

ISSN 1916-9736 (Print)
ISSN 1916-9744 (Online)

GLOBAL JOURNAL OF HEALTH SCIENCE

Vol. 14 No. 3, March 2022



CANADIAN CENTER OF SCIENCE AND EDUCATION®

Editorial Board

Editor-in-Chief

Gabriele Messina, University of Siena, Italy

Associate Editors

Diadie Maiga, World Health Organization, Regional Office for Africa, Congo

Loray Daws, British Columbia Masterson Institute, Canada

Meng Zhao, Texas A&M University at Corpus Christi, USA

Ru-Jeng Teng, Medical College of Wisconsin, USA

Editorial Assistant

Erica Grey, Canadian Center of Science and Education, Canada

Reviewers

Abdulbari Bener <i>Turkey</i>	France Ncube <i>Zimbabwe</i>	Montarat Thavorncharoensap <i>Thailand</i>
Abin Varghese <i>India</i>	Francisco Rodenas Rigla <i>Spain</i>	Myo Nyein Aung <i>Thailand</i>
Abiodun Adeniran <i>Nigeria</i>	Gavric Zivana <i>Bosnia and Herzegovina</i>	Misheck Dube <i>South Africa</i>
Ahmed M Ballo <i>Canada</i>	Gabriel Gulis <i>Denmark</i>	Natasha Azzopardi Muscat <i>Malta</i>
Ahmed Hassan Ghada <i>Egypt</i>	Georgann Valerie Weissman <i>USA</i>	Pedram Iranmanesh <i>Iran</i>
Althea Jane Gamble Blakey <i>New Zealand</i>	Gunta Bēta <i>Latvia</i>	Pi-Ming Yeh <i>USA</i>
Ama Pokuaa Fenny <i>Ghana</i>	Hadii M Mamudu <i>USA</i>	Piotr Raźniak <i>Poland</i>
Amy Clements-Cortes <i>Canada</i>	Helen Lida Smits <i>USA</i>	Polly Yeung <i>New Zealand</i>
Amy E Jetton <i>USA</i>	Hilal Hamood Alrahbi <i>Oman</i>	Pradnya V Kakodkar <i>India</i>
Ana Maria Antao <i>Portugal</i>	Horng-Jyh Tsai <i>Taiwan</i>	Pranshu Sahgal <i>USA</i>
Angel Alfonso Velarde Lopez <i>Guatemala</i>	Hülya Yardimci <i>Turkey</i>	Radu Iulian Spataru <i>Romania</i>
Angus N Oli <i>Nigeria</i>	Jaime Hinzpeter <i>Chile</i>	Raildo da Silva Coqueiro <i>Brazil</i>
António Calha <i>Portugal</i>	Jan Chrastina <i>Czech Republic</i>	Raymond Jagessar <i>Guyana</i>
Aris Gkoulalas-Divanis <i>USA</i>	Jason Tsai <i>UK</i>	Raywat Deonandan <i>Canada</i>
Arpad Kovacs <i>Hungary</i>	Jeffery T Spickett <i>Australia</i>	Regina E. Ella <i>Nigeria</i>
Ayesha Johnson <i>USA</i>	Jingxian Cai <i>USA</i>	Robert Sloan <i>Japan</i>
Basak Baglama <i>Cyprus</i>	José Joaquín Mira <i>Spain</i>	Roslyn Kane <i>UK</i>
Bruria Adini <i>Israel</i>	Jose R Cordon <i>Spain</i>	Sá Giulian César <i>Brazil</i>
Carlos Aceves-Gonzalez <i>Mexico</i>	Judie Arulappan <i>Oman</i>	Samir Othman <i>Iraq</i>
Carlos Martin Ardila <i>Colombia</i>	Kartheek R Balapala <i>Malaysia</i>	Santha James <i>Australia</i>
Darampal Dambhare <i>India</i>	Keun-Yeong Jeong <i>Korea, Republic of</i>	Sara Melo <i>UK</i>
David John Lindsay <i>Australia</i>	Kim Solez <i>Canada</i>	Soon Soo Hoo <i>Australia</i>
David Otieno Odongo <i>Kenya</i>	Kinley Wangdi <i>Australia</i>	Soontareeporn Meepring <i>Thailand</i>
David Richard Walwyn <i>South Africa</i>	Krzysztof Goniewicz <i>Poland</i>	Suleyman Gorpelioglu <i>Turkey</i>
Diamantis L. Floratos <i>Greece</i>	Laura Monahan <i>USA</i>	Thandiwe Marethabile Letsie <i>South Africa</i>
Delfina Gabriela Ramos <i>Portugal</i>	Lisa Scherer <i>USA</i>	Tawheda El-saidy <i>Egypt</i>
Donna M Wilson <i>Canada</i>	Le Thi Thanh Xuan <i>Viet Nam</i>	Thammanard Charernboon <i>Thailand</i>
Emad Adel Shdaifat <i>Saudi Arabia</i>	Liye Suo <i>USA</i>	Thanusin Saleeon <i>Thailand</i>
Eman Rashad Ahmad Mohamed <i>Saudi Arabia</i>	Marcel Wullschlegler <i>Switzerland</i>	Tomás Goicoa <i>Spain</i>
Evangelia Mavrikaki <i>Greece</i>	Marcelle Bottecchia <i>Brazil</i>	Tsan Yang <i>Taiwan</i>
Evanthia Sakellari <i>Greece</i>	Maria Malliarou <i>Greece</i>	Tuelo Masilo <i>South Africa</i>
Faik Ardahan <i>Turkey</i>	Mariana de Lourdes Almeida Vieira <i>Brazil</i>	Tulyakul Phatcharapon <i>Thailand</i>
Fathi Shamma <i>Israel</i>	Mini Sood <i>Malaysia</i>	Valery Piacherski <i>Belarus</i>
Farahnaz Amini <i>Malaysia</i>	Matteo Vitali <i>Italy</i>	Victoria Alikari <i>Greece</i>
Fengsong Gao <i>Australia</i>	Monia Ouederni <i>Tunisia</i>	Zaini Mohd-Zain <i>Malaysia</i>

Contents

Differences in Male Climacteric Symptoms by Aging Male's Symptoms Scale and Coping Strategies with Aging among Rotating Night Shift Workers	1
<i>Sachiko Kubo, Toshiyuki Yasui, Yukie Matsuura & Masahito Tomotake</i>	
COVID-19 in Socially Vulnerable Patients with Tuberculosis in Brazil	12
<i>Eliza Miranda Ramos, Emerson Luiz Lima Araújo, James Venturini, Gilberto Gonçalves Facco, Cinthya Cristina de Oliveira Canuto dos Reis, Grazielle Franco Ferro da Costa Rodrigues, Antônio Carlos de Abreu, Francisco José Mendes dos Reis, Pamela Aline Miranda Teodoro, Ernani Mendes da Fonseca Junior, Rubens César Ferreira Pereira & Valter Aragão do Nascimento</i>	
Improving Global TBI Tracking and Prevention: An Environmental Science Approach	20
<i>Mara Chen, Karl Maier, Donna Ritenour & Christina Sun</i>	
Analysis of Reasons of Blood Donor Deferral at a Tertiary Care Institute in India and Its Reflections on Community Health Status	30
<i>Sheetal Malhotra & Gita Negi</i>	
Health Workers' Experience on Directly Observed Treatment Short Courses Strategy to Stop TB Transmission in Khomas Redion, Namibia	36
<i>Carolina Texeira & Emmanuel Magesa</i>	
Level of Sexual Health Knowledge and One-Night Stand Relationships among University Students	45
<i>Shayesteh Jahanfar & Zahra Fazli Khalaf</i>	
E-Waste and Its Consequence for Environment and Public Health: Perspectives in Covid-19 Pandemic Times	54
<i>Joselito Nardy Ribeiro, Angelo Fernando Melo Barbosa, Araceli Veronica Flores Nardy Ribeiro, Madson de Godoi Pereira, Jairo Pinto de Oliveira, Alan Bragança Zordan & André Romero da Silva</i>	
The Process of Going/Settling on the Streets: The Relations between Gender, Being Homeless and Access the Health Services	77
<i>Dalvan Antônio de Campos & Rodrigo Otávio Moretti-Pires</i>	
Smartphone Medical Apps Use by Health Professionals: Is Gender a Confounding Factor?	87
<i>Elena J. Tetenova, Aleksei V. Nadezhdin, Alexey J. Kolgashkin, Mikhail V. Fedorov, Inessa A. Bedina, Egor A. Koshkin, Sergei V. Zolotukhin, Alexandr I. Klyachin, Valery V. Shipitsin, Yelena I. Sokoltchik, Evgeniya A. Koshkina, Sergei G. Koporov & Evgeny A. Bryun</i>	
Prevalence and Characteristics of Oral Squamous Cell Carcinoma in Fiji: A Retrospective Study	100
<i>Mehwish Dean, Ratu Osea Gavidu, Masoud Mohammadnezhad & Richard D. Nair</i>	
An Observational Study on Barbers' Practices and Associated Health Hazard in Fiji	108
<i>Dip Chand, Masoud Mohammadnezhad & Sabiha Khan</i>	
Reviewer Acknowledgements for Global Journal of Health Science, Vol. 14, No. 3	117
<i>Erica Grey</i>	

Differences in Male Climacteric Symptoms by Aging Male's Symptoms Scale and Coping Strategies with Aging among Rotating Night Shift Workers

Sachiko Kubo^{1,2}, Toshiyuki Yasui³, Yukie Matsuura³ & Masahito Tomotake⁴

¹ Faculty of Nursing, Shikoku University, Tokushima, Japan

² Graduate School of Health Sciences, Tokushima University, Tokushima, Japan

³ Department of Reproductive and Menopausal Medicine, Tokushima University Graduate School, Tokushima, Japan

⁴ Department of Mental Health, Tokushima University Graduate School, Tokushima, Japan

Correspondence: Sachiko Kubo, Faculty of Nursing, Shikoku University, 1-123 Ebisuno, Furukawa, Ojin-cho, Tokushima, Japan.

Received: December 11, 2021 Accepted: January 13, 2022 Online Published: January 25, 2022

doi:10.5539/gjhs.v14n3p1 URL: <https://doi.org/10.5539/gjhs.v14n3p1>

Abstract

The aim of this study was to clarify how male rotating night shift workers cope with male climacteric symptoms and whether coping strategies are different depending on age. A self-administered questionnaire survey regarding coping strategies in male rotating night shift workers over the age of 20 years was performed. Male climacteric symptoms were evaluated by using the Aging Male's Symptoms scale [AMS]. Of 1,891 questionnaires that were sent, 1,561 were collected. For all of the 16 symptoms, the most frequent strategy was to try to ignore and tolerate the symptoms and the second-most frequent strategy was to take time to relax. The proportions of men who ignored and tolerated psychological symptoms and sleep problems were high in all age groups. The proportions of men who ignored and tolerated the symptom of decline in the feeling of general well-being were high in men in their 20s and low in men in their 60s. The proportion of men who consulted a doctor for the symptom of joint and muscular pain was high in men in their 50s. The most frequent strategy for coping with male climacteric symptoms was to ignore and tolerate the symptoms and the second-most frequent strategy was to take time to relax. There was a difference in coping behavior depending on age in rotating night shift workers.

Keywords: Male climacteric symptoms, aging male's symptoms scale, rotating night shift workers, coping strategies

1. Introduction

Late-onset hypogonadism [LOH] syndrome, which is induced by androgen deficiency in men, may result in deterioration in the quality of life and may adversely affect the functions of multiple organ systems. It has been reported that a low testosterone level is associated with an increased risk of bone fractures, risk of death due to cardiovascular disease, metabolic syndrome and type 2 diabetes in men (Kenny, Prestwood, & Raisz, 2000; Laughlin, Barrett-Connor, & Jaclyn, 2008; Zitzmann, Faber, & Nieschlag, 2006; Selvin et al., 2007) These various concerns have led to increased interest worldwide in LOH syndrome (Nieschla et al., 2006).

Among middle-aged men with low testosterone levels, the degrees of physical and psychological symptoms and sexual disorders are different (Rivas, Mulkey, Lado-Abeal, & Yarbrough, 2017). Considering the advances in methods for diagnosis and treatment of LOH syndrome, men with any symptoms of LOH syndrome should be recommended to visit a hospital. However, many men are reluctant to visit a hospital and receive appropriate treatment (Corona, Vignozzi, Sforza, & Maggi, 2013). The strategies for coping with male climacteric symptoms in men who do not visit a hospital have not been clarified.

Ichioka (Ichioka et al., 2006) reported that there were no significant differences in AMS scores for somatic and psychological symptoms by age in 2111 men who underwent health screening. However, approximately 50% of men in their 40s had moderate or severe symptoms in the sexual subscore. Liu et al. reported that the 5078 Chinese men aged 40 years-79 years old were analyzed by AMS and free testosterone levels, and found a significant decrease in free testosterone with age ($p < 0.01$) and a significant negative association with the

presence of at least three sexual symptoms ($p = 0.03$) (Liu et al., 2021). We previously reported that the proportion of men who reported male climacteric symptoms in rotating night shift workers, increased with advance of age. There were significant age-dependent differences in AMS scores for somatic symptoms and sexual symptoms (Kubo, Yasui, Matsuura, & Tomotake, 2019).

As many health problems such as disorders of the cardiovascular and gastrointestinal systems, related to shift work have reported for decades (Smith et al., 2005; Torquati, Mielke, Brown, & Kolbe-Alexander, 2018) However, few studies have examined the Male climacteric symptoms for night shift workers.

Moreover, it has not been clarified how shift workers cope with these symptoms. Although working women with climacteric symptoms are generally supported (Matsuzaki, Uemura, & Yasui, 2016; Iioka, 2010), As the well-being of the night-shift workers exert a significant impact on productivity, it is highly important to explore coping strategies.

This study aimed to clarify how male rotating night shift workers cope with male climacteric symptoms by AMS and whether strategies used for coping with symptoms are different depending on age.

2. Method

2.1 Study Design

A cross-sectional survey was conducted in 2017. An unsigned self-reported questionnaire survey was planned for male rotating night shift workers over the age of 20 years, including those working all or some of the hours from 10:00 p.m. to 5:00 a.m., in manufacturing companies in Japan.

