Gênero & Direito
Periódico do Núcleo de Estudos e Pesquisas sobre Gênero e Direito
Centro de Ciências Jurídicas - Universidade Federal da Paraíba
V. 8 - Nº 04 - Ano 2019 – Special Edition
ISSN | 2179-7137 | http://periodicos.ufpb.br/ojs2/index.php/ged/index

OCCUPATIONAL RISK FACTORS FOR DEMENTIA IN A SAMPLE OF OLDER ADULTS COVERED BY THE IRANIAN OIL INDUSTRIES' HEALTH CENTERS, 2018

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Abstract: Introduction: here is a new case of dementia in the world every three seconds. It kills more people in the US than breast cancer and prostate cancer combined, while it is the number one killer in England and Wales. The current cost of the disease is about a trillion US dollars a year, and that is forecast to double by 2030.Object: The aim of this study was to determine the probable occupational and environmental risk factors of dementia among the retirees of Iranian oil industries. Methods: A case-control study of 551 randomly selected older adults, all aged 60 and above including 180 demented and 371 nondemented retirees, pair matched for education and gender, was conducted. We evaluated the adjusted associations between dementia risk and the probable

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occupational and environmental variables through multiple logistic regression.Results: A history of exposure to air pollution (Adjusted OR=2.00, 95%CI= 1.00-7.00), head injuries (Adjusted OR=2.00, 95%CI= 1.00-6.00) and more than 20 years of work in the operational fields (Adjusted OR=5.00, 95%CI= 3.00-8.00) was significantly correlated with an increased risk of dementia. We could not find any significant associations between dementia risk and exposure to fossil fuels, solvents, noise pollution and or a combination of occupational risk factors. Conclusion: The results propose that long-term exposure to field occupational risk factors is likely to increase the risk of dementia. We suggest simultaneous serial oil industries' particulate evaluations with proper cognitive assessments for the pre-retired staff.

KeyWords: Dementia, Occupational risk factors, Case-control, Oil industry

Introduction

Major Neurocognitive disorders (dementias) have tremendous consequences for individuals, their families, the healthcare system, and the economy. In the United States, Alzheimer's disease (AD) is a leading cause of death, hospital admissions, skilled nursing facility admissions, and home health care. The costs of health services and the informal costs of unpaid caregiving for individuals with dementia are high and growing. Family caregivers also experience increased emotional stress, depression, and health problems (1).

Diagnosis of major NCD requires evidence of significant cognitive decline from a previous level of performance in one or more of the cognitive domains (table 1). Additionally, the cognitive deficits must be sufficient to interfere with independence in activities of daily living. The cognitive deficits must not be attributable to other mental disorders. The criterion of maintenance or loss of independent functioning represents the key distinction between mild and major NCD (1).

Today, there are nearly 50 million demented people living in the world and it is believed that the figure will have tripled in 30 years(2). It has been proposed that a noticeable rise in

life expectancy and subsequent global population aging have been the main causes for this phenomenon. Right now, the global expected annual cost of caring for dementia patients has surpassed $1 trillion(3). The intolerable financial burden of care for dementia patients and the unavailability of an effective treatment for postponing or stopping dementia progression has made it one of the most horrific diseases for the nations and families(4), while pharmaceutical advances for the disease have not been satisfying(3). Furthermore, until now, we have not completely comprehended the causes and etiologies of the disease, which make it more urgent to put dementia under microscope. In order to cope with worldwide difficulties caused by dementia, taking primary preventive measures such as adjusting modifiable risk factors like high blood pressure, obesity, diabetes, sedentary life style and smoking have been shown to be effective(5). For example, a considerable drop in the number of Alzheimer's disease' rates in some countries has been attributed to an effective modulating of the preventable risk factors(6). However, in the absence of modifiable risk factors, it becomes highly challenging to explain the possible risk factors responsible for the onset of the disease. To date, there are numerous studies reporting on various risk factors for dementia (7-21). To our knowledge, given the geographical differences in dementia prevalence and incidence, there is no comprehensive domestic study evaluating possible occupational risk factors for dementia in the Iranian population. Given the considerable differences between the culture and life styles of the Iranian population and other parts of the World, validating the findings from other parts of the World to the Iranian population is a highly demanding task. We performed a case-control study in a sample of older adults covered by NIOC[8] health centers. Our aim was to provide an overview of the possible occupational risk factors associated with prevalent dementia in this group.

