

## Burden of Disease Attributable to Suboptimal Breastfeeding in Iran during 1990-2010; Findings from the Global Burden of Disease Study 2010

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### Abstract

**Background:** This study uses data of the global burden of diseases (GBD) study 2010 to report death, disability-adjusted life year (DALYs), years of life lived with disability (YLDs) and years of life lost due to premature mortality (YLLs), attributed to suboptimal breastfeeding by age and gender during 1990 to 2010 in Iran. **Materials and Methods:** The GBD assessments were used, together with estimates of death and DALYs due to specific risk factors to calculate the attributed burden of each risk factor exposure compared with the theoretical-minimum-risk exposure. Uncertainties in the distribution of exposure, relative risks, and relevant outcomes were incorporated into estimates of mortality attributable and burden and were presented as 95 % uncertainty interval (UI). **Results:** In both genders, the age standardized DALYs rates and the age standardized death rate [(from 5 (95% UI: 2-8) to 1 (95% UI: 0-2) per 100,000 populations], attributed to breastfeeding, had a decreasing trends. The age standardized YLD rate increased from 7 (95% UI: 2-15) to 10 (95% UI: 3-23) per 100,000 populations in boys and, from 7(95% UI: 2-16) to 11(95% UI: 3-26) per 100,000 populations in girls. The YLD changes showed some variation according to age categories. For both genders, the age standardizes YLL rate decreased from 395 (95% UI: 185-681) per 100,000 populations to 111(95% UI: 42-213) per 100,000 populations. **Conclusion:** The burden attributed to suboptimal breastfeeding had a considerable reduction rate from 1990 to 2010. Additional studies on burden of exclusive breastfeeding with more accurate data are recommended for policies make decision.

**Key Words:** Breastfeeding, Burden, Disability-adjusted life year, Iran, Years lost due disability.

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## 1- INTRODUCTION

Previous studies have shown that more than 56 million people around the world died in 2001. Of these, more than 10.6 million were children (1). About 99% of child deaths occurred in low- and middle-income countries. In addition, more than half of deaths in this year were due to respiratory diseases, diarrhea, malaria, AIDS, measles and perinatal conditions (1). Infectious diseases, particularly respiratory and gastrointestinal infections, are major causes of hospitalization and death in infants and children (1-3).

The risk of infectious diseases in children depends on many factors; most notably gender, gestational age, birth weight, nutritional status, socio-economic level of the family, family size, parental educational level and smoking status, as well as children care status (3-7). Infectious diseases are still a main health problem for children. For instance, 1.1 episodes of diarrhea per child-year for children under 5 years of age are reported in the USA (8). Respiratory infection in infants is still a common problem in American children, where about 3% of infants are hospitalized with moderate to severe respiratory infections every year (9). Several studies show that the prevalence of overweight and obesity in adults and children is increasing. Overweight and obesity also have been shown to be underlying or aggravating cause of many physical and mental diseases. Therefore, weight control has been proposed as a public health priority (10, 11). Chronic non-communicable diseases (NCDs), the most common of them are cardiovascular diseases, diabetes mellitus, hypertension, hypercholesterolemia and cancer, are the main public health problems (12,13). Several studies show a protective effect of breastfeeding in infancy against infectious and allergic diseases during infancy, childhood, or even throughout the life (14-

16). This is a protective effect against most non-communicable diseases like cardiovascular diseases (17-20), hypercholesterolemia (21, 23), diabetes mellitus 1, 2 (22, 24), hypertension (25, 26) and cancer (27, 29) during childhood, adolescence and adulthood.

Due to the numerous benefits of breastfeeding for infants, this paper aimed to present the age-and gender-specific DALYs and deaths rate attributed to suboptimal breastfeeding in Iran from 1990 to 2010. Data were obtained from global burden of diseases (GBD) 2010, which have been gathered and calculated by the Institute for Health Metrics and Evaluation (IHME), providing results for the years 1990, 1995, 2000, 2005, and 2010. We also, discuss the data, methods, and limitations of the GBD study 2010 in terms of different aspects of policy making.