2.2 Study Participants and Sampling Procedure

We requested the managers of general affairs or occupational health nurses in 33 companies for cooperation in the study, and we distributed the questionnaires to 1891 Japanese men who work in rotating night shift during the period from March to May in 2017. The number of employees of the companies ranged from 50 to over 1000. We firstly distributed an explanation sheet and a consent form to the manager in the company, and we received written informed consent after explanation regarding the study. The study targeted only men who agreed to participate after explanation by using the explanation sheet through the manager in the company. The explanation sheet included an explanation about the respect for autonomy and anonymization of personal data. The questionnaires were obtained from collection boxes or by mail.

2.3 Data Analysis

Baseline characteristics were analyzed by descriptive statistics. Comparisons of leisure activities among age groups were done by the chi-square test. We calculated the proportion of men who coped with each symptom and compared the presence of coping strategies with male climacteric symptoms among five age groups (20s to 60s) by using the chi-square test. The presence of coping strategies was used as a dependent variable and age was used as an independent variable in the analysis. Items that were found to have significant differences among the age groups were analyzed by residual analysis. Differences in the proportions of men who coped with symptoms according to age were calculated. When residual values after adjustment were less than or more than 1.96, $p < 0.05$ were considered to be statistically significant, and when residual values after adjustment were less than or more than 2.58, $p < 0.01$ were considered to be statistically significant. For symptoms and coping strategies for which significant differences in frequencies were detected among age groups, the degrees of symptoms in the age groups were also analyzed by the Kruskal-Wallis test.

All statistical analyses were conducted using SPSS statistics, version 25 (IBM Corp.).

2.4 Ethical Approval

This study was approved by the Research Ethics Committee of Tokushima University Hospital (2745). An explanation sheet and a consent form were sent to the manager of each company, and written informed consent was obtained after an explanation regarding the study. We then recruited participants through the general affairs department of each company and health management center. The subjects were only men who agreed to participate after receiving an explanation of the study from the manager of the company. The explanation sheet included an explanation about the respect for autonomy and anonymization of personal data.

3. Results

3.1 Socio-Demographics

Of the 1,891 subjects recruited, 1,561 responded (response rate of 82.5%). We excluded 26 participants who were under the age of 20 years, 11 participants who were fixed night shift workers and 24 participants for whom ages were unknown, and we analyzed data for 1500 rotating night shift workers. Baseline characteristics including age distribution, duration of shiftwork and type of shiftwork are shown in Table 1. (Table 1)

Table 1. Baseline Characteristics

		Number	Proportion (%)
Age (years) (n=1524)	20-29	451	29.7
	30-39	237	15.6
	40-49	382	25.1
	50-59	337	22.1
	≥60	93	6.1
	Missing	24	1.6
Duration of shiftwork (years) (n=1500)	<10	570	38
	11-19	270	18
	20-29	319	21.3
	30-39	198	13.2
	≥40	129	8.6
	Missing	14	0.9
Types of shift (n=1500)	Three-shift work	1110	74
	Two-shift work	343	22.9
	Others	46	3.1
	Missing	1	0.1
Employment status (n=1500)	Regular employee	1301	86.7
	Contract employee	117	7.8
	Dispatched employee	31	2.1
	Part-time workers	7	0.5
	Others	31	2.1
	Missing	13	0.9
Ages of men living with their wives (years) (n=915)	20-29	125	27.8
	30-39	146	61.6
	40-49	278	72.8
	50-59	285	84.6
	≥60	80	86
	Missing	1	1
Leisure activities (multiple answers allowed) (n=1500)	Shopping	642	42.8
	Playing TV games and using a smartphone and computer	613	40.9
	Spending time with family	537	35.8
	Exercising	437	29.1
	Playing pinball games and bicycle races	382	25.5
	Socializing	294	19.6
	Watching movies	258	17.2
	Watching sports	195	13.0
	Listening to music	185	12.3
	Reading books	134	8.4
	Doing home carpentry	61	4.1
	Others	350	23.3

Table 2. Top three strategies for coping with male climacteric symptoms

		First ranking	%	number	Second ranking	%	number	Third ranking	%	number
Somatic symptoms	Decline in the feeling of general well-being	Ignoring and tolerating symptoms	33.0	222/673	Taking a rest	32.4	218/673	Talking with wife	21.6	145/672
	Joint pain and muscular ache	Ignoring and tolerating symptoms	34.0	234/688	Taking a rest	26.2	180/687	Consulting a family or occupational physician	19.5	134/688
	Excessive sweating	Ignoring and tolerating symptoms	58.9	119/202	Taking a rest	19.3	39/202	Talking with wife	9.9	20/202
								Searching on the Internet	9.9	20/202
	Sleep problems	Ignoring and tolerating symptoms	51.0	337/661	Taking a rest	25.6	170/663	Talking with wife	11.6	77/663
	Increased need for sleep, often feeling tired	Ignoring and tolerating symptoms	47.9	377/787	Taking a rest	40.6	319/786	Talking with wife	9.8	77/787
	Physical exhaustion / lacking vitality	Ignoring and tolerating symptoms	48.4	333/688	Taking a rest	30.9	212/687	Exercising	12.8	88/688
	Decrease in muscular strength	Ignoring and tolerating symptoms	46.4	313/674	Exercising	30.3	204/673	Taking a rest	15.9	107/672
Psychological symptoms	Irritability	Ignoring and tolerating symptoms	53.7	347/646	Taking a rest	25.3	163/645	Enjoying hobbies	20.1	130/647
	Nervousness	Ignoring and tolerating symptoms	57.2	253/442	Taking a rest	24.0	106/442	Enjoying hobbies	12.0	53/442
	Anxiety	Ignoring and tolerating symptoms	54.4	186/342	Taking a rest	23.1	79/342	Talking with wife	9.6	33/342
	Depressive mood	Ignoring and tolerating symptoms	53.0	258/487	Taking a rest	23.2	113/488	Enjoying hobbies	16.4	80/488
	Feeling burnt out, having hit rock-bottom	Ignoring and tolerating symptoms	64.9	131/202	Taking a rest	18.8	38/202	Talking with wife	8.4	17/202
Sexual symptoms	Feeling that you have passed your peak	Ignoring and tolerating symptoms	59.8	196/328	Taking a rest	16.2	53/328	Talking with wife	10.3	34/329
	Decrease in beard growth	Ignoring and tolerating symptoms	67.0	77/115	Taking a rest	11.3	13/115	Talking with wife	7.8	9/115
	Decrease in ability/frequency to perform sexually	Ignoring and tolerating symptoms	68.1	241/354	Taking a rest	13.0	46/354	Talking with wife	6.8	24/354
	Decrease in the number of morning erections	Ignoring and tolerating symptoms	68.8	245/356	Taking a rest	12.1	43/356	Talking with wife	6.4	23/357
	Decrease in sexual desire/libido	Ignoring and tolerating symptoms	13.0	39/299	Taking a rest	2.7	8/299	Enjoying hobbies	1.7	5/299

Table 3-1. Proportions of men with the top three strategies for coping with physical symptoms according to ages

Age (years)	Item of first ranking coping strategy						P values	Item of second ranking coping strategy						P values	Item of third ranking coping strategy						P values
	20s	30s	40s	50s	60s			20s	30s	40s	50s	60s			20s	30s	40s	50s	60s		
Decline in the feeling of general well-being	Ignoring and tolerating symptoms							Taking a rest							Talking with wife						
Proportion (%)	42.4*	37.3	33.5	27.7	13.3*	0.002	43.1*	32.4	26.8	28.7*	37.8	0.017	32.3	24.2	32.1	35.8	44.7	0.264			
Number	61/144	38/102	65/194	52/188	6/45	* <0.01	62/144	33/103	52/194	54/188	17/45	* <0.01	10/31	16/66	45/140	57/159	17/38				
Joint pain and muscular ache	Ignoring and tolerating symptoms							Taking a rest							Consulting doctors						
Proportion (%)	42.7**	41.0	38.1	26.0*	19.2**	0.001	33.6	30.5	24.8	20.2*	32.7	0.048	9.1*	12.4**	17.7	29.4*	21.2	<0.01			
Number	48/110	45/105	80/203	59/218	10/52	**<0.05, *<0.01	37/110	32/105	50/203	44/218	17/52	* <0.01	10/110	13/105	36/203	64/218	11/52	**<0.05, *<0.01			
Excessive sweating	Ignoring and tolerating symptoms							Taking a rest							Talking with wife						
Proportion (%)	47.5	39.5	55.4	46.4	58.3	0.418	25.0	29.0	13.1	16.7	16.7	0.332	9.1	17.6	15.2	13.0	30.0	0.692			
Number	27/44	14/31	40/61	31/54	7/12		11/44	7/31	8/61	9/54	2/12		1/11	3/17	7/46	6/46	3/10				
															Searching on the Internet						
															18.0*						
															11/61						
															3/38						
															3/74						
															2/69						
															1/14						
															* <0.01, **<0.05						
Sleep problems	Ignoring and tolerating symptoms							Taking a rest							Talking with wife						
Proportion (%)	49.7	52.0	52.9	49.7	48.6	0.965	29.6	35.0**	20.7	20.8	27.0	0.033	18.4	16.9	15.0	16.4	18.9	0.97			
Number	89/179	52/100	99/188	78/159	18/37		53/179	35/100	39/188	33/159	10/37	**<0.05	9/49	12/71	23/153	26/159	7/37				
Increased need for sleep, often feeling tired	Ignoring and tolerating symptoms							Taking a rest							Talking with wife						
Proportion (%)	46.1	50.8	51.6	47.7	31	0.15	48.3*	39.8	39.0	33.0**	40.5	0.037	12.5	12.4	12.7	14.8	16.7	0.93			
Number	107/232	60/118	113/219	84/176	13/42		112/232	47/118	85/218	58/176	17/42	* <0.01, **<0.05	9/72	12/97	23/181	26/176	7/42				
Physical exhaustion/ lacking vitality	Ignoring and tolerating symptoms							Taking a rest							Exercising						
Proportion (%)	48.6	47.6	50.5	47.8	40.5	0.834	32.1	33.3	32.3	25.0	38.1	0.349	16.4	11.7	9.5	12.5	14.1	0.062			
Number	68/140	49/103	111/220	88/184	17/42		45/140	34/103	71/220	46/184	16/42		23/140	12/103	21/220	23/184	9/42				
Decrease in muscular strength	Ignoring and tolerating symptoms							Exercising							Taking a rest						
Proportion (%)	47.3	40.0	50.7	46.7	37.5	0.333	36.6	34.3	27.0	25.4	40.0	0.079	13.7	15.2	13.4	19.3	20.0	0.454			
Number	62/131	42/105	102/201	92/197	15/40		48/131	36/105	54/201	50/197	16/40		18/131	16/105	27/201	38/197	8/40				

* and **: significant according to residual analysis.

Table 3-2. Proportions of men with the top three strategies for coping with psychological symptoms according to ages

Age (years)	Item of first ranking coping strategy						P value	Item of second ranking coping strategy						P value				
	20s	30s	40s	50s	60s			20s	30s	40s	50s	60s						
Irritability	Ignoring and tolerating symptoms							Taking a rest										
Proportion (%)	46.6	51.8	57.1	59.7	59.3	0.128	34.0 [#]	28.2	21.7	16.4 [#]	18.5	0.004	31.9 [*]	24.5	14.6 ^{**}	9.7 [*]	7.4	<0.001
Number	89/191	57/110	105/184	80/134	16/27		65/191	31/110	40/184	22/134	5/27	[#] <0.001	61/191	27/110	27/185	13/134	2/27	[*] <0.01, ^{**} <0.05
Nervousness	Ignoring and tolerating symptoms							Taking a rest										
Proportion (%)	54.2	56.9	59.2	58.9	55.6	0.938	31.7	25	19.2	22.4	11.1	0.122	14.2	13.9	11.2	8.4	16.7	0.639
Number	65/120	41/72	74/125	63/107	10/18		38/120	18/72	24/125	24/107	2/18		17/120	10/72	14/125	9/107	3/18	
Anxiety	Ignoring and tolerating symptoms							Taking a rest										
Proportion (%)	51.0	44.2	54.5	65.1	50.0	0.165	33.3 [*]	28.8	20.2	13.3 ^{**}	8.3	0.01	3.2	14.3	13.1	13.3	33.3	0.135
Number	49/96	23/52	54/99	54/83	6/12		49/96	15/52	20/99	11/83	1/12	[*] <0.01, ^{**} <0.05	1/32	6/42	11/84	11/83	4/12	
Depressive mood	Ignoring and tolerating symptoms							Taking a rest										
Proportion (%)	48.4	51.9	54.2	61.6	34.6	0.09	27.9	28.7	21.3	15.2	26.9	0.11	25.6 [*]	17.7	10.6 ^{**}	13.4	11.5	0.013
Number	62/128	41/79	77/142	69/112	9/26		36/129	23/80	30/141	17/112	7/26		33/129	14/79	15/142	15/112	3/216	[*] <0.01, ^{**} <0.05
Feeling burnt out, having hit rock-bottom	Ignoring and tolerating symptoms							Taking a rest										
Proportion (%)	70.7	51.9	67.2	64.4	62.5	0.591	26.8	11.1	19.4	15.3	25.0	0.481	8.3	13	15	7.9	5	0.95
Number	29/41	14/27	45/67	43/59	5/8		11/41	3/27	13/67	9/59	2/8		1/12	3/23	6/40	6/59	1/8	

^{*}, ^{**} and [#]: significant according to residual analysis

Table 3-3. Proportions of men with the top three strategies for coping with psychological symptoms according to ages