[8] National Iranian Oil Company

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Table 1. Functional limitations associated with impairment in different cognitive domains

Cognitive domain	Examples of changes in everyday activities
Complex attention	Normal tasks take longer, especially when there are competing stimuli; easily distracted; tasks need to be simplified; difficulty holding information in mind to do mental calculations or dial a phone number
Executive functioning	Difficulty with multi-stage tasks, planning, organizing, multi-tasking, following directions, keeping up with shifting conversations
Learning and memory	Difficulty recalling recent events, repeating self, misplacing objects, losing track of actions already performed, increasing reliance on lists, reminders
Language	Word-finding difficulty, use of general phrases or wrong words, grammatical errors, difficulty with comprehension of others' language or written material
Perceptual-motor/visuospatial function	Getting lost in familiar places, more use of notes and maps, difficulty using familiar tools and appliances
Social cognition	Disinhibition or apathy, loss of empathy, inappropriate behavior, loss of judgment

Materials and methods

551 individuals aged 60 and above, including 180 cases with confirmed dementia diagnosis based on DSM-5 criteria (table 2) (1), have participated in this study. The typical diagnosed cases included when acquired cognitive impairment has become severe enough to compromise social and/or occupational functioning (22), abnormal MMSE (mini-mental state examination) score along with indicating changes in MRI/CT imaging and paraclinical records archived in the central medical

data bases of the NIOC hospitals and oilfields in 2017. Cases were from 15 operational (provinces) across the NIOC health branches throughout the country who were compared with 371 elderly controls without dementia, matched for sex and educational level but not for age. The control group was selected using randomized multi-stage sampling from the same source of demographic data proportional to the population size of each province. The controls underwent a comprehensive medical and cognitive assessment, with no evidence of cognitive impairment, and were visited by a physician in the same period as the cases were visited. In the control group, we used a standard Farsi validated version of MMSE(23), a 30-point questionnaire that is used extensively in the clinical and research settings to measure cognitive impairment as a classification tool to stratify the patients into three subgroups of dementia based on the severity, namely mild dementia (20-22), moderate dementia (10-19), and severe dementia (<9). A cutoff point of 19 for illiterates and low educated individuals, 27 for individuals having a moderate educational attainment and 29 for whom having academic educational attainment to separate the individuals suspected to having a cognitive problem was used. The proxies signed the consent forms since the dementia patients lack decision-making capacity. The participation rates for the cases and controls were 100% and 87%, respectively.

Table 2, Neurocognitive Disorders as Diagnosed in DSM-5

Diagnostic Criteria	**Major Neurocognitive Disorder/Dementia**	**Minor Neurocognitive Disorder/Dementia**
A	Significant cognitive decline in one or more cognitive domains, based on:	Modest cognitive decline in one or more cognitive domains, based on:
	1. Concern about significant decline, expressed by individual or reliable	1. Concern about mild decline, expressed by individual or reliable informant, or observed by clinician.

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Diagnostic Criteria	**Major Neurocognitive Disorder/Dementia**	**Minor Neurocognitive Disorder/Dementia**
	informant, or observed by clinician.	
	2. Substantial impairment, documented by objective cognitive assessment.	2. Modest impairment, documented by objective cognitive assessment.
B	Interference with independence in everyday activities.	No interference with independence in everyday activities, although these activities may require more time and effort, accommodation, or compensatory strategies
C	Not exclusively during delirium.	
D	Not better explained by another mental disorder.	
E	Specify one or more etiologic subtypes, "due to" Alzheimer's disease Cerebrovascular disease (Vascular Neurocognitive Disorder) Frontotemporal Lobar Degeneration (Frontotemporal Neurocognitive Disorder) Dementia with Lewy Bodies (Neurocognitive Disorder with Lewy Bodies) Parkinson's disease Huntington's disease Traumatic Brain Injury HIV Infection Prion Disease Another medical condition Multiple etiologies	

Adapted from: American Psychiatric Association: Diagnostic and Statistical Manual of Mental Disorders, Fifth Edition. Arlington, VA, American Psychiatric Association; 2013

checklist.

the 3

3. Characteristics of the cases and the controldemographic characteristics		**Cases (%)**	**Controls (%)**
age	60-64	59(32%)	299(80%)
	75-89	100(55%)	70(18%)
	90+	21(11%)	2(0/3%)
Sex	Male	95(52%)	207(55%)
	female	85(47%)	164(44%)
Education	Illiterate	27(15%)	22(5%)
	Elementary and high elementary	58(32%)	53(14%)
	Highschool or diploma	68(37%)	139(37%)
	Associate and bachelor’s	21(11%)	35(36%)
	Master’s and higher	6(3%)	22(5%)

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The univariate logistic regression showed that the risk of dementia was affected by occupational exposures to fossil fuels, solvents, unusual air and noise pollution, electromagnetic fields, a combination of occupational risk factors, recurring occupational head injury and a history of more than 20 years of working in the operational fields.