## 2- MATERIALS AND METHODS

In brief, burden of diseases, injuries and risk factors are expressed in DALYs, a summary measurement of population health gap. DALYs reveal the sum of the years of life lost due to premature mortality (YLL) in the population and years of life lost due to disability (YLD) (30). More practical details about the data and methods used for specific risk factors including breast feeding are also available (31). In this approach also suboptimal breastfeeding include a third level to distinguish between nonexclusive breastfeeding during the first 6 months (31).

### 2-1. Study Design and Population

Using data of the GBD study 2010, this paper presents the trends in deaths and DALYs attributed to breast-feeding by gender and age from 1990 to 2010 for Iranian children.

### 2-2. Methods

This project was a systematic effort for data gathering and estimation processing of 291 types of diseases and injuries and 67 risk factors in 187 countries to calculate the global and regional comparative risk assessment of deaths and DALYs caused by different risk factors and diseases as described previously (31-37).

### 2-3. Ethical considerations

Ethical issues (Including plagiarism, Informed Consent, misconduct, data fabrication and/or falsification of data, double publication and/or submission, redundancy, etc ) have been completely observed by the authors.

### 2-4. Data analyses

Using the Population Attributable Fraction (PAF), considered the fraction by which the occurrence of interested outcomes changed under a sustained alternative and more favorable exposure distribution. Death and disease burden attributable to risk factors (PAF) were computed by comparing the current distribution of exposure to the theoretical minimum risk counterfactual distribution of the exposure for each year, gender, age group, and cause. Uncertainty Interval (UI) was also calculated in the simulation analysis.

$$\text{PAF} = \frac{\text{Counterfactual population risk} - \text{Factual population risk}}{\text{Factual population risk}}$$

To assess the full effects of exposure distributions of breast feeding, five main steps were used (38). First, risk-outcome pairs were selected to be included in the analysis based on causal association criteria. The cause-specific mortality extracted from available published cohort studies (31). Estimation of distribution of exposure and statistical modeling such as space-time/Gaussian process regression model or meta-regression were followed through a wide range of covariates in databases that were generated in the GBD

2010 project was verified. In the third step, the effect size of breastfeeding outcomes' specific mortality considered. In this regard for each risk-outcome pair, relative risk estimated for each unit of exposure. The distribution of exposure has been compared to an alternative (counterfactual) distribution (theoretical-minimum-risk) and uncertainty in the estimates is presented as 95% uncertainty interval (95% UI).

## 3- RESULTS

**Table.1** presents the cause specific DALYs rates per 100,000 populations attributed to breastfeeding in different age groups of children from 1990 to 2010. In both genders, the age standardized DALYs rates attributed to breastfeeding had a decreasing trend from 1990 to 2010. In another words 492 (95% UI: 191- 689) life year that were estimates in 1990 as life years that are spending with disability, through a decreasing trend reached to 121 (95% UI: 50- 224) in 2010.

The age standardized death rate attributed to breast feeding decreased 4 cases/100,000 population from 1990 to 2010 (from 5 (95% UI: 2-8) to 1 (95% UI: 0-2 respectively).

**Table.2** presents the cause- specific death rates per 100,000 populations attributed to breastfeeding in different age groups between 1990 and 2010. The age standardized YLD rate or years of life lived with disability for both gender due to breast feeding increased from 1990 to 2010 [from 7(95% UI: 2-15) to 10(95% UI: 3-23) in boys, and from 7(95% UI: 2-16) to 11(95% UI: 3-26) in girls). The YLD changes or years of life that lost due to premature mortality showed some variation according to age categories (**Table.3**).

It is estimated that YLL follow a decreasing rate during the time between the 1990 and 2010. For both gender, age

standardizes rate decreased from 395(95% UI: 185-681) in 1990 to 111(95% UI: 42-213) in 2010. The highest rate of YLL for both sexes was observed in neonatal age group (**Table.4**).

#### **4- DISCUSSION**

This study showed that the DALY, death, and YLL rates attributed to suboptimal breastfeeding in Iran had a decreasing trend from the year 1990 to 2010 in infants and different age groups of children, as well as in all other age groups.

