and characteristics of parents are limited. Effective preventive interventions for reducing burden of disease rely on a suitable knowledge translation of relationship risk factor with disease using measures that be easily understood by policy makers and health care providers (17). One of these measures is population attributable risk (PAR). PAR are the fraction of the total disease in a population that would not have occurred if the associated effect with the risk factor of interest were absent (8). Given the fact that rare evidence exists regarding the role of risk factors in preventing and reducing unintentional childhood poisoning in Iran, we estimated the adjusted PAR of unintentional poisoning related to its risk factors using data of a case control- study.

2. MATERIAL AND METHODS

A hospital based case-control study was performed from March 2013 to July 2013 (16-month) at paediatric poisoning department of Loghman Hospital as a tertiary care centre referral in Tehran, Iran. 140 incidence cases of unintentional poisoning were captured. Controls were selected from hospital sections that the causes of admissions were unrelated to studied exposure. For every case two controls were chosen among children who were taken to the outpatient clinics of the hospital with suspected problems of the respiratory and digestive system or with infectious diseases. Controls were matched according to age (within a calliper of six month), gender, and date of hospital attendance.

2-1. Measuring tools

In our study, all children and their guardians were then interviewed by the same person using a check list that covered demographic, behavioural, and risk factors of accidental poisonings. The nature of the study did not allow blinding of the interviewer with respect to case-control status of the child. For cases, information was also obtained concerning type and conditions of poisoning. Considering that the majority of the variables in this check list had objective nature; for this check list do not reliability and validity ; Of course was consulted with two statistician and three epidemiologist experts in the field, they also had the same opinion. In this check list, content validity measured by relying on the knowledge of specialists poisoning who were familiar with the construct being measured. These subject-matter experts were usually provided with access to the check list and were asked to provide feedback on how well each question measures the construct in question. Then their feedback analysed that there was sufficient agreement between them in the field of content validity.

2-1. Ethical considerations

The ethics committee of Loghman Hospital approved the study and all of the children parents provided written informed consent. Participation in the study was voluntary and the questionnaires had no

name. Data were extracted all the questionnaires, in general.

2-2. Data analysis

Multivariable conditional logistic-regression was used to estimate adjusted odds ratio (OR) with the corresponding 95 % confidence intervals (CIs) to examine the association of risk factors with unintentional poisoning. Population attributable risk (PAR) was used to estimate what proportion of unintentional poisoning is attributable to the risk factor. It shows the proportion of cases that would not occur in a population if the risk factor was eliminated. PAR was estimated by using an approach based on conditional logistic regression (18). The formula for adjusted PAR estimate is: $PAR\% = \frac{P(OR-1)}{OR}$

Where **P** is the proportion of the risk factor among cases and **OR** is the adjusted odds ratio of disease due to that risk factor. Statistical analyses were conducted using Stata software, version 11 (Stata Corp, College Station, TX, USA) and P-value less than 0.05 was considered as statistically significant.

3. RESULTS

The characteristics of 140 poisoned children were exhibited in (Table.1). The mean age and standard deviation (SD) of the cases was 3.7 $\pm$ 2.5 years and 42.8% of them were boys. The most common types of poisoning were related to narcotics (58.6%) and among the narcotics; methadone was the most frequent poisoning agent (74.7%). Twenty five present of poisoning was happened when child not supervised by parental care, caregivers or other family members (Table.1). Estimates of odds ratios and related PAR are shown in details in (Table.2). Among the keeping place and package type risk factors, not paying attention of parents to labels of toxic substance or medicine was statistically significance 2.66 times more among cases then controls (odds ratio OR: 3.66, 95% confidence interval CI: (1.24,10.82) and with the not paying attention proportion of 0.742%, it resulted in PAR of 54%.

However storage of toxic materials in unsafe place had most of association, OR (%95 CI); 21.65 (1.1, 42.6), but it lead to a PAR of 6.7% because the proportion of storage of toxic materials in unsafe place among cases was 0.5%. Analysis indicated that having parent addicted were 13.84 times in cases as compared to controls and with narcotic addicted parents proportion of 0.621%, it resulted in the largest PAR of 57%. Overall PARs measure for storage of toxic materials, father education and mother education were 10.2%, 16.1% and 26.1% respectively.