Age (years)	Item of first ranking coping strategy						Item of second ranking coping strategy						Item of third ranking coping strategy					
	20s	30s	40s	50s	60s	P value	20s	30s	40s	50s	60s	P value	20s	30s	40s	50s	60s	P value
Feeling that you have passed your peak	Ignoring and tolerating symptoms						Taking a rest						Talking with wife					
Proportion (%)	60	56.8	69.9	56.3	40.7	0.056	22.9	18.2	18.4	12.6	11.1	0.508	23.1	8.1	5.8	14.3	18.5	0.104
number	21/35	25/44	72/103	67/119	11/27		8/35	8/44	19/103	15/119	3/27		3/13	3/37	6/103	17/119	5/27	
Decrease in beard growth	Ignoring and tolerating symptoms						Taking a rest						Talking with wife					
Proportion (%)	55.6	50.0	74.4	67.5	66.7	0.448	22.2	21.4	14.0	5.0	0	0.488	0	14.3	4.7	7.5	22.2	0.419
number	5/9	7/14	32/43	27/40	6/9		2/9	3/14	7.43	2/40	0/9		0/2	2/14	2/43	3/40	2/9	
Decrease in ability and frequency to perform sexually	Ignoring and tolerating symptoms						Taking a rest						Talking with wife					
Proportion (%)	71.9	65.2	68.1	68.1	67.9	0.984	3.1	17.4	16.8	9.6	17.9	0.139	0	4.7	8.8	7.4	7.1	0.787
number	23/32	30/46	77/113	92/135	19/28		1/32	8/46	19/113	13/135	5/28		0/11	2/43	10/113	10/135	2/28	
Decrease in the number of morning erections	Ignoring and tolerating symptoms						Taking a rest						Talking with wife					
Proportion (%)	69.7	57.8	72.2	70.2	65.6	0.486	6.1	17.8	13.0	10.7	12.5	0.584	0	8.9	7.8	6.1	6.3	0.845
number	23/33	26/45	83/115	92/131	21/32		2/33	8/45	15/115	14/131	4/32		0/11	4/45	9/115	8/131	2/32	
Decrease in sexual desire/libido	Ignoring and tolerating symptoms						Taking a rest						Enjoying hobbies					
Proportion (%)	3.1*	5.4	17.9	27.6*	22.2	<0.001	0.8	2.7	3.6	4.6	5.6	0.451	0	0	0	4.3	5.4	0.015
number	4/129	2/37	5/28	24/87	4/18	* <0.01	1/129	1/37	1/28	4/87	1/18		0/129	0/37	0/28	5/87	0/18	

*: significant according to residual analysis

The proportion of men living with their wives increased with the advance of age. Shopping was the most common leisure activity followed by playing video games, using smartphones and personal computers, and relaxing with the family. The proportion of men who played video games, used smartphones and computers, did exercise, watched movies, listened to music and read books was high in men in their 20s ($p < 0.01$). The proportions of men who did shopping and relaxed with their family as leisure activities were not different in the age groups.

3.2 Coping Strategies for Male Climacteric Symptoms

The top 3 coping strategies for 17 male climacteric symptoms by AMS are shown in Table 2. (Table 2)

The most frequent coping strategy for all symptoms was simply to try to ignore and tolerate the symptoms. The second-most frequent coping strategies were to take time to relax for 16 symptoms and to exercise for the symptom of decrease in muscle strength. The third-most frequent coping strategies were talking with their wives, consulting a doctor, exercising, enjoying their hobbies and using the Internet.

Since coping strategies may differ depending on age, differences in the top 3 strategies for coping with symptoms in the different age groups were examined (Table 3).

The proportions of men who tried to ignore and tolerate the symptom of decline in the feeling of general well-being were high in men in their 20s and low in men in their 60s. The proportions of men who took a rest for the symptom of decline in the feeling of general well-being were high in men in their 20s and low in men in their 40s.

The proportions of men who tried to ignore and tolerate joint and muscular pain were high in men in their 20s and low in men in their 50s and 60s. The proportion of men who took a rest for the symptom of joint and muscular pain was low in men in their 50s. The proportions of men who consulted a family doctor or occupational doctor for the symptom of joint and muscular pain were low in men in their 20s and 30s and high in men in their 50s. The proportion of men who spent time using the Internet as a strategy for coping with excessive sweats was high in men in their 20s. The proportions of men who took a rest for the symptoms of increased need for sleep and often feeling tired were high in men in their 20s and low in men in their 50s. The proportions of men who took a rest for the symptom of irritability and anxiety were high in men in their 20s and low in men in their 50s. The proportions of men who took time to enjoy their hobbies as a strategy for coping with depressive mood were high in men in their 20s and low in men in their 40s.

For symptoms that showed significant differences in frequency depending on age, the degrees of these symptoms in the different age groups were examined. Only the degree of irritability in men who took a rest as a coping strategy differed significantly among the age groups. The proportion of men who had severe irritability was high in young men and the proportion of men who had mild irritability was high in elderly men ($p = 0.012$).

4. Discussion

4.1 Frequent coping Strategies with Male Climacteric Symptoms

The most frequent coping with physical symptoms was simply to try to ignore and tolerate the symptoms. However, men consulted a family doctor or occupational doctor for symptoms in specific sites such as joint and muscle pain. For coping with psychological symptoms, the most frequent strategy was trying to ignore and tolerate the symptoms and the second-most frequent strategy was taking a rest. Men in their 20s tended to spend time enjoying their hobbies for coping with irritability and anxiety. Spending time enjoying hobbies is a common strategy used for improving psychological symptoms, but it was not included in the top three strategies for coping with physical symptoms. Synder et al. reported that coping by pleasurable distractions might be particularly effective in the face of uncontrollable stressors (Synder, 2001). The proportion of men who ignored sexual dysfunction was high in the present study. Sexual dysfunction might not be recognized as a male climacteric symptom. It has been reported that the level of awareness of andropause was very low despite the fact that many men over the age of 40 years have experienced symptoms due to andropause (Samipoor Pakseresht, Rezasoltani, & Leili, 2017). Although a statistically significant difference was found between strategies for coping with sexual symptoms and ages, the statistical significance is considered to be weak because of the small number of responses to questions on sexual symptoms.

4.2 Differences in Coping Strategies with Aging

The proportions of men who tried to ignore and tolerate psychological symptoms were high in all age groups. Men may also not recognize psychological symptoms as male climacteric symptoms. Even if they feel anxiety about these symptoms, they may not know which clinical department they should visit. Among physical symptoms, the proportions of men who ignored the symptom of decline in the feeling of general well-being were high in men in their 20s and low in men in their 60s. Young men may feel that the degree of their symptoms is

mild and it is not necessary to visit a hospital. It has been reported that working men do not visit general physicians unless they have a severe health problem and have to stop working (Hale, Grogan, & Willott, 2010). Working men do not have time for visiting hospitals. Although rotating shift workers can visit hospitals during the day, they may lack the motivation for visiting hospitals because of sleepiness and general fatigue. The proportions of men who ignored the symptom of joint and muscular pain were low in men in their 50s and 60s. Men in their 50s and 60s may decide to not endure symptoms in order to prevent worsening of mild symptoms since they might consider that deterioration of symptoms would affect their work in the factory.

The proportions of men who consulted a family doctor or occupational doctor about a decline in the feeling of general well-being were high in men in their 50s and low in men in their 20s. Many men in their 20s do not have family doctors, and they may be reluctant to visit a hospital. Men in their 50s, on the other hand, may decide to visit a hospital since their worsening health condition might affect their job status in night shift work. Since many men in their 50s would already have visited hospitals for their poor conditions or for various diseases, they may not hesitate to visit a hospital. In addition, men in their 50s may have some anxiety about their health. Rotating shift workers in the manufacturing industry are likely to work in a standing position and to use the musculoskeletal system including upper and lower limbs. Musculoskeletal system-related symptoms may affect their work at the workplace. It has been reported that the severity and functional disability of low back pain were correlated with age and job tenure among workers (Al-Salameen, Abugad, & Al-Otaib, 2019; Sterud & Tynes, 2013).

We showed that men in their 20s were likely to search on the Internet to cope with the symptoms of decline in the feeling of general well-being and severe sweats. Sweats in women are well-known female climacteric symptoms, but sweats in men have not been recognized as male climacteric symptoms. It has been reported that young people were more frequent users of the Internet for obtaining health information and that young people felt that searching on the Internet was important before visiting hospitals (Turan, Kaya, & Aydin, 2015; McMullan, 2006).

There were high proportions of men in their 20s who took a rest for coping with the symptom of decline in the feeling of general well-being and the symptom of irritability and anxiety. Men in their 20s might not have any coping strategies due to their lack of experience at their workplaces. Men in their 50s may use individual coping strategies for maintenance of a healthy psychological state based on their own experiences that would enable them to continue to work as rotating shift workers for a long time.

It has been reported that the prevalence of insomnia and other sleep problems in shift workers was higher than that in non-shift workers (Doi, 2005). We showed that the proportions of men who took time to relax to cope with the symptom of increased need for sleep and often feeling tired were high in men in their 20s and low in men in their 50s. Men in their 20s may need to take a rest since the proportion of men whose symptoms were moderate or severe was higher in men in their 20s than in men in their 50s. Rotating shift workers in their 20s may compensate for their lack of sleep at night by sleeping more during the day. There were men who ignored sleep problems in all age groups. Night rotating shift workers may understand that working against the circadian rhythm induces these symptoms.

Men in their 50s and 60s tended to talk with their wives as a coping strategy. It has been reported that rotating shift workers in their 50s and 60s were able to continue their jobs for a long time due to the support of their wives (Kubo & Tada, 2014). It has been shown that talking with their wives and advice given by wives encourage men to consult doctors (Ministry of Health and Welfare, 2017).

4.3 Occupational Health Nurses

Occupational health nurses can also provide information on self-diagnosis of male climacteric symptoms, information on outpatient clinics for male climacteric symptoms and information on LOH syndrome. However, it might be difficult for male workers to consult with nurses about sexual dysfunction unlike physical symptoms since most of the occupational health nurses in companies are females. It is important for occupational health nurses to have knowledge for assessment of male climacteric symptoms. It has been reported that a large number of men with LOH syndrome were obese and had lifestyle-related diseases (Zarotsky et al., 2014). Occupational health nurses can provide appropriate suggestions including suggestions for maintenance of appropriate body weight and improvement of lifestyle-related diseases. In addition, education regarding male climacteric symptoms by occupational health nurses may be needed for workers. If workers have an awareness of male climacteric symptoms and take appropriate coping strategies, deterioration of various symptoms including sarcopenia, osteoporosis and cardiovascular diseases caused by LOH syndrome may be prevented.

4.4 Study Limitations

This study has several limitations. There may be selection bias due to missing data. Some of the participants did not answer the question about sexual symptoms. In addition, it cannot be determined whether sleep problems are

related to male climacteric symptoms or circadian rhythm disturbance. A passive coping strategy by drinking alcohol should also be considered (Smith et al., 2005). The accessibility to occupational physicians might be different since the sizes of companies varied. Finally, information such as information on past history and present illness was not included in the questionnaire because of the protection of personal data. Therefore, the possibility that diseases other than male climacteric symptoms were included cannot be ruled out. This is another limitation of the questionnaire survey without biological data.

5. Conclusion

The most frequent strategy used by rotating shift workers for coping with male climacteric symptoms by AMS was to ignore and tolerate the symptoms and the second-most frequent strategy was taking a rest. There was a difference in strategies for coping with symptoms depending on age, and there were high proportions of men in their 20s who ignored and tolerated the symptom of decline in the feeling of general well-being and the symptom of joint and muscular pain. The proportions of men who took a rest to cope with irritability and anxiety were high in men in their 20s and low in men in their 50s.

Acknowledgments

The authors would like to express our gratitude to participants, managers of general affairs and occupational health nurses. We are also grateful to Professor Iwamoto.

Competing Interests Statement

The authors declare that there are no competing conflicts of interest.

References

- Al-Salameen, A. H., Abugad, H. A., & Al-Otaibi, S. T. (2019). Low back pain among workers in a paint factory. *Saudi journal of medicine & medical sciences*, 7(1), 33. https://doi.org/10.4103/sjmms.sjmms_81_17
- Corona, G., Vignozzi, L., Sforza, A., & Maggi, M. (2013). Risks and benefits of late onset hypogonadism treatment: an expert opinion. *The world journal of men's health*, 31(2), 103-125. <https://doi.org/10.5534/wjmh.2013.31.2.103>
- Doi, Y. (2005). An epidemiologic review on occupational sleep research among Japanese workers. *Industrial health*, 43(1), 3-10. <https://doi.org/10.2486/indhealth.43.3>
- Hale, S., Grogan, S., & Willott, S. (2010). Male GPs' views on men seeking medical help: A qualitative study. *British Journal of Health Psychology*, 15(4), 697-713. <https://doi.org/10.1348/135910709X479113>
- Heinemann, L. A., Saad, F., Zimmermann, T., Novak, A., Myon, E., Badia, X., ... & Giroulet, C. (2003). The Aging Males' Symptoms (AMS) scale: update and compilation of international versions. *Health and quality of life outcomes*, 1(1), 1-5. <https://doi.org/10.3109/13685539909003173>
- Ichioka, K., Nishiyama, H., Yoshimura, K., Itoh, N., Okubo, K., & Terai, A. (2006). Aging males' symptoms scale in Japanese men attending a multiphasic health screening clinic. *Urology*, 67(3), 589-593. <https://doi.org/10.1016/j.urol.2005.09.057>
- Iioka, Y. (2010). Mental and physical changes experienced by premenopausal women and coping methods. *Journal of Japanese Society of Psychosomatic Obstetrics and Gynecology*, 15, 237-247.
- Kenny, A. M., Prestwood, K. M., & Raisz, L. G. (2000). Short-term effects of intramuscular and transdermal testosterone on bone turnover, prostate symptoms, cholesterol, and hematocrit in men over age 70 with low testosterone levels. *Endocrine research*, 26(2), 153-168. <https://doi.org/10.3109/07435800009066159>
- Kubo, S., & Tada, T. (2014) Work-life difficulties and coping strategies of male night-shift workers. *Journal of Shikoku Public Health Society*, 5 (1), 133-139.
- Kubo, S., Yasui, T., Matsuura, Y., & Tomotake, M. (2020). Differences in male climacteric symptoms with aging among rotating night shift workers. *The Aging Male*, 23(5), 995-1003. <https://doi.org/10.1080/13685538.2019.1650264>
- Laughlin, G. A., Barrett-Connor, E., & Bergstrom, J. (2008). Low serum testosterone and mortality in older men. *The Journal of Clinical Endocrinology & Metabolism*, 93(1), 68-75. <https://doi.org/10.1210/jc.2007-1792>
- Liu, Y. J., Shen, X. B., Yu, N., Shang, X. J., Gu, Y. Q., Zuo, L. D., ... & Zhou, Y. Z. (2021). Prevalence of late-onset hypogonadism among middle-aged and elderly males in China: results from a national survey. *Asian Journal of Andrology*, 23(2), 170. https://doi.org/10.4103/aja.aja_59_20
- Lyne, K., & Roger, D. (2000). A psychometric re-assessment of the COPE questionnaire. *Personality and Individual Differences*, 29(2), 321-335. [https://doi.org/10.1016/S0191-8869\(99\)00196-8](https://doi.org/10.1016/S0191-8869(99)00196-8)