Results of previous studies showed that if 90% of USA families could comply with the recommendations of exclusive breastfeeding for 6 months, the United States would prevent a yearly excess 911 deaths of infants (39). Several studies also have shown more than 10 million child deaths and 44 million DALYs per year (40). Exclusive breastfeeding in the first 6 months of life is associated with lower incidence of infectious diseases, and lower deaths and DALY rate in children (39-42). Also, previous studies show that exclusive breastfeeding is associated with lower risk of obesity and high blood pressure in children and adolescents (43-45).

These effects assigned to factors such as Lactoferrin (LF), Immune Globulin A (IgA), secretion polysaccharides and oligosaccharides (3, 14). This protective effect was also dependent on the duration of breastfeeding (3, 7, 14). Related studies confirmed that exclusive breastfeeding significantly reduces the risk of neonatal morbidity such as; sepsis and severe infections (especially in full term infants) (3, 4, 15), acute otitis media (AOM) and viral upper respiratory tract infection and eustachian tube dysfunction (46).

Several factors such as the family socio-economic status, religious beliefs and cultural customs, lifestyle, mother's employment, parents' education, parents' age at marriage, maternal age,

advertisements by milk powder producing companies and the promotion of exclusive breast-feeding by mass media, are effective on increasing the prevalence of exclusive breastfeeding in children under 6 months and on continuation of breastfeeding (47-50).

This has been shown in many parts of the world, as the studies show an increase of the prevalence of exclusive breastfeeding after 2002 (51-53). The Demographic and Health Survey (DHS) conducted in the years 2000, 2005 and 2010 In Iran, showed an upward trend in the prevalence of exclusive breastfeeding in the first 6 months of life (54).

##### **4-1. Study limitations and strengths**

There are some limitations to the GBD Study 2010. In Iran, exposure estimations for many risk factors, including suboptimal breastfeeding, were affected by data source limitations. Estimation of exposure with the approach used here is another weakness of the study because of the data gaps for specific regions such as Iran. Finally, the GBD findings were at a national level, while sub-national information about the burden of diseases and risk factors are required for policy making. So, the burden of diseases, injuries, and risk factors should be evaluated at sub-national level. Also, to the best of our knowledge, present study is the first study, which report burden of diseases attributed to suboptimal breastfeeding in Iran using the GBD data.

#### **5- CONCLUSIONS**

Present study, revealed that burden attributed to suboptimal breastfeeding had a considerable reduction rate from 1990 to 2010. Similar to other part of world, results of the reduction of child mortality and DALY in Iran, comply with the upward trends in exclusive breastfeeding. Additional studies on burden of exclusive breastfeeding with more accurate data at

national and subnational level are recommended for policies make decision.

**6- CONFLICT OF INTEREST:** None.

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<b>Table-1: DALYs rate [95%UI] per 100,000 population attributed to suboptimal breastfeeding in Iran in different age and sex groups from 1990 to 2010</b>					
Variables	1990 Rate [95% UI]	1995 Rate [95% UI]	2000 Rate [95% UI]	2005 Rate [95% UI]	2010 Rate [95% UI]
<b>Both Genders</b>					
Under 5 years	4345[2058,7444]	2623[1186,4604]	1742[748,2986]	1658[742,2846]	1356[564,2502]
Neonatal	63571[29321,109129]	37490[17245,62784]	21112[9286,35368]	17380[7274,30337]	14599[5359,27474]
Post Neonatal	19396[8604,34807]	12487[5318,23159]	8064[3298,14676]	7222[2958,13201]	5798[2236,11457]
1 to 4 years	146[11,445]	121[9,347]	117[9,343]	124[10,335]	123[11,325]
All Ages	725[343,1241]	344[156,604]	171[73,293]	140[63,241]	113[47,208]
Age standardized	402[191,689]	257[116,453]	166[71,285]	148[66,254]	121[50,224]
<b>Girl</b>					
Under 5 years	4242[1909,7444]	2591[1154,4596]	1780[779,3071]	1715[778,3076]	1397[561,2773]
Neonatal	59913[25709,105612]	35724[16868,63845]	20591[9165,36111]	17462[6349,33554]	14625[5029,32594]
Post Neonatal	19015[7852,35892]	12386[5003,23040]	8299[3460,14935]	7514[3081,14097]	6006[2207,13159]