Table 1: Distribution of unintentionally poisoned children by injury characteristics (n=140)

Variables		N (%)
Type of poisoning	Narcotics	82 (58.6)
	Methadone	62 (74.7)
	Opium	10 (12)
	Cannabis	1 (1.2)
	Amphetamine	10 (12.1)
	Medicinal	42 (30)
	Tablet	38 (92.6)
	Syrup	4 (7.4)
	Chemical	11 (7.9)
	Raticide	1 (9)
	Insecticide	1 (9)
	Petroleum products	9 (82)
	Monoxide carbon	3 (2.1)
	Unknown	2 (1.4)

Location of poisoning	Bedroom	70 (50)
	Kitchen	58 (41.4)
	Yard	7 (5)
	Unknown	5 (3.6)
Outcome of poisoning	Hospitalization	138 (98.6)
	Death	2 (1.4)
Poison entrance	Digestive	124 (88.6)
	Respiratory	14 (10)
	Other	2 (1.4)
Does child was unsupervised when poisoning is happened?	No	105 (75)

Table 2: Adjusted odds ratio (95% CI) and population attributable risk of risk factors on un-intentional poisoning

Variables	Case (n=180)	Control (n=280)	Adjusted OR (95 % CI)	PAR %
Inaccessibility to poison product				
No	65 (46.43)	10 (3.57)	10.15 (2.01-21.25)	41
Cupboard doors locked				
No	109 (77.86)	103 (36.79)	1.06 (0.37-3.05)	4
Read the labels				
No	104 (74.29)	51 (18.21)	3.66 (1.24-10.82)	54
Storage of toxic materials				
Cabinet	123 (87.86)	265 (94.64)	Reference	
Bathroom	10 (7.14)	12 (4.29)	1.98 (0.33-3.82)	3.5
Other place	7 (5)	3 (1.07)	21.65 (1.1-42.6)	6.7
Stored on drinking containers				
Yes	55 (39.29)	21 (7.5)	2.78 (0.58-4.37)	25.1
Drugs with unsafe packing				
Yes	75 (53.57)	75 (26.88)	3.39 (0.7-7.34)	37.7
Chemical with unsafe packing				
Yes	74 (52.86)	86 (30.82)	1.87 (0.39-4.45)	24.5
Attractive and colourful packaging				
Yes	72 (51.43)	109 (39.07)	1.70 (1.11-2.62)	21.1
Appropriate labelling				
No	89 (63.57)	109 (38.93)	2.95 (0.62-5.2)	42
Height storage				
<=100 cm	115 (82.14)	203 (72.5)	2.02 (0.6-4.9)	41.4
Previous poisoning				
Yes	41 (29.29)	18 (6.43)	5.63 (1.38-10.87)	24
Maternal occupation				
Yes	17 (12.41)	16 (5.71)	1.95 (0.37-3.52)	6
Paternal smoking				
Yes	97 (69.29)	65 (23.21)	5.1 (3.37-8.24)	54
Narcotic addicted parents				
Yes	87 (62.14)	21 (7.55)	14.84 (3.35-25.14)	57
Paternal education				
>10 yrs of education	59 (42.14)	184 (65.71)	Reference	-
≤10 yrs of education	70 (50)	89 (31.79)	1.41 (0.43-4.69)	14.5
No formal education	11 (7.86)	7 (2.5)	1.27 (0.05-3.45)	1.6
Maternal education				
>10 yrs of education	53 (37.86)	176 (62.86)	Reference	-
≤10 yrs of education	81 (57.86)	101 (36.07)	1.63 (0.2-1.98)	22.3
No formal education	6 (4.29)	3 (1.07)	9.8 (0.1-18.2)	3.8
Parental with mental disorders				
Yes	30 (21.43)	15 (5.36)	4.54 (0.9-8.9)	16.7

4. DISCUSSION

To best our knowledge, this was the first study on PAR of unintentional childhood poisoning in case control design in Iran. Unintentional poisoning in children can be avoidable and preventable. The findings of this study showed that notable proportion of the unintentional childhood poisoning can be prevented by intervention on child home environment and parenting characteristics. PAR% is known as a linking factor between causality and public health action. It is useful in designing effective or efficient interventions and prioritization of preventive health systems programs in view of public health (19); it determine direction of modifying intervention on the risk factor that lead to striking reduce of burden of disease.

In present study, majority of unintentional poisoning had occurred insides home,, so home modification with measures such as engineering concerned with re-designing of the home environment and the distribution of safety devices can be considered as an effective strategy to decreasing burden of this adverse outcome (20, 21). In this study, adjusted PAR for storage of toxic materials in unsafe place was 6.7%; indeed it had the strongest effect measure of association among the keeping place and package type risk factors. Little PAR of this risk factor is attributed to its low proportion among cases (5%), However ,this result is not consistent with other similar studies which have been carried out in this field (8, 22). For example, in a hospital based matched case - control study conducted in Pakistan by Bilal Ahmed; PAR was about 12% for unsafe storage of poisoning material (8).