- Matsuzaki, K., Uemura, H., & Yasui, T. (2016). Differences in coping with menopausal symptoms in nurses and general workers in Japan. *Maturitas*, 86, 45-52. <https://doi.org/10.1016/j.maturitas.2016.01.010>
- McMullan, M. (2006). Patients using the Internet to obtain health information: how this affects the patient–health professional relationship. *Patient education and counseling*, 63(1-2), 24-28. <https://doi.org/10.1016/j.pec.2005.10.006>
- Ministry of Health, Labour and Welfare. Patient's Behavior Survey 2017 Outline of Result. Retrieved July 29, 2019, from <https://www.mhlw.go.jp/toukei/saikin/hw/jyuryo/17/dl/gaikyo-all-g.pdf>
- Nieschlag, E., Swerdloff, R., Behre, H. M., Gooren, L. J., Kaufman, J. M., Legros, J. J., ... & Wu, F. C. (2005). Investigation, treatment and monitoring of late-onset hypogonadism in males. *The Aging Male*, 8(2), 56-58. <https://doi.org/10.2164/jandrol.05047>
- Rivas, A. M., Mulkey, Z., Lado-Abéal, J., & Yarbrough, S. (2014, October). Diagnosing and managing low serum testosterone. In *Baylor University Medical Center Proceedings* (Vol. 27, No. 4, pp. 321-324). Taylor & Francis. <https://doi.org/10.1080/08998280.2014.11929145>
- Samipoor, F., Pakseresht, S., Rezasoltani, P., & Kazemnadjad Leili, E. (2017). Awareness and experience of andropause symptoms in men referring to health centers: a cross-sectional study in Iran. *The Aging Male*, 20(3), 153-160. <https://doi.org/10.1080/13685538.2017.1298586>
- Selvin, E., Feinleib, M., Zhang, L., Rohrmann, S., Rifai, N., Nelson, W. G., ... & Platz, E. A. (2007). Androgens and diabetes in men: results from the Third National Health and Nutrition Examination Survey (NHANES III). *Diabetes care*, 30(2), 234-238. <https://doi.org/10.2337/dc06-1579>
- Smith, L., Tanigawa, T., Takahashi, M., Mutou, K., Tachibana, N., Kage, Y., & Iso, H. (2005). Shiftwork locus of control, situational and behavioural effects on sleepiness and fatigue in shiftworkers. *Industrial health*, 43(1), 151-170. <https://doi.org/10.2486/indhealth.43.151>
- Sterud, T., & Tynes, T. (2013). Work-related psychosocial and mechanical risk factors for low back pain: a 3-year follow-up study of the general working population in Norway. *Occupational and environmental medicine*, 70(5), 296-302. <https://doi.org/10.1136/oemed-2012-101116>
- Snyder, C. R. (Ed.). (2001). *Coping with stress: Effective people and processes*. Oxford University Press. <https://doi.org/10.1093/med:psych/9780195130447.001.0001>
- Torquati, L., Mielke, G. I., Brown, W. J., & Kolbe-Alexander, T. (2018). Shift work and the risk of cardiovascular disease. A systematic review and meta-analysis including dose–response relationship. *Scandinavian journal of work, environment & health*, 44(3), 229-238. <https://doi.org/10.5271/sjweh.3700>
- Turan, N., Kaya, N., & Aydın, G. Ö. (2015). Health problems and help seeking behavior at the internet. *Procedia-Social and Behavioral Sciences*, 195, 1679-1682. <https://doi.org/10.1016/j.sbspro.2015.06.248>
- Zarotsky, V., Huang, M. Y., Carman, W., Morgentaler, A., Singhal, P. K., Coffin, D., & Jones, T. H. (2014). Systematic literature review of the epidemiology of nongenetic forms of hypogonadism in adult males. *Journal of Hormones*, 2014. <https://doi.org/10.1155/2014/190347>
- Zitzmann, M., Faber, S., & Nieschlag, E. (2006). Association of specific symptoms and metabolic risks with serum testosterone in older men. *The Journal of Clinical Endocrinology & Metabolism*, 91(11), 4335-4343. <https://doi.org/10.1210/jc.2006-0401>

Copyrights

Copyright for this article is retained by the author(s), with first publication rights granted to the journal.

This is an open-access article distributed under the terms and conditions of the Creative Commons Attribution license (<http://creativecommons.org/licenses/by/4.0/>).

COVID-19 in Socially Vulnerable Patients with Tuberculosis in Brazil

Eliza Miranda Ramos^{1,5}, Emerson Luiz Lima Araújo², James Venturini⁴, Gilberto Gonçalves Facco³, Cinthya Cristina de Oliveira Canuto dos Reis⁵, Grazielle Franco Ferro da Costa Rodrigues⁵, Antônio Carlos de Abreu¹, Francisco José Mendes dos Reis¹, Pamela Aline Miranda Teodoro¹, Ernani Mendes da Fonseca Junior⁶, Rubens César Ferreira Pereira⁷ & Valter Aragão do Nascimento¹

¹ Group of Spectroscopy and Bioinformatics Applied to Biodiversity and Health, School of Medicine, Postgraduation Program in Health and Development in the Midwest Region, Faculty of Medicine, Federal University of Mato Grosso do Sul, Campo Grande, Mato Grosso do Sul, Brazil

² Ministry of Health, Secretary of Health Surveillance, Department of Strategic Coordination of Health Surveillance, General Coordination of Public Health Laboratories, Brasília-DF, Brazil

³ Graduate Program in Environments and Regional Development, Anhanguera University, UNIDERP, Mato Grosso do Sul, Brazil

⁴ Federal University of Mato Grosso do Sul, Coordinator of the Postgraduate Program in Infectious and Parasitic Diseases (PPGDIP/UFMS), Campo Grande, Mato Grosso do Sul, Brazil

⁵ Fundação para o Desenvolvimento Científico e Tecnológico em Saúde (FIOTEC/FIOCRUZ), Rio de Janeiro, Brazil

⁶ Estácio de Sa University, Campo Grande, Mato Grosso do Sul, Brazil

⁷ Federal University of Mato Grosso do Sul, Campo Grande, Mato Grosso do Sul, Brazil

Correspondence: Valter Aragão do Nascimento, Group of Spectroscopy and Bioinformatics Applied to Biodiversity and Health, School of Medicine, Postgraduation Program in Health and Development in the Midwest Region, Faculty of Medicine, Federal University of Mato Grosso do Sul, Campo Grande, Mato Grosso do Sul, Brazil. E-mail: aragao60@hotmail.com

Received: December 20, 2021 Accepted: January 23, 2022 Online Published: January 26, 2022

doi:10.5539/gjhs.v14n3p12

URL: <https://doi.org/10.5539/gjhs.v14n3p12>

Abstract

Introduction: COVID-19 is a global public health problem. The first case reported in the socially vulnerable population in the territory of Mato Grosso do State/Brazil occurred in August 2020. However, information about the co-infection of Tuberculosis (TB) and COVID-19 is rarely described in the world literature. **Objective:** to describe for the first time a group of vulnerable patients who died or not due to Tuberculosis and COVID-19, using a Cohort study of a control group and a treatment group.

Methods: Reporting 7 cases of TB associated with COVID-19 confirmed by respiratory RT-PCR, hospitalized in a hospital department of COVID-19 (CEAA: 42969320.0.0000.0021).

Results: The patients included in this case report were aged between 19 and 83 years, respectively, with a predominance of females, 4 patients were vaccinated with BCG. In addition, 3 patients died from COVID-19, and 2 patients were considered cured by COVID-19. The mean time to diagnosis between Tuberculosis and COVID-19 in the “control group” was 43 days and the mean time to diagnosis in the “treatment group” was 37 days. The average number of days of hospital stay in the “control group” was 50 days and in the “treatment group” it was 40 days. In the patients in the “control group”, 2 presented a unilateral pulmonary cavity lesion on the X-ray. In the “treatment group”, only 1 patient presented a unilateral pulmonary cavity lesion on the X-ray, and 2 presented a bilateral pulmonary cavity lesion, and only one developed bilateral non-cavitary lesion with infiltrates. Regarding drug resistance to the treatment of Tuberculosis, in the “treatment group” only 2 patients were sensitive and 3 were resistant. On the other hand, in the “control group”, 1 patient presented resistance and 1 sensitivity. It was found that 4 patients with drug resistance to Tuberculosis died (57%). Among the patients who died, it was observed that patients aged 83, 70 years and 66 years were not vaccinated with Bacillus Calmette-Guérin (BCG). It was found in this case report that patients with COVID-19 and Tuberculosis have 60% less chance of cure. Furthermore, patients cured with pulmonary sequelae of COVID-19 may be at greater risk of developing advances in the

worsening of Tuberculosis in the future. However, according to the results found in this case report, in some socially vulnerable regions where the forms of advanced Tuberculosis occur there is the presence of drug-resistant Mycobacterium Tuberculosis strains.

Conclusion: Our study showed that Mycobacterium tuberculosis (MTB) infection in the socially vulnerable population increased the susceptibility to SARS-CoV-2 and the severity of COVID-19 or vice-versa. Based on this case report, it is recommended that, in the socially vulnerable population, the status of MTB infection be verified in patients with suspected COVID-19 at hospital admission.

Keywords: COVID-19, Tuberculosis, SARS-CoV-2, active, treatment

1. Introduction

The COVID-19 virus, designated as severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) in the period from 2000 to 2021 in vulnerable people in Brazil, has drawn the attention of public health researchers in Brazil regarding preventive, diagnostic and therapeutic actions (Zhou et al., 2020).

Recent scientific evidence suggests that individuals with tuberculosis are considered infectious as are individuals with SARS-CoV-2 (Zhou et al., 2020; Ramos et al., 2022). Thus, these diseases can spread quickly in the indigenous community due to the lack of inherited immunity, culminating in a high fatality rate among the elderly, as well as in patients with comorbidities such as Diabetes Mellitus. In fact, patients with COVID-19 present symptoms such as cough, fever, tiredness, dyspnea, and other signs that are similar to those of Tuberculosis (TB) and other respiratory infections caused by the virus (Fraisse, 2020; Ramos et al., 2020).

Tuberculosis and undergoing treatment occurred at the end of April 2020 in the vulnerable population of Mato Grosso do Sul State/Brazil. Therefore, after the notification of a patient with COVID-19 and Tuberculosis at the end of April 2020, the Brazilian socially vulnerable health department implemented a series of blocks across the socially vulnerable population in an attempt to interrupt the virus cycle, transmission and the redirection of resources, human and health infrastructure as an emergency response to the national effort to respond to the COVID-19 pandemic in Brazil (Ministério da Saúde, 2019; Ramos et al., 2022). Thus, these actions required the reconfiguration of current models of primary care in socially vulnerable health to support the new social distancing and preventive measures (WHO, 2020).

Thus, these actions caused changes that were reflected in the form of reductions in the frequency of clinical visits in order to minimize the risk of exposure to COVID-19 and changes in the methods used for direct observation therapy (DOT), since the traditional model of Tuberculosis treatment in these settings uses monthly dispensing of anti-TB drugs for self-administration at home (Ministério da Saúde, 2019; WHO, 2019). In Sierra Leone, the World Health Organization reported the impact of blockages in the provision of Tuberculosis care in the pandemic, mainly with the decrease in DOT (Ministério da Saúde, 2019; WHO, 2019). Therefore, in the year 2020 there were in Sierra Leone approximately 2.000 fewer notifications of Tuberculosis across the country, which corresponds to a reduction of 11.3% compared to 2019 due to the implementation of DOT (WHO, 2020; Vesga et al., 2020).

In the socially vulnerable population in Brazil, little is known about the relationship between COVID-19 and Tuberculosis (Glaziou, 2020). In this study, data from 7 cases (Cohort) that occurred in the Brazilian socially vulnerable territory were reported and demonstrated that patients with COVID-19 may develop complications of COVID-19 before, simultaneously or after the diagnosis of Tuberculosis.

Therefore, the aim of this study is to describe for the first time a group of socially vulnerable patients, who died from Tuberculosis and COVID-19 using a Cohort study of a control group and a treatment group.

2. Methodology

Data from the control and treatment cohorts were combined in order to assess mortality in the socially vulnerable population using the case report method. The Cohort study includes 7 patients with Tuberculosis and COVID-19, distributed in “control group” (With a negative result for COVID-19 and positive for Tuberculosis) and “treatment group” (With a positive result for COVID-19 and Tuberculosis). All patients residing in regions in Mato Grosso do Sul State with vulnerability and were admitted to hospitals located in the vicinity of these regions.

This research was approved by the Ethics Committee of the Federal University of Mato Grosso do Sul (UFMS), which is linked to the EPISUS project in the vulnerable villages population of Mato Grosso do Sul State, Brazil. The data analyzed refer to the period from 2020 to 2021. This study was approved by the Ethics Committee of ethic linked to the EPISUS project in the villages of Mato Grosso do Sul State, Brazil (CEAA: 42969320.0.0000.0021). The data analyzed refer to the period from 2020 to 2021. In all patients from the control group and treatment group included with a diagnosis of active tuberculosis and undergoing treatment and with

COVID-19, the demographic and clinical variables were included, which were collected retrospectively, including comorbidities and risk factors for mortality.

The confirmation of patients with Tuberculosis and COVID-19 included in this study was performed using the RT-qPCR (molecular biology) technique. The first diagnosis of COVID-19 in patients with Tuberculosis in the vulnerable population in the territory occurred on August 20, 2020, it is emphasized that this study was authorized by the UFMS ethics committee (CEAA: 42969320.0.0000.0021) and all data obtained ethical consent for use.