All data gathered from the recorded occupational health files, stated by the participants and reliable informants/proxies in the cases' setting4

4. Logistic regression model results for dementia

Occupational risk factors		**Cases**	**Controls**	**Unadjusted Odds**	**95%CI**	**p-value**
	Fossil fuels	19(10%)	12(3%)	2.00	(1.00-6.00)	.018
	solvents	8(4%)	10(2%)	1.00	(0.00-4.088)	<.001
	Electro-magnetic fields	12(6%)	36(9%)	1.046	(0.00-2.00)	<.001
	Air pollution	24(13%)	14(3%)	6.00	(2.00-12.00)	<.001
	Noise pollution	25(13%)	64(17%)	1.00	(0.00-2.00)	<.001
	A combination of the Occupational risk factors	10(5%)	9(2%)	3.00	(1.00-10.018)	.009
	Head trauma	34(18%)	16(4%)	4.00	(2.00-9.00)	<.001
	Less than 20 years of work in the operational fields	20(11%)	44(11%)	1.00	(0.00-2.00)	<.001

	20 years or more of work in the operational fields	47(26%)	41(11.1%)	2.000	(1.00-5.00)	<.001

After adjusting for sex, and education, the results showed that the risk of developing dementia was significantly affected by an exposure to air pollution, traumatic brain injury and a history of more than 20 years of work in the operational fields. Indeed, a history of exposure to unusual air pollution was associated with a 2times increase in the risk of dementia (OR=2.00, 95%CI= 1.00-7.00).

Similarly, an exposure to occupational brain trauma was associated with approximately the same amount of risk (OR=2.00, 95%CI= 1.00-6.00). Moreover, a history of more than 20 years of work in the operational fields was associated with a 5times increase in the risk of dementia (OR=5.00, 95%CI= 3.00-8.00). Further details are presented in the table 5.

5. Results of multivariate logistic regression model for dementia

Occupational risk factors		**Adjusted Odds**	**95%CI**	**p-value**
	Fossil fuels	1.00	(0.00-4.00)	<.001
	solvents	1.00	(0.00-4.00)	<.001
	Electro-magnetic fields	.00	(0.00-1.012)	<.001
	Air pollution	2.00	(1.00-7.00)	.017
	Noise pollution	.00	(0.00-1.00)	<.001
	A combination of the Occupational risk factors	.00	(0.00-3.00)	<.001
	Head trauma	2.00	(1.00-6.00)	.010

	Less than 20 years of work in the operational fields	1.00	(0.00-4.00)	<.001
	20 years or more of work in the operational fields	5.00	(3.00-8.00)	<.001

Discussion

Previous studies have related dementia to occupational risk factors, but to our knowledge, until now, no domestic study have been done to assess the relationship between them.

In the present study, we found that a long-term exposure to air pollution was significantly associated with an increase in the risk of dementia in the older adults. This finding is consistent with the results of the other studies, which show that exposures to air pollutants can increase the risk of cognitive problems (24). However, studies on dementia and air pollutants are rare and if not, until now have not been able to explain the relationship fully between dementia and air pollutants. Some studies have focused on the individual constituents of air pollution such as ozone and particulate matter. For example, Animal studies suggested that particulate matter may cause brain inflammation which is the product of the accumulation of Ab 42, which in turn causes the aftermath dysfunction of, cerebrovascular damage, neural degeneration and dementia (24). Likewise, some other animal studies relate ozone-caused oxidative stress to the deficiency of brain repair mechanisms, which leads to memory loss and dementia (25).

In line with the previous studies, our study showed that exposure to head injury increased the risk of dementia. The unadjusted risk was even higher. The relationship between head injury and dementia has long been an interesting subject for the researcher for many years. In addition, while the clinical trials report no association between them, epidemiological studies constantly suggest head injury as a risk factor for dementia (26-28). Nevertheless, what seems to be consistent in all the epidemiological

studies including ours is that there is at least a weak association between head injury and dementia. A systematic review and Meta-analyze by Vanesa et al. reported a weak association between head injury and (5). Similarly, another Systematic Review and Meta-Analysis by Yanjun Li et al. emphasized on head injury as a risk factor for dementia (28). A possible mechanism suggested by is that recurring head injury leads to chronic traumatic, which in turn leads to dementia (29). Since we compared all dementia cases with non-demented controls for head trauma exposure, the observed relationship puts forward the notion that the relationship between head trauma and dementia is not specific to a single subgroup of dementia, rather, head trauma is a risk factor for all dementias which was also proposed by Salib et al in their study(27).

In the present study, more than 20 years of work in the operational fields was related with a 5times increase in the risk of dementia. If we assume the length of exposure tantamount to the number of years then this relationship would be reasonable. In his case-control study, Amy showed that an increased exposure to solvents had increased the risk of Alzheimer's disease. However, when the intensity level of each exposed job was multiplied by the number of years on the job the increase in risk with increasing dose was no longer significant (30). Given the relationship between exposure time and the risk of dementia, it seems logical that in long term, the so-called occupational risk factors are accumulated in the central nerves system that in turn is supported by literature (31).

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