One of the best evidence about childhood poisoning prevention comes from a systematic review. This systematic reviews study showed that preventive interventions mainly should be focused on education and safety behaviours such as cupboard locks. Moreover the role of modification on other risk factors such as substance abuse of parent, maternal occupation or other safety behaviour had been disregarded in the studies (23). Our study shows that if preventive interventions be designed at individual and community levels based on substance abuse of parents; notable proportion of unintentional poisoning can be avoided.

Having parents addicted had a very strong effect measure of association with PAR 57%. In this study, narcotics poisoning was the most common type of poisoning in children and among narcotics poisoning, methadone was found to be the most common form of poisoning featuring in 74.7% of occasions. The main cause of methadone poisoning in all children was due to the consumption of methadone that was mistakenly put and maintained in water/drink bottles by parents. These results were consistent with results of the studies which have been carried out by Martin in USA and Shadnia in Iran (24, 25), Because of in two study; methadone poisoning mainly was occurred for some reasons such as unsafe keeping at home, its appealing taste when blended with fruit juice, attractive or colourful packaging and consuming methadone syrup instead of anti-cough syrup or water. Evidence about the association addicted parents with un-intentional poisoning is rare in Iran. One study on 97 young children poisoned in North Eastern Iran showed that most of the poisoning cases were accidental methadone ingestion and 20% of them were intentionally poisoned from addicted parents but there was not significant association between intentional poisoning and parents' addiction (26).

The adjusted PAR for lack of attention to labels of poisoning products and availability to them was 54%, so read the label carefully and follow the instructions strictly when giving medications to children, pay attention to information

provided on label of household products such as cleaning products and illustrations recognizable by children can be as useful preventive interventions. A study on labelling quality of medicine or chemical product in Iran can be useful. In one study in Brazil on a random sample of cleaning product label shown that 75% of them were with no useful and cautionary information to avoid adverse outcomes such as un-intentional poisoning in children (27).

Parental education can be effective in the prevention of poisoning by effect on health literacy and promote it, knowledge about type of poisoning agent, safety behaviours such as safe storage, locks on cup-boards containing cleansing fluids and other household chemicals; however our study showed that overall PAR for paternal education and maternal education were 16.1% and 26.1% respectively. Studies that have been done in this field by Kendrick and Towner found that parent education can be along with a weak to modest effect in prevention of poisoning (28, 29) . Parent with mental disorders was another important risk factor in our study; this result was consistent with other similar study which has been carried out by Leiferman, it has been suggested maternal safety behaviours may be impaired by mental health problems (30).

PARs for some factors such as mental disorder in family, maternal occupation or some packaging and storage safety behaviours should be interpreted with caution until these associations are confirmed whether are causal or not. Causal association between risk factor and outcome is crucial when interpreting of PAR; because estimation of PARs actually is applicable for the risk factors that there is causal inference assumption for theirs. (well-define intervention, non-positivity and exchangeability) (31). Here the estimation of PARs can be considered as potential impact fraction and it can be expected what proportion of unintentional childhood poisoning is eliminated with reducing the prevalence of risk factor if causality be confirmed later (32).

Our study had strengths and limitations. This study was the first study that was done on estimating Population Attributable Risk (PAR) of Unintentional childhood poisoning in Iran, which can be one of the strengths in our study; so the finding of this study can help to design of effective prevention programs and following that further reduction in avoidable burden of disease. Case group is captured from a referral hospital; they can be representativeness of all cases in Tehranian population and probability of exposure of disease. Furthermore, this study, like many case-control studies may be faced with differential recall bias. Since the case group are aware of their illness, they may more readily remember possible factors associated with their illness than the control group; that we used hospital controls to mitigate the recall bias. The nature of the study was such that there was no possibility of blinding interviewer with respect to the status of cases and controls; therefor the results can be along with the degree of interviewer bias. Also socioeconomic status was not entered into our study. It has been showed unintentional childhood poisoning have dose response relationship with socioeconomic status and demonstrate a deprivation gradient (8, 23). Despite the limitations outlined above, we presented a robust methodology for calculating quantitative epidemiological measures of disease burden which provides policy makers and health service administrators with an important tool to prioritize health services and prevention strategies.

5- CONCLUSION

Main cause of Unintentional childhood poisoning was accidental methadone poisoning. Unintentional childhood

poisoning can be prevented by the education of parent especially addicted parents about reading labels of poisoning products carefully, using child resistant and non-attractive packaging and storage of poisoning products in safe places that be out of a child's reach.

6- CONFLICT OF INTEREST: None.

7- AKNOWLEGMENTS

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