Continuous variables in this study, when not otherwise specified, were presented as medians. Categorical variables were described with absolute and relative frequency (percentage). A two-tailed p value less than 0.05 was considered statistically significant.

3. Results

Table 1 shows the demographic characteristics of patients confirmed in the period from 2021 to 2021 with presumptive Tuberculosis and confirmed by molecular biology during the intra-COVID-19 period. A total of 7 socially vulnerable patients tested positive for Tuberculosis, corresponding to 4 female patients (57.1%) and 3 male patients (42.9%). Overall, 5 patients belong to the “treatment group” Cohort and are distributed in the age group of 19 years (1), 29 years (1), 51 years (1), 66 years (1) and 83 years (1). On the other hand, two patients belong to the “control group” and are distributed in the age group of 51 years (1) and 70 years (1). In addition, 5 patients belonging to the “treatment group” tested positive for COVID-19.

Table 1. Demographic information of socially vulnerable of patients with Tuberculosis and COVID-19

DEMOGRAPHIC DATA						
Age	Male	Female	TUBERCULOSIS	COVID-19 (RT-PCR POSITIVE)	Patients with Covid-19 Control Group or treatment (RT-PCR POSITIVE)	Patients without COVID-19 (RT - PCR - Negative) Control Group
19	0	1	1	1	1	0
29	0	1	1	0	0	1
51	1	1	2	1	1	1
66	0	1	1	1	1	0
70	1	0	1	0	1	0
83	1	0	1	1	1	0
TOTAL	3	4	7	4	5	2

Source: UFMS-MS, 2021.

Table 2 shows the clinical evolutionary characteristics of socially vulnerable patients with a positive result for Tuberculosis. Only two patients had been diagnosed with COVID-19 before Tuberculosis (19 years and 51 years), in this case, the 19-year-old patient was diagnosed simultaneously with COVID-19 and Tuberculosis (4 days apart), on the other hand, 5 patients were diagnosed with COVID-19 after confirmation of Tuberculosis. Only two patients died unrelated to COVID-19, therefore, they had severe respiratory failure in the clinical course during the hospital stay. However, 3 patients died from COVID-19, 2 patients were considered cured for COVID-19 and the mean time of diagnosis between Tuberculosis and COVID-19 in the "control group" was 43 days and the mean time to diagnosis in the “treatment group” was 37 days.

The average number of days of hospital stay in the “control group” was 50 days and in the “treatment group” it was 40 days. In patients in the “control group”, only 2 presented unilateral pulmonary cavity lesion on the X-ray. In the “treatment group”, only 1 patient presented unilateral pulmonary cavity lesion on X-ray, however, 2 patients presented bilateral pulmonary cavity lesions and only one developed bilateral non-cavitary lesion with infiltrates. Regarding drug resistance to the treatment of Tuberculosis, in the “treatment group” only 2 patients were sensitive and 3 were resistant. In the “control group”, 1 patient was resistant and 1 was sensitive to the drug. Table 2 shows that 4 patients with drug resistance to Tuberculosis died (57%).

Table 2. Clinical evolution of 7 of socially vulnerable of patients with Tuberculosis and COVID-19

Age	Time between COVID-19 and TB diagnosis (n° of days)	Clinical Evolution of COVID-19	Time of hospitalization (n° of days)	Imaging during TB/COVID-19 of course Time	Drug Resistance
19	4	Cured	12	Bilateral cavitary lesions	Sensitive
29	129	Died Not of COVID-19	35	Unilateral cavitary lesions	Resistance
51	10	Cured	32	Unilateral cavitary lesions	Sensitive
51	36	Died Not of COVID-19	65	Unilateral cavitary lesions	Sensitive
66	130	Died of COVID-19	56	Bilateral cavitary lesions	Resistance
70	121	Died of COVID-19	48	Bilateral cavitary lesions	Resistance
83	89	Died of COVID-19	51	Bilateral infiltrates (no cavities)	Resistance

Source: UFMS-MS, 2021.

Table 3 shows the characteristics of 7 patients from the socially vulnerable population of co-infected with active/treated tuberculosis (TB) and Coronavirus in the period of 2021. Among the patients who died, only patients aged 83, 70 years and 66 years were not vaccinated with Bacillus Calmette-Guérin (BCG). However, 4 patients were infected with pan-susceptible strains and Mycobacterium Tuberculosis due to drug resistance, therefore, Mycobacterium bovis proved to be intrinsically resistant to topirazinamide (See Table 2).

The infection of 6 patients with SARS-CoV-2 was nosocomial (Table 3). Six patients required mechanical ventilation, but one patient did not use mechanical ventilation during the hospital stay (Table 3). In the “treatment group” of this case report, a median of 31 days after the diagnosis of COVID-19 was relevant to cause death or accelerate its occurrence. The overall fatality rate was 71% and the result seems consistent with those observed over time in other studies. Overall, 6 patients were affected by comorbidity, specifically Diabetes Mellitus (Table 3).

In all cases, COVID-19 favored to worsen the prognosis of patients with Tuberculosis and cause death (Table 2). The main limitation of this cohort study is that although it can report the majority of cases of Tuberculosis and COVID-19 in the vulnerable population, it cannot be considered representative for the entire Brazilian population.

Table 3. Characteristics of 7 patients co-infected with active/treated tuberculosis (TB) and Coronavirus in the socially vulnerable population disease, 2021

Age	Time between COVID-19 and TB diagnosis (n° of days)	Clinical presentation on admission (n° of days)	Status da TB and Vaccine of TB	SpO2 %, respiratory rate per minutes	Mandatory critical care and requires the use of Mechanical Ventilation and diabetics
13	4	Breathlessness for 3 days, fever and 4 days.	Active/Yes	92	Not/Not
29	129	Breathlessness for 7 days, fever for 12 days.	In treatment/Yes	87	Yes/Yes
51	10	Breathlessness for 8 days, fever for 9 days.	Active/Yes	90	Yes/Yes
51	36	Breathlessness for 4 days, fever for 8 days.	in treatment/Yes	81	Yes/Yes
66	130	Breathlessness for 4 days, fever for 6 days, cough for 2 month.	in treatment/Not	83	Yes/Yes
70	121	Fever for 15 days	in treatment/Not	82	Yes/Yes
83	89	Fever for 14 days	in treatment/Not	86	Yes/Yes

Source: UFMS-MS, 2021.

4. Discussion

Tuberculosis and COVID-19 have presented significant challenges in screening, treating and managing and controlling the infection (Tadoline et al., 2020). This study is the first case report in patients with Tuberculosis and COVID-19 in the vulnerable population. Thus, there is a great challenge for Brazilian public health to overcome the challenges inherent in the management of both diseases (Motta et al., 2020; Ramos et al., 2022). However, Brazil has taken new health policy decisions to meet the needs and help patients of socially vulnerable population in response to the pandemic (Andrade Junior et al., 2020).

Some of the deaths in this study of SARS-CoV-2 infection were nosocomial during the period from 2020 to 2021, which were similar to that which occurred in Italy and Spain in the period of 2020 (Ramos et al., 2020). Thus, it is worth highlighting the importance of implementing strict infection control interventions for all hospitalized patients, particularly in patients at high risk of death due to age over 60 years and patients with comorbidities including Tuberculosis (Rodriguez-morales, 2020). The results of this study showed that the risk of viral transmission from other patients, visitors and health professionals to the socially vulnerable population in community must be taken into account, as limited or no protection against COVID-19 is one of the problems that leads to co-infection (Sy et al., 2020).

Another important factor is the age of patients, since it is the reason that can influence the increase in mortality in vulnerable of population in patients with COVID-19, when compared to other patients with other viral diseases that develop pneumonia or other injuries (Ramos et al., 2022; Vesga et al., 2020; Togun et al., 2020; STOP; Partnership, 2020).

Although the present study predicts mortality, due to the small number of patients using the Cohort study, we cannot draw specific conclusions. In fact, the findings of the study showed that in the “treatment group” there is mortality in elderly patients with comorbidity (Diabetes), with Tuberculosis being one of the main determinants of mortality in the vulnerable population people in Brazil (71%) due to their age and greater number of comorbidities. Thus, this study demonstrated that the vulnerable population with Tuberculosis and COVID-19 have a higher risk of negative outcome and death compared to patients with COVID-19 alone. Therefore, early detection of the association between these diseases is important for the proper management of COVID-19 and Tuberculosis.

It is emphasized that patients with COVID-19 and Tuberculosis have 60% less chance of cure (Table 2). Furthermore, patients cured with pulmonary sequelae of COVID-19 may be at greater risk of developing advances in the worsening of Tuberculosis in the future.

However, according to the results found in this case report, it is observed that in vulnerable of population in some regions in Mato Grosso do Sul State where the forms of advanced Tuberculosis occur there is the presence of strains of *Mycobacterium Tuberculosis* that are resistant to drugs as shown in Table 2. Nevertheless, higher rates of deaths can be expected in young individuals as evidenced by previous studies (Amirlak et al., 2021).

The patients in this case report had respiratory problems and the clinical characteristics of patients with COVID-19 and those with active or under treatment Tuberculosis were fully elucidated. Due to the presence of respiratory problems in these patients, it is important to emphasize that the presence of cavitory disease on chest X-rays should be prioritized for the performance of the Multidrug-Resistant Tuberculosis (MDR-TB) and COVID-19 test (Miller et al., 2020; Athikarisamy, 2021).

Previous studies report that 20% of new MDR-TB cases occur in patients previously treated for Tuberculosis, and generally, patients who experience symptoms and disease recurrence should undergo laboratory tests for MDR-TB and COVID-19 (Sy et al., 2020; Eggenhuizen et al., 2021).

Given the above, it is important to implement strict infection control interventions for all hospitalized vulnerable population, which consider the risk of viral transmission from other patients, visitors and health professionals (Amirlak et al., 2021). In this case, greater care should be given to patients at high risk such as the elderly and patients with comorbidities including Tuberculosis (Gao et al., 2020; Andrade Junior et al., 2020).

The diagnosis of Tuberculosis during the period of the COVID-19 pandemic requires high clinical suspicion, as the two diseases have similar clinical signs, such as fever and mild or severe respiratory symptoms (Ramos et al., 2022). In addition, it is highlighted in this study that two patients were simultaneously diagnosed with COVID-19 and undiagnosed preexisting tuberculous disease (infection detected by chest X-ray) (Husain et al., 2020).

Therefore, COVID-19 may also have a negatively high impact on latent tuberculosis infection (Husain et al., 2020). Therefore, it is concluded in this study that immune dysregulation caused by COVID-19 affects the treatment and management of patients with latent tuberculosis infection (Table 3 and Table 4). The occurrence of mortality from

Tuberculosis and COVID-19 linked to social distancing is largely to blame for the decrease in access to Tuberculosis healthcare and treatment (Pittet et al., 2021). This case report demonstrated that the absence of BCG vaccination is related to an increase in mortality in 60% of patients with a positive result for COVID-19 (Miller et al., 2020).

Therefore, due to the supporting evidence obtained in experimental studies and according to the results presented in Table 3, this case report emphasizes that the BCG vaccine generates a protective effect against viral pathogens such as COVID-19 (Pittet et al., 2021).

Given the above, this case report makes clear the importance of BCG vaccination as a booster to the immune system of the general population, especially for the vulnerable of population in patients (Pittet et al., 2021).

The impact caused by COVID-19 on the vulnerable of population is heterogeneous, as, in turn, it is attributed to the cultural difference in rules, mitigation efforts and especially health infrastructure (Amirlak et al., 2021).

According to Miller et al. (2020), the heterogeneity of the impact of COVID-19 can be explained in part by the different health policies linked to childhood BCG vaccination, which has been intensively reported for protection against respiratory infections. In addition, Miller et al. (2020), when associated with the number of BCG vaccination policies in some countries with morbidity and mortality from COVID-19, found that places without vaccination policies, such as Italy, the Netherlands and the USA, have a high rate of deaths by COVID-19 when compared to countries with universal vaccination policies such as Brazil for BCG (Amirlak et al., 2020; Eggenhuizen et al., 2021).

However, it should be noted that vaccination for BCG does not generate unique and specific protection for COVID-19, but it strengthens the immune system and can lead to a higher percentage of protection and simultaneously a milder infection by the virus, in this case, COVID-19.

COVID-19 causes a known and exaggerated immune response, which leads to the disordered production of cytokines and pro-inflammatory proteins, in this case, the “Cytokine Storm” (Eggenhuizen et al., 2021). On the other hand, the BCG vaccine helps to organize the inflammatory response more efficiently, avoiding an uncontrolled immunological activity in order to reduce morbidity and mortality, therefore, using the BCG vaccine can be a possible tool in the fight against COVID-19 (Husain et al., 2020; Mehta et al., 2020; Athikarisamy, 2021).

5. Conclusion

Taking into account the results found in this case report, it seems that Tuberculosis like COVID-19 are two diseases that pose great challenges to public health in Brazil, especially when it involves the vulnerable population.

Given the above, it is noted that it is necessary to create policies to combat the pandemic in the Brazilian vulnerable population, but it is necessary to systematically carry out the fight against Tuberculosis. Given the above, it is noted that it is necessary to create policies to combat the pandemic in the Brazilian vulnerable population, but it is necessary to systematically carry out the fight against Tuberculosis. The study highlights the importance of considering the screening and management of these two infections that are causes of mortality mainly in the vulnerable population, justifying a common public health implication.

Infection with *Mycobacterium tuberculosis* (MTB) in the vulnerable population increased the susceptibility to SARS-CoV-2 and the severity of COVID-19. Thus, based on this case report study, it is recommended that in the indigenous population, the status of MTB infection is verified in patients with suspected COVID-19 at hospital admission.

Competing Interests Statement

The authors declare that there are no competing or potential conflicts of interest.