1 to 4 years	154[13,46]	125[9,375]	120[9,34]	126[10,345]	126[11,347]
All Ages	698[314,1226]	335[149,594]	172[75,297]	144[66,259]	115[46,228]
Age standardized	393[177,687]	254[113,452]	169[73,293]	153[69,275]	125[50,248]
<b>Boy</b>					
Under 5 years	4444[1988,7957]	2654[1154,4891]	1706[720,3160]	1603[628,2973]	1316[499,2657]
Neonatal	67072[27885,130272]	39179[15583,74449]	21608[8533,39942]	17301[6718,31987]	14575[4614,31974]
Post Neonatal	19762[8119,3713]	12584[4964,24930]	7840[3161,15504]	6943[2589,13747]	5599[1915,12339]
1 to 4 years	139[10,429]	117[9,357]	114[9,340]	122[10,327]	121[11,322]
All Ages	750[336,1343]	353[153,651]	170[72,315]	136[53,252]	110[42,222]
Age standardized	412[184,738]	260[113,481]	162[68,301]	143[56,266]	118[45,237]

<b>Table-2: Deaths rate [95% UI] per 100,000 population attributed to suboptimal breastfeeding in Iran in different age and sex groups from 1990 to 2010</b>					
Variables	1990 Rate [95% UI]	1995 Rate [95% UI]	2000 Rate [95% UI]	2005 Rate [95% UI]	2010 Rate [95% UI]
<b>Both Genders</b>					
Under 5 years	50[23,86]	30[13,53]	19[8,34]	18[7,32]	14[6,28]
Neonatal	735[339,1266]	432[195,727]	241[105,409]	198[81,349]	166[59,317]
Post Neonatal	224[98,404]	143[60,266]	91[37,167]	81[31,151]	64[23,129]
1 to 4 years	1[0,4]	1[0,3]	1[0,2]	1[0,2]	0[0,1]
All Ages	8[4,14]	4[2,7]	2[1,3]	2[1,3]	1[0,2]
Age standardized	5[2,8]	3[1,5]	2[1,3]	2[1,3]	1[0,2]
<b>Girls</b>					
Under 5 years	48[22,85]	29[13,52]	20[8,35]	19[8,34]	15[6,31]
Neonatal	693[294,1223]	411[192,738]	235[103,416]	199[71,386]	166[55,376]
Post Neonatal	219[88,415]	142[56,265]	94[37,171]	84[33,162]	67[23,150]
1 to 4 years	1[0,4]	1[0,3]	1[0,2]	1[0,2]	0[0,1]
All Ages	8[4,14]	4[2,7]	2[1,3]	2[1,3]	1[0,3]
Age standardized	4[2,8]	3[1,5]	2[1,3]	2[1,3]	1[1,3]

Boys					
Under 5 years	51[22,92]	30[12,56]	19[8,36]	17[7,33]	14[5,29]
Neonatal	776[321,1509]	452[175,860]	247[96,460]	197[75,368]	166[50,368]
Post Neonatal	228[92,430]	144[56,288]	88[34,176]	78[28,157]	62[19,140]
1 to 4 years	1[0,4]	1[0,3]	1[0,2]	1[0,2]	1[0,2]
All Ages	9[4,15]	4[2,7]	2[1,4]	1[1,3]	1[0,2]
Age standardized	5[2,8]	3[1,6]	2[1,3]	2[1,3]	1[0,3]