References

- Amirlak, L., Haddad, R., Hardy, J. D., Khaled, N. S., Chung, M. H., & Amirlak, B. (2021). Effectiveness of booster BCG vaccination in preventing Covid-19 infection. *Human Vaccines & Immunotherapeutics*, 1-3. PMID: 34403297; PMCID: PMC8425429. <https://doi.org/10.1080/21645515.2021.1956228>
- Andrade Júnior, F. P. de, Silva Neta, M. das N., Silva, K. S. da, Moraes, G. F. Q., Teixeira, A. P. de C., Lima, I. O., & Lima, E. de O. (2020). Antituberculosis in pregnancy: a review. *Research, Society and Development*, 9(6), 2020, e118963714. <https://doi.org/10.33448/rsd-v9i6.3714>
- Athikarisamy, S. E., & Jacob, J. R. (2021). Does BCG bolster one's immunity against COVID-19? Rapid response in the BMJ 2020. Retrieved August 19, 2021, from, <https://www.bmj.com/content/368/bmj.m1252/rr>

- Chen, Y., Wang, Y., Fleming, J., Yu, Y., Gu, Y., Liu, C., ... & Liu, Y. (2020). Active or latent tuberculosis increases susceptibility to COVID-19 and disease severity. *MedRxiv*. <https://doi.org/10.1101/2020.03.10.20033795>
- Cilloni, L., Fu, H., Vesga, J. F., Dowdy, D., Pretorius, C., Ahmedov, S., ... & Arinaminpathy, N. (2020). The potential impact of the COVID-19 pandemic on the tuberculosis epidemic a modelling analysis. *EClinicalMedicine*, 28, 100603. Retrieved from https://stoptb.org/assets/documents/news/Modeling%20Report_1%20May%202020_FINAL.pdf
- Diao, B., Wang, C., Tan, Y., Chen, X., Liu, Y., Ning, L., ... & Chen, Y. (2020). Reduction and functional exhaustion of T cells in patients with coronavirus disease 2019 (COVID-19). *Frontiers in immunology*, 11, 827. <https://doi.org/10.3389/fimmu.2020.00827>
- Eggenhuizen, P. J., Ng, B. H., Chang, J., Fell, A. L., Cheong, R. M., Wong, W. Y., ... & Ooi, J. D. (2021). BCG vaccine derived peptides induce SARS-CoV-2 T cell cross-reactivity. *Frontiers in Immunology*, 3034. PMID: 34421902; PMCID: PMC8374943. <https://doi.org/10.3389/fimmu.2021.692729>
- Fraisse, P. (2020). Impact de l'épidémie de Covid-19 sur l'activité des centres de lutte antituberculeuse. *Réseau national des centres de lutte antituberculeuse. GREPI*. Retrieved from <http://splf.fr/covid-19-informations-aux-professionnels>
- Gao, Y., Liu, M., Chen, Y., Shi, S., Geng, J., & Tian, J. (2020). Association between tuberculosis and COVID-19 severity and mortality: A rapid systematic review and meta-analysis. *Journal of medical virology*. <https://doi.org/10.1002/jmv.26311>
- Glaziou, P. (2020). Predicted impact of the COVID-19 pandemic on global tuberculosis deaths in 2020. *MedRxiv*. <https://doi.org/10.1101/2020.04.28.20079582>
- Husain, A. A., Monaghan, T. M., & Kashyap, R. S. (2021). Impact of COVID-19 pandemic on tuberculosis care in India. *Clinical Microbiology and Infection*, 27(2), 293. <https://doi.org/10.1016/j.cmi.2020.08.014>
- Mehta, P., McAuley, D. F., Brown, M., Sanchez, E., Tattersall, R. S., & Manson, J. J. (2020). COVID-19: consider cytokine storm syndromes and immunosuppression. *The lancet*, 395(10229), 1033-1034. [https://doi.org/10.1016/S0140-6736\(20\)30628-0](https://doi.org/10.1016/S0140-6736(20)30628-0)
- Miller, A., Reandelar, M. J., Fasciglione, K., Roumenova, V., Li, Y., & Otazu, G. H. (2020). Correlation between universal BCG vaccination policy and reduced mortality for COVID-19. *MedRxiv*. <https://doi.org/10.1101/2020.03.24.20042937>
- Ministério da Saúde. (2019). MANUAL DE RECOMENDAÇÕES PARA O CONTROLE DA TUBERCULOSE NO BRASIL. 2ª edição atualizada. Retrieved from https://bvsm.sau.gov.br/bvs/publicacoes/manual_recomendacoes_controle_tuberculose_brasil_2_ed.pdf
- Motta, I., Centis, R., D'Ambrosio, L., García-García, J. M., Goletti, D., Gualano, G., ... & Migliori, G. B. (2020). Tuberculosis, COVID-19 and migrants: preliminary analysis of deaths occurring in 69 patients from two cohorts. *Pulmonology*, 26(4), 233-240. <https://doi.org/10.1016/j.pulmoe.2020.05.002>
- Pittet, L. F., Messina, N. L., Gardiner, K., Orsini, F., Abruzzo, V., Bannister, S., ... & Curtis, N. (2021). BCG vaccination to reduce the impact of COVID-19 in healthcare workers: Protocol for a randomised controlled trial (BRACE trial). *BMJ open*, 11(10), e052101. PMID: 34711598; PMCID: PMC8557250. <https://doi.org/10.1136/bmjopen-2021-052101>
- Ramos, E. M., Araújo, E. L. L., dos Reis, F. J. M., de Souza, I. D., Facco, G. G., Ramos, I. B., ... & do Nascimento, V. A. (2022). Vitamin D, Zinc and Iron in Adult Patients with Covid-19 and Their Action in the Immune Response as Biomarkers. *Global Journal of Health Science*, 14(1), 1-1. <https://doi.org/10.5539/gjhs.v14n1p1>
- Ramos, E. M., de Abreu, A. C., de Freitas, S. L. F., de Lima, M. D., dos Reis, F. J. M., Ramos, H. V., ... & do Nascimento, V. A. (2020). COVID-19, rate of case factors and nutritional characteristics of patients dying in Italy and Brazil: a critical analyze. *Global J Health Sci*, 12(7), 133. <https://doi.org/10.5539/gjhs.v12n7p133>
- Ravimohan, S., Kornfeld, H., Weissman, D., & Bisson, G. P. (2018). Tuberculosis and lung damage: from epidemiology to pathophysiology. *European Respiratory Review*, 27(147). <https://doi.org/10.1183/16000617.0077-2017>
- Rodriguez-Morales, A. J., Cardona-Ospina, J. A., Gutiérrez-Ocampo, E., Villamizar-Peña, R., Holguin-Rivera, Y., Escalera-Antezana, J. P., ... & Sah, R. (2020). Clinical, laboratory and imaging features of COVID-19: A systematic review and meta-analysis. *Travel medicine and infectious disease*, 34, 101623. PMCID: PMC7102608. <https://doi.org/10.1016/j.tmaid.2020.101623>

- Sy, K. T. L., Haw, N. J. L., & Uy, J. (2020). Previous and active tuberculosis increases risk of death and prolongs recovery in patients with COVID-19. *Infectious Diseases*, 52(12), 902-907. <https://doi.org/10.1080/23744235.2020.1806353>
- Tadolini, M., Codecasa, L. R., García-García, J. M., Blanc, F. X., Borisov, S., Alffenaar, J. W., ... & Migliori, G. B. (2020). Active tuberculosis, sequelae and COVID-19 co-infection: first cohort of 49 cases. *European Respiratory Journal*, 56(1). <https://doi.org/10.1183/13993003.01398-2020>
- Togun, T., Kampmann, B., Stoker, N. G., & Lipman, M. (2020). Anticipating the impact of the COVID-19 pandemic on TB patients and TB control programmes. *Annals of clinical microbiology and antimicrobials*, 19, 1-6. <https://doi.org/10.1186/s12941-020-00363-1>
- Vesga, J. F., Hallett, T. B., Reid, M. J., Sachdeva, K. S., Rao, R., Khaparde, S., ... & Arinaminpathy, N. (2019). Assessing tuberculosis control priorities in high-burden settings: a modelling approach. *The Lancet Global Health*, 7(5), e585-e595. [https://doi.org/10.1016/S2214-109X\(19\)30037-3](https://doi.org/10.1016/S2214-109X(19)30037-3)
- World Health Organization [WHO]. (2020). COVID-19 Coronavirus Pandemic; 2020 Retrieved from https://www.who.int/emergencies/diseases/novelcoronavirus2019?adgroupsurvey={adgroupsurvey}&gclid=CjwKCAiA55mPBhBOEiwANmzoQiRypEpVYPfcS2gVAFB566MUo7UeyvzEXOrpz1FsiYw_1Ek_BHeyRoC8TMQAvD_BwE
- World Health Organization [WHO]. (2020). Global Tuberculosis Report; 2019 Retrieved from <file:///C:/Users/adminsgi/Downloads/9789241565714-eng.pdf>
- Zhou, P., Yang, X. L., Wang, X. G., Hu, B., Zhang, L., Zhang, W., ... & Shi, Z. L. (2020). A pneumonia outbreak associated with a new coronavirus of probable bat origin. *nature*, 579(7798), 270-273. PMID: PMC7095418. <https://doi.org/10.1038/s41586-020-2012-7>

Copyrights

Copyright for this article is retained by the author(s), with first publication rights granted to the journal.

This is an open-access article distributed under the terms and conditions of the Creative Commons Attribution license (<http://creativecommons.org/licenses/by/4.0/>).

Improving Global TBI Tracking and Prevention: An Environmental Science Approach

Mara Chen¹, Karl Maier², Donna Ritenour³ & Christina Sun⁴

¹ Henson School of Science & Technology, Salisbury University, Maryland, USA

² Fulton School of Liberal Arts, Salisbury University, Maryland, USA

³ College of Health and Human Services, Salisbury University, Maryland, USA

⁴ College of Computer, Mathematical, and Natural Sciences, University of Maryland, Maryland, USA

Correspondence: Mara Chen, Henson School of Science & Technology, Salisbury University, Salisbury, MD 21801, USA. E-mail: mxchen@salisbury.edu

Received: July 24, 2021 Accepted: January 13, 2022 Online Published: January 27, 2022

doi:10.5539/gjhs.v14n3p20

URL: <https://doi.org/10.5539/gjhs.v14n3p20>

Abstract

Traumatic brain injury (TBI) has grown to pandemic proportions, placing a significant burden on global public health, socio-economic condition, and human capital resources. This paper examines the global spatial distribution of TBI using currently available data from research studies to advance a comprehensive review of TBI that integrates geospatial and environmental perspectives. It reveals significant geographic differences and socioeconomic gaps in global TBI incidence tracking, prevalence, and mortality rates. It proposes an environmental science approach to improving public awareness, tracking and prevention of TBI through the integration of environmental data using GIS. The use of GIS for accurate location-based mapping and integrated analysis of environmental data subsequently helps reveal risk factors for targeted research, education outreach, and more effective public health policy and preventative measures.

Keywords: TBI, TBI Tracking and Prevention, Global Health, Health and Environmental Perspective

1. Introduction

As we face the acute crisis of COVID-19, another global public health pandemic has silently emerged in recent years - traumatic brain injury (TBI). In the U.S., TBI has often been considered a silent epidemic due to its many subtle effects and the general lack of public awareness. Yet, TBI has become a critical public health problem and a significant socio-economic burden throughout the world: It is prevalent in both low- and high-income countries and affects people of all ages and a leading killer of children in the developed and developing world (Peeters et al., 2015; Bell et al., 2017). A comprehensive geospatial approach is needed to better address TBI – a problem that is perhaps best understood by the very nature of our relationships with the environment throughout human history.

Traumatic brain injuries directly affect our critical executive organ, our human intelligence hub. The injuries sustained from head trauma stem from our inability to prevent or adequately adapt in real time to abrupt environmental changes encountered in daily living, which may be naturally occurring or human-induced (Chen et al., 2020). In a parallel progression, human ecological habitats have evolved from natural caves to nomadic shelters, tribes, cities, and metropolises, to emerging intelligent cities with digital grids beyond physical infrastructure and traditional spatial boundaries. Deep geological history has shown a vital story of major and minor adaptations of organisms to environmental challenges. In our short human history, we have also experienced and adapted to tremendous environmental challenges, either naturally occurring and/or human induced, such as the Ice Age, great floods, volcanic eruptions, dust storms, and infectious diseases. Many societal advancements are largely propelled by the evolution of human intelligence and ingenuity along with our adaptations to environment, such as agriculture cultivation, industrialization, automotive transportation, distant wireless communication, computing, and artificial intelligence (AI). The TBI problem highlights the vital importance of human-environment interactions and calls for better intelligent design of safer environments, and the maximization of resources for TBI awareness and prevention.

Toward this, we take a broader view of the global TBI problem to promote improvements in TBI tracking and prevention. The biopsychosocial concept continues to evolve toward a more ecological understanding of health, such that biological, psychological, and social factors interact at many levels of analysis (Maier & al'Absi, 2017).

The physical and social environmental dimensions that can be uniquely integrated by geospatial analysis are essential to more fully understanding and preventing TBI. We analyzed available data in these areas to support our call for environment-based research and education measures on TBI awareness and prevention.

2. Current Challenges of Global TBIs

Traumatic brain injury is reported as a leading killer of children in both the developed and developing world (Bell et al., 2017), and the leading cause of global death and disability, more than any other traumatic insult (Dewan et al., 2018). According to the U.S. Centers for Disease Control and Prevention (CDC), TBI in the U.S. affects the young and old the most. From 1990 to 2016, the TBI age-standardized prevalence has increased by 8.4% (GBD 2016 Traumatic Brain Injury and Spinal Cord Injury Collaborators, 2019). Globally, it is currently estimated that 69 million people sustain a TBI each year, a leading cause of worldwide death and disability; however, TBI incidence and distribution across regions and socioeconomic divides remain unknown (Dewan et al., 2018). Another study indicates that approximately half of the population will likely have one or more TBIs over their lifetime (Maas et al., 2017).

It is estimated that over 50 million adults in the US have experienced a disability, and TBI is one of the leading causes of disability (Courtney-Long et al., 2013). Research in 16 European countries indicates that TBI causes a substantial burden to victims, their families, and society (Majdan et al., 2017). Moderate and severe TBI cause major neural impairments and deficits in mental function. Most patients of moderate TBI regain consciousness, but the long-term cognitive and functional deficit is largely unknown (Vitaz et al., 2003). Previous research shows that survivors of moderate to severe TBI have approximately a 25-35% reduction in maximal aerobic capacity 6-18 months post-injury (Washnik et al., 2019). TBI causes systemic health problems, often affecting multisensory functions such as vision, hearing, skin sensitivity, overall physical balance, and mobility, in addition to the cognitive and emotional problems from direct brain impact. Long-term prognosis of severe TBI and recurrent TBIs remains less than optimistic. Brain tissue loss from moderate to severe TBI is estimated on the order of 5% per year; atrophy-induced deformations may trigger a negative feedback loop, causing further deformation (Harris et al., 2019).

The long-lasting impact on the quality of life of patients, their families, and broader socio-economic burdens are simply beyond calculation. The life quality of TBI victims can be severely disturbed or truncated by associated morbidity and mortality. Recent studies estimate that people with short-term mild to severe TBI experience health losses of 11.0% and 21.4%, respectively, compared with a person in full health, measured by years of life lived with disability (GBD 2016 Traumatic Brain Injury and Spinal Cord Injury Collaborators, 2019). It is estimated that TBI has contributed, on average, 41% (44% in males and 34% in females) to overall injury years of life lost (YLLs), meaning that about 1.3 million YLLs were attributable to TBI in the EU-28 in 2013 (Majdan et al., 2017). In addition, an array of psychiatric disorders, including depression, anxiety, and substance abuse are prevalent after TBI, more so with moderate to severe cases (Juengst et al., 2017). Mental illness after surviving TBI compounds public health problems.

The global economic burden of road injuries alone in the 166 countries included in a study is projected to increase to \$1.8 trillion (2010 US\$) from 2015 to 2030 (Chen et al., 2019). TBI incidences will likely continue to increase due to factors of growing population density, aging, increased use of motor vehicles, motorcycles, and bicycles (GBD 2016 Traumatic Brain Injury and Spinal Cord Injury Collaborators, 2019). The proportion of TBIs from road traffic injuries are highest in Africa and SE Asia (Dewan et al., 2018). Research suggests a multidisciplinary approach may likewise be optimal for treatment and rehabilitation (Katarzyna et al., 2019). Therefore, it is pertinent to highlight the importance of research efforts on geospatial, physical, and social environmental factors for better TBI prevention.

3. Spatial Differentiations in Global TBIs

Given the increased global economic burden of TBI, it is equally important to highlight the spatial differentiations of the distribution of the economic burden and the capacity to deal with it. There are wide differentiations in the cause, prevalence, and mortality rate of TBI among regions and nations. First, the leading cause varies. According to the CDC, falling is the leading cause of TBI in the United States, while road injury remains dominant cause of TBI in the developing countries. TBI results mainly from road accidents in the most populous and rapid developing countries, such as China and India (Maas et al., 2017; Maas, 2017). The dynamics between people and their environment varies greatly from place to place. Major environmental factors include population density, socio-economic conditions, education, employment, transportation infrastructure, road condition, social order and human interactions, population stratification and aging, access to drugs and weapons, and mental health issues. Low- and middle-income countries (LMICs) experience nearly three times more cases of TBI proportionally than high income countries (HICs), even though total TBI incidence is highest in North America (Dewan et al., 2018).

Based on data from the GBD 2016 Traumatic Brain Injury and Spinal Cord Injury Collaborators, different spatial patterns emerge. Table 1 shows several spatial and social patterns: 1). The top five countries with the highest TBI incidence are India, China, Russia, Brazil, and Pakistan. India, China, and Brazil are of high population density and experiences rapid economic transformation during the study period. 2). Syria has both the highest age-standardized rate (ASR) and the highest percentage increase of ASR (PCASR) in TBI, and the constant civil conflicts might have been an important factor. Several other nations in the same category also experienced political changes and social instability, such as Yemen, Iraq, Afghanistan. 3). The five countries of low ASR and decreased percentage change of ASR or negative PASR (from 1990 to 2016) are nations of higher social stability, such as UK and Japan. This data only shows the patterns of highest TBI incidences and changing rates during the study period from 1990 to 2016. There is a real need for more social science research efforts on the reasons and factors behind the changes within each country.

This study carried out a comparative analysis of TBI mortality rate between 16 European countries and the U.S. TBI data for the year 2013, based on the data availability. The 2013 European TBI data came from the research of cross-sectional analysis of 16 European countries (Washnik et al., 2019) and the 2013 U.S. TBI data was extracted from the Centers for Disease Control and Prevention. Overall, the senior population had the highest TBI mortality rate.

Various chi-squared analyses were carried out, such as among different age groups, among the 16 different European nations, and between the 16 composite European nations (total numbers) and the U.S. total TBI cases. All *p* values are close to 0, which indicate that the spatial and age-group variations are all statistically significant. The chi-squared analysis of three European countries with the highest TBI death counts is shown in Table 2, and the chi-squared analysis of the 16 European nations and the US TBI mortality data is shown in Table 3. Based on the results, it is reasonable to project that the differences between developed countries and developing countries are also significant, if data were available.

Table 1. Global TBI incidence patterns and trends, 1990-2016

Country	2016 Highest Incidences	2016 Highest ASR	Highest PCASR	Low AST with negative PCASR AST	PCASR
India	5641697				
China	4339654				
Russia	1202502				
Brazil	786433				
Pakistan	745843				
Syria		1322			
Slovenia		1092			
Czech Republic		1022			
Poland		893			
Slovakia		889			
Syria			424.8		
Yemen			99		
Iraq			67.2		
Afghanistan			63.3		
North Korea			56.4		
Timor-Leste				235	-26.3
UK				260	-5.9
Japan				263	-15.5
Portugal				267	-29.3
Liberia				270	-61.6

Data source: Extracted from the GBD 2016 Traumatic Brain Injury and Spinal Cord Injury Collaborators article (Dewan et al., 2018).

ASR: age-standardized rate per 100,000.

PCASR: percentage change in age-standardized rates, 1990-2016.

Table 2. Chi-squared analyses of the three European nations, with the highest TBI death counts in 2013

Age-group	Italy	United Kingdom	Romania	Total	P Value
0 - 4	22	26	31	79	
5 - 14	29	18	33	80	
15 - 34	594	361	276	1231	$p < 0.001$
35 - 64	1063	881	923	2867	
65+	2973	2472	664	6109	
Total	4681	3758	1927	10366	

Table 3. Chi-squared analyses of the 16 European nations and the U.S. 2013 TBI deaths

TBI Age Category	European 16 Nations	U.S.A.	Total	P Value
0-4	119	760	879	
5 - 14	152	724	876	
15 - 34	2079	12964	15043	$p < 0.001$
35 - 64	5436	20529	25965	
65+	9263	20943	30206	
Total	17049	55920	72969	

Sources: The U.S. data is from the CDC, and the data of the 16 European nations is adapted from Majdan et al., 2017.

4. Environmental Variables as an Essential Component of Global TBI Data Infrastructure

Environmental parameters should be an essential component of any TBI database, in addition to current TBI variables, such as causes, severity, age, and gender. The environmental variables need to include both physical and social parameters. Physical variables might include factors like geo-referenceable location, topography, weather, road condition, and transportation mode. Social variables could cover employment status, urban or rural settings, neighborhood characteristics, and ethnicity.

The spatial variability of TBI across different continents and countries calls for more effective tracking and prevention strategies by taking geospatial and social environmental factors into consideration. Measurement of the burden of TBI in greater geographic and demographic detail is of substantial value (GBD 2016 Traumatic Brain Injury and Spinal Cord Injury Collaborators, 2019). However, complete TBI databases at a national level do not currently exist or some national TBI data are not available for the research community to access. Approximately 10 million of moderate-to-severe TBI annually is estimated in India, yet there remains a major need of data to study TBI (Maas, 2017)

Continuous data tracking of TBI incidences has only been available in the U.S. and certain European countries over the past few decades. TBI data are almost absent in low- and middle-income countries (LMICs) where TBI is likely to occur much more frequently (Maegle, 2019). It is both crucial and feasible for all nations to document and track TBI incidences, with the use of modern technologies and similar digital formats and guidelines.

Lacking complete and compatible data is a major problem in global TBI tracking, and inconsistency in currently available data compounds the problems in studying TBI incidences and mortality. The U.S. and many European countries have decades of TBI data tracking and reporting. However, the TBI data collection and analyses across Europe and the U.S. still have wide variations and discrepancies in the reported incidences and mortality rates (Maegle, 2019; Li et al., 2016; Majdan et al., 2016; Maas et al., 2017).

5. A GIS Framework of TBI

Geographic Information System (GIS) is known for its capability in location-based mapping and integrated geospatial analysis. It has been widely used in location-based mapping and geospatial analyses of features and events at different scales and in many disciplines. It has been effectively used in epidemiology and public health for providing sophisticated spatial analysis of disease occurrence, cancer data and other health data, geostatistical data analysis of interconnected health and contributing environmental risk factors (Rytkönen, 2004; Kontopantelis et al., 2015; Davies et al., 2016; Cho et al., 2020). The increasing utilization of GIS has transformed health in

disease infectious diseases surveillance and tracking, public health management, and citizens data input (Davenhall & Kinabrew, 2012; Saran et al., 2020). Geographic information system and artificial intelligence (AI) offer immense possibilities for improving community health and healthcare (Shaw & McGuire, 2017; Kirby et al., 2017; Boulous et al., 2019; Wang, 2020). Geospatial analyses using GIS help address the geographic distribution of a disease and delineate potential patterns and trends of disease incidences (Nayak et al., 2021).

For example, GIS has played a critically important role in mapping and communicating the daily spatial clustering and temporal trend of the ongoing COVID-19 (Dong et al., 2020; Ahasan & Hossain, 2021). Geospatial mapping and analysis on diseases occurrences and interrelationships of the diseases and associated environmental factors help us better understand the causes, trends, and underlying risk factors.

In this vein, we need to take on the challenges of the TBI epidemic in the same way that we deal with other public health threats and any other types of environment disasters, through both proactive/anticipatory and reactive approaches using GIS technology. Currently, health care professionals, the research community, and decision-makers have largely focused on TBI treatment and subsequent management. Much progress has been made in TBI treatment and management in developed countries, but such improvement has not been seen significantly in developing nations where the risk factors are among highest. Historically, increased awareness, optimal management and guidelines, and significant technological advancements in current treatment regimens resulted in an overall TBI-related death rate (Harvey & Close, 2012)

Still, the prevalence of global TBI is increasing. Limited research efforts have focused on anticipatory strategies, i.e., how to better track and prevent TBI in the first place. Leading causes of TBI vary significantly from country to country and across demographical age groups. Falling is the leading cause of TBI for older adults (Nykiforuk & Flaman, 2021), while TBI due to accidents or sports is a leading cause of death and disability in children and young adults in the United States (U.S. National Institute of Health). Road injury remains dominant cause of TBI in the developing countries, especially TBI following road traffic collision is more common in LMICs (Dewan et al., 2018).

Traumatic brain injuries have become an urgent and important public health issue. Important public health questions need to be addressed: where did TBI occur? How did they happen? Are there any spatial and temporal patterns and trends of TBI? What are possible important risk factors? Geographic Information System can be effectively used to address these questions if TBI incidences are tracked and coded with georeferenced locations. Geographic Information System can create different types of maps by overall TBI incidences, by cause, by time, by severity, by different spatial scales (local, city, regional, national, global), by age group, and so on. Integrated TBI health data and environmental data analysis help reveal risk factors. These maps and analysis results would then become important for public health communication and decision making.

The use of GIS as a geospatial mapping and analysis tool has become particularly effective and timely relevant in tracking and mitigating the COVID-19 global pandemic (Franch-Pardo et al., 2020). In a similar vein, the use of GIS in TBI as a mapping and analytical tool can lead to three major beneficial outcomes: developing a better global TBI data infrastructure (Chen et al., 2020), improving TBI tracking and promoting better public awareness by using accurate and complete geospatial TBI databases, and formulating more effective prevention measures (Figure 1).

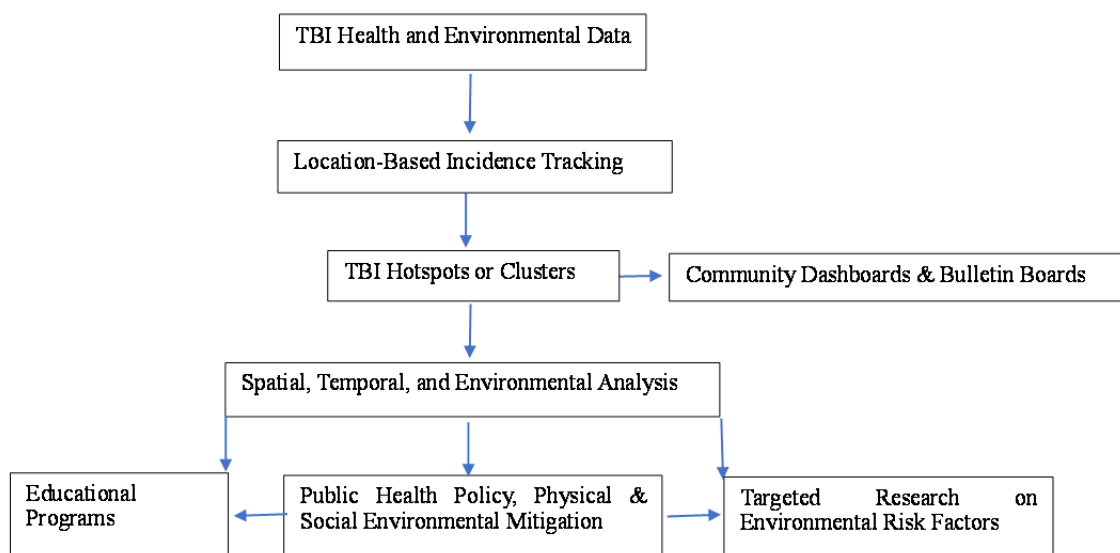


Figure 1. Framework of using GIS in improving TBI tracking and prevention

6. GIS for Integrated Environmental Analysis and TBI Prevention

Geographic Information System is not only an effective tool to tracking disease occurrences and create maps for visualization, but is also a robust system to process, analyze, integrate, and model complex incidence data to reveal spatial and temporal patterns, as well as correlations between TBI and different physical and social environmental variables. Integrated environmental analysis can be used for TBI prevention in major aspects: reveal important environment risk factors, promote public awareness and educational measures, and improve better public health policy and effective TBI mitigation strategies.