<b>Table-3: YLDs rate [95%UI] per 100000 population attributed to suboptimal breastfeeding in Iran in different age and gender groups from 1990 to 2010</b>					
Variables	1990 Rate [95% UI]	1995 Rate [95% UI]	2000 Rate [95% UI]	2005 Rate [95% UI]	2010 Rate [95% UI]
<b>Both Genders</b>					
Under 5 years	78[26,174]	83[27,189]	100[33,229]	113[38,257]	120[38,268]
Neonatal	333[110,684]	333[113,643]	347[114,660]	337[122,654]	337[121,635]
Post Neonatal	210[73,441]	222[81,446]	249[90,502]	263[99,522]	269[109,538]
1 to 4 years	45[3,134]	51[4,155]	65[5,199]	75[6,203]	82[6,231]
All Ages	13[4,29]	11[4,25]	10[3,22]	10[3,22]	10[3,22]
Age standardized	7[2,16]	8[3,17]	9[3,20]	10[3,23]	11[3,24]
<b>Girls</b>					
Under 5 years	81[24,182]	86[27,193]	104[33,237]	117[35,261]	124[37,296]
Neonatal	335[102,691]	338[107,682]	354[114,708]	344[122,695]	343[114,685]
Post Neonatal	212[73,458]	225[80,472]	254[89,532]	268[98,567]	275[100,552]
1 to 4 years	48[4,144]	54[4,165]	68[5,208]	79[6,208]	87[7,255]
All Ages	13[4,30]	11[4,25]	10[3,23]	10[3,22]	10[3,24]
Age standardized	7[2,16]	8[3,17]	9[3,21]	10[3,23]	11[3,26]
<b>Boys</b>					

Under 5 years	76[24,172]	80[26,185]	97[31,225]	109[38,253]	116[36,253]
Neonatal	330[99,707]	328[104,651]	340[105,659]	331[111,678]	331[119,669]
Post Neonatal	208[67,460]	218[76,445]	244[86,495]	258[92,528]	264[97,552]
1 to 4 years	43[3,135]	49[4,145]	62[5,189]	72[6,208]	78[6,219]
All Ages	13[4,29]	11[3,25]	10[3,22]	9[3,21]	10[3,21]
Age standardized	7[2,15]	7[2,17]	9[3,20]	10[3,22]	10[3,23]

<b>Table-4: YLLs rate [95% UI] per 100000 population attributed to suboptimal breastfeeding in Iran in different age and sex groups from 1990 to 2010</b>					
Variables	1990 Rate [95% UI]	1995 Rate [95% UI]	2000 Rate [95% UI]	2005 Rate [95% UI]	2010 Rate [95% UI]
<b>Both Genders</b>					
Under 5 years	4267[1998,7357]	2540[1142,4556]	1642[692,2893]	1545[627,2739]	1236[475,2379]
Neonatal	63239[29117,108847]	37157[16750,62509]	20765[9069,35137]	17042[6967,29998]	14263[5082,27241]
Post Neonatal	19187[8451,34653]	12266[5143,22843]	7815[3171,14355]	6959[2633,13009]	5529[1995,11097]
1 to 4 years	101[8,306]	69[5,214]	52[4,159]	49[4,140]	41[4,121]
All Ages	711[333,1227]	333[150,597]	161[68,284]	131[53,232]	103[39,197]
Age standardized	395[185,681]	250[112,448]	156[66,276]	138[56,245]	111[42,213]
<b>Girls</b>					
Under 5 years	4161[1847,7292]	2504[1089,4501]	1676[688,2980]	1598[676,2952]	1272[485,2641]
Neonatal	59578[25257,105218]	35386[16481,63496]	20238[8864,35770]	17118[6086,33192]	14282[4702,32312]
Post Neonatal	18803[7595,35657]	12161[4785,22760]	8044[3148,14644]	7246[2825,13907]	5732[1992,12871]
1 to 4 years	106[9,333]	71[5,226]	52[4,158]	47[4,144]	39[3,120]
All Ages	685[304,1201]	324[141,582]	162[67,288]	135[57,248]	105[40,218]
Age standardized	385[171,675]	246[107,442]	160[65,284]	143[60,264]	114[43,236]

Boys					
Under 5 years	4369[1928,7867]	2573[1071,4829]	1609[647,3075]	1493[567,2837]	1201[422,2510]
Neonatal	66742[27583,129810]	38851[15092,73980]	21268[8234,39586]	16970[6416,31679]	14244[4296,31654]
Post Neonatal	19554[7857,36919]	12366[4769,24705]	7596[2925,15143]	6685[2379,13519]	5335[1656,12014]
1 to 4 years	96[7,307]	68[5,217]	52[4,166]	50[4,139]	43[4,129]
All Ages	737[325,1328]	342[142,642]	160[64,306]	127[48,241]	100[35,210]
Age standardized	405[179,729]	253[104,476]	153[62,293]	133[51,253]	107[38,224]