First, potential environmental risk factors for public health problems can be revealed (Ijumulana et al., 2020; Bhuiyan et al., 2020; Long et al., 2020). As such, there are different causes behind TBI hotspots due to varied environmental factors. If TBI clusters are related to road injuries from vehicle accidents, GIS can be used to analyze TBI occurrences in the context of road condition, topographic slope, weather condition, travel speed, visibility, in addition to a driver’s condition and behavior. If TBI clusters in a crime-prone neighborhood, GIS analysis can focus on the potential linkages to social environmental factors, such as unemployment, education, drug use, and violence. For TBI clusters in schools or recreational areas, GIS could be used to identify possible facility and human action and interaction factors behind sports-related injuries. If TBI clusters in elderly people from falls, GIS could be used to analyze the factors related to living environment arrangements, types of activities, time of activities, and health conditions. Using GIS for mapping and environmental analysis can help delineate TBI hotspots and identify possible vulnerable groups and associated risk factors. More personal, clinical, and environmental data are increasingly becoming available for research, and accessible data source for identifying clinical associations and environmental patterns could lead to a better understanding of TBIs (Cobb et al., 2018; Mollayeva et al., 2019). Geospatial and temporal patterns of TBIs may indicate potential correlations with environmental factors and human activities and behaviors.

Second, once TBI incidences and possible environmental risk factors are identified and mapped out, the mapped clusters of concentrated TBI can present geospatial distribution patterns and temporal trends. These maps and information can be put on a community web dashboard and channel into news media, as part of periodic public health announcements to promote public awareness. Environmental analysis using GIS has been used for public health promotion (Nykiforuk & Flaman, 2021).

In addition to promote public awareness using community dashboard and news media, integrated environmental analysis result can further facilitate targeted research and proactive education programs, based on the identified risk factors. Traumatic brain injury education measures can be an immense catalyst for promoting positive changes. Schools are ideal settings for promoting health, beyond individual behavioral changes, and turning schools into health-promoting settings is a form of sound social investment (Gugglberger, 2021). Traumatic brain injury educational outreach can start anywhere from childhood to adulthood, i.e., from kindergarten through college. Each stage can have a different but somewhat overlapping focus for sustaining improvement on TBI awareness and prevention education. For example, a “Safety ABC”, from head to toes, can be designed as a health concept for

children K-5. For early teens, the focus should be placed more on holistic personal safety (physical, emotional wellbeing, and mental health) and social interaction interpersonal safety (driving, sports, entertainment). In college, education should center around autonomy, body, mind, and environmental ecology management (nutrition, psychological development, social environmental ecology, and public services). All these approaches would promote TBI awareness and prevention among children and youths.

Third, the integrated analysis of both physical and social environmental data would allow decision makers to develop community-oriented public health policy and mitigation strategies. The use of GIS technology provides the most effective for decision-making in a multi-disciplinary context to facilitate sharing of data, knowledge, and expertise (Joyce, 2009). The combined utilization of GIS and remote sensing data has improved knowledge of climatic, environmental, and biodiversity factors, and the research has facilitated decision-making processes for allocating limited resources, mapping risks, and creating early warning systems against vector-borne diseases such as malaria, visceral leishmaniasis, dengue, Rift Valley fever, schistosomiasis, Chagas disease and leptospirosis (Ceccato et al., 2018). The prevalence and varied nature of TBI cases are highly environment dependent, and GIS data integration and analysis would lead to a better decision making and more effective preventative strategies. For example, TBI hotspots are associated with road injuries are prevalent in LMICs (Dewan et al., 2018), decision makers can then better decide if a community needs to set up road warning signs, reconstruct certain segments of road network, install wireless camera monitoring systems, or tighten travel speed limits at certain locations. For TBI hotspots related to social environment instability and complex social dynamic conflicts, it could be more important and effective to provide public health counseling educational seminars, and behavior interventions coupled with more frequent public safety patrol and social outreach programs. For the TBI hotspots of older patients from falling, it would be more effective to alleviate or prevent some falling problems by designing safer living environment and reducing alone activity time.

7. Discussion and Conclusion

The rapid economic development and imbalanced dynamic interactions between humans and their changing environment has led to what is essentially a global TBI epidemic. Subsequently, the TBI epidemic has caused major socio-economic interruptions and dysfunctions. It causes not only individual suffering, but also a tremendous global socio-economic burden.

The effectiveness of any preventative health policy depends on appropriate, timely identification and mitigation of major causes and risk factors. The common leading causes of TBI are known, but highly variable both geographically and temporally, within a country and across the globe. Integrated physical and social environment studies using GIS is important and effective in mapping out TBI hotspots and revealing the correlations between TBI incidences and environmental risk factors. The integrated data analysis of TBI and environment risk factors would help promote public health education and formulate better public health policy and specific TBI prevention guidelines to target causes in high incidence areas.

People from the worldwide can greatly benefit from interdisciplinary environmental research beyond medical studies on the TBI causes, treatment and rehabilitation. The effective uses of GIS in COVID-19 and vector-borne diseases surveillance and early warning offer a great promise for its broader applications in TBI research. Geographic information system can delineate TBI spatial distribution hotspots and temporal shifting trends and reveal associated complex environmental variables. Convergent research efforts from medical researchers, environmental scientists, and GIS professionals would provide comprehensive science data and knowledge of TBI causes and contributing environmental risk factors.

Interdisciplinary or transdisciplinary research would help develop better public health policies and more effective TBI prevention strategies on how to create a safer environment, heightened human conscious awareness, and better human and environment dynamics. The preventative measures will lead to safer design and uses of assisted living facilities, athletic gears, as well as road infrastructures and vehicles. Professionals in different science disciplines and health care fields and policymakers can collaborate on specific educational content and mitigation strategies. TBI is one of the most urgent global public health challenges. Integrated environmental science approach will help improve global TBI awareness and prevention.

Competing Interests Statement

The authors declare that there are no competing or potential conflicts of interest.

References

Ahasan, R., & Hossain, M. M. (2021). Leveraging GIS and spatial analysis for informed decision-making in COVID-19 pandemic. *Health policy and technology*, 10(1), 7-9. <https://doi.org/10.1016/j.hlpt.2020.11.009>

- Bell, M. J., Adelson, P. D., & Wisniewski, S. R. (2017). Challenges and opportunities for pediatric severe TBI—review of the evidence and exploring a way forward. *Child's nervous system*, 33(10), 1663-1667. Epub 2017 Sep 6. PMID: 29149394. <https://doi.org/10.1007/s00381-017-3530-y>
- Bhuiyan, M. A. H., Karmaker, S. C., Bodrud-Doza, M., Rakib, M. A., & Saha, B. B. (2021). Enrichment, sources and ecological risk mapping of heavy metals in agricultural soils of dhaka district employing SOM, PMF and GIS methods. *Chemosphere*, 263, 128339. Epub 2020 Sep 15. PMID: 33297265. <https://doi.org/10.1016/j.chemosphere.2020.128339>
- Boulos, M. N. K., Peng, G., & VoPham, T. (2019). An overview of GeoAI applications in health and healthcare. *International Journal of Health Geographics*, 18(1), 1-9. <https://doi.org/10.1186/s12942-019-0171-2>
- Ceccato, P., Ramirez, B., Manyangadze, T., Gwakisa, P., & Thomson, M. C. (2018). Data and tools to integrate climate and environmental information into public health. *Infectious diseases of poverty*, 7(1), 1-11. PMID: 30541601; PMCID: PMC6292116. <https://doi.org/10.1186/s40249-018-0501-9>.
- Chen, S., Kuhn, M., Prettner, K., & Bloom, D. E. (2019). The global macroeconomic burden of road injuries: estimates and projections for 166 countries. *The Lancet Planetary Health*, 3(9), e390-e398. [https://doi.org/10.1016/S2542-5196\(19\)30170-6](https://doi.org/10.1016/S2542-5196(19)30170-6)
- Chen, M., Ritenour, D., & Maier, K. (2020). Enhancing the US TBI data infrastructure: geospatial perspective. *Annals of GIS*, 26(3), 311-318. <https://doi.org/10.1080/19475683.2020.1744724>.
- Cho, J., You, S. C., Lee, S., Park, D., Park, B., Hripcsak, G., & Park, R. W. (2020). Application of Epidemiological Geographic Information System: An Open-Source Spatial Analysis Tool Based on the OMOP Common Data Model. *International journal of environmental research and public health*, 17(21), 7824. <https://doi.org/10.3390/ijerph17217824>
- Cobb, A. N., Benjamin, A. J., Huang, E. S., & Kuo, P. C. (2018). Big data: More than big data sets. *Surgery*, 164(4), 640-642. <https://doi.org/10.1016/j.surg.2018.06.022>
- Courtney-Long, E. A., Carroll, D. D., Zhang, Q. C., Stevens, A. C., Griffin-Blake, S., Armour, B. S., & Campbell, V. A. (2015). Prevalence of disability and disability type among adults—United States, 2013. *MMWR. Morbidity and mortality weekly report*, 64(29), 777. <https://doi.org/10.15585/mmwr.MM6429a2>
- Davenhall, W. F., & Kinabrew, C. (2012). GIS in Health and Human Services. *Springer Handbook of Geographic Information*, 557-578. https://doi.org/10.1007/978-3-540-72680-7_29
- Davies, T. M., Jones, K., & Hazelton, M. L. (2016). Symmetric adaptive smoothing regimens for estimation of the spatial relative risk function. *Computational Statistics & Data Analysis*, 101, 12-28.
- Dewan, M. C., Rattani, A., Gupta, S., Baticulon, R. E., Hung, Y. C., Punchak, M., ... & Park, K. B. (2018). Estimating the global incidence of traumatic brain injury. *Journal of neurosurgery*, 130(4), 1080-1097. <https://doi.org/10.3171/2017.10.JNS17352>
- Dong, E., Du, H., & Gardner, L. (2020). An interactive web-based dashboard to track COVID-19 in real time. *The Lancet infectious diseases*, 20(5), 533-534. [https://doi.org/10.1016/S1473-3099\(20\)30120-1](https://doi.org/10.1016/S1473-3099(20)30120-1)
- Franch-Pardo, I., Napoletano, B. M., Rosete-Verges, F., & Billa, L. (2020). Spatial analysis and GIS in the study of COVID-19. A review. *Science of The Total Environment*, 739, 140033. PMID: 32534320; PMCID: PMC7832930. <https://doi.org/10.1016/j.scitotenv.2020.140033>. Epub 2020 Jun 8.
- GBD 2016 Traumatic Brain Injury and Spinal Cord Injury Collaborators. (2019). Global, regional, and national burden of traumatic brain injury and spinal cord injury, 1990–2016: a systematic analysis for the Global Burden of Disease Study 2016. *The Lancet Neurology*, 18(1), 56-87. [https://doi.org/10.1016/S1474-4422\(18\)30415-0](https://doi.org/10.1016/S1474-4422(18)30415-0).
- Gugglberger, L. (2021). A brief overview of a wide framework—Health promoting schools: a curated collection. *Health Promotion International*, 36(2), 297-302. <https://doi.org/10.1093/heapro/daab037>
- Harris, T. C., de Rooij, R., & Kuhl, E. (2019). The Shrinking Brain: Cerebral Atrophy Following Traumatic Brain Injury. *Ann Biomed Eng*, 47(9), 1941-1959. <https://doi.org/10.1007/s10439-018-02148-2>
- Harvey, L. A., & Close, J. C. (2012). Traumatic brain injury in older adults: characteristics, causes and consequences. *Injury*, 43(11), 1821-1826. <https://doi.org/10.1016/j.injury.2012.07.188>
- Ijumulana, J., Ligate, F., Bhattacharya, P., Mtalo, F., & Zhang, C. (2020). Spatial analysis and GIS mapping of regional hotspots and potential health risk of fluoride concentrations in groundwater of northern Tanzania.

- The Science of the Total Environment*, 735, 139584. <https://doi.org/10.1016/j.scitotenv.2020.139584>
- Joyce, K. (2009). "To me it's just another tool to help understand the evidence": Public health decision-makers' perceptions of the value of geographical information systems (GIS). *Health & Place*, 15(3), 831-840. Epub 2009 Feb 8. PMID: 19268622. <https://doi.org/10.1016/j.healthplace.2009.01.004>.
- Juengst, S. B., Kumar, R. G., & Wagner, A. K. (2017). A narrative literature review of depression following traumatic brain injury: prevalence, impact, and management challenges. *Psychology research and behavior management*. <https://doi.org/10.2147/PRBM.S113264>
- Katarzyna, K., Agata, T., & Marcin, M. (2019). Severe TBI patients benefit from multi-modal and multi-disciplinary treatments approaches—two exemplary case reports. *Journal of medicine and life*, 12(1), 71. PMID: 31123528; PMCID: PMC6527415. <https://doi.org/10.25122/jml-2019-0016>
- Kirby, R. S., Delmelle, E., & Eberth, J. M. (2017). Advances in spatial epidemiology and geographic information systems. *Annals of epidemiology*, 27(1), 1-9. <https://doi.org/10.1016/j.annepidem.2016.12.001>
- Kontopantelis, E., Springate, D. A., Ashworth, M., Webb, R. T., Buchan, I. E., & Doran, T. (2015). Investigating the relationship between quality of primary care and premature mortality in England: a spatial whole-population study. *Bmj*, 350. <https://doi.org/10.1136/bmj.h904>
- Li, M., Zhao, Z., Yu, G., & Zhang, J. (2016). Epidemiology of traumatic brain injury over the world: a systematic review. *General medicine: open access*, 4(5), e275-e275. <https://doi.org/10.4172/2327-5146.1000275>
- Long, X., Liu, F., Zhou, X., Pi, J., Yin, W., Li, F., ... & Ma, F. (2021). Estimation of spatial distribution and health risk by arsenic and heavy metals in shallow groundwater around Dongting Lake plain using GIS mapping. *Chemosphere*, 269, 128698. Epub 2020 Oct 22. PMID: 33121802. <https://doi.org/10.1016/j.chemosphere.2020.128698>.
- Maas, A. I. (2017). Traumatic brain injury in India: a big problem in need of data. *Neurology India*, 65(2), 257. <https://doi.org/10.4103/0028-3886.201848>. PMID: 28290383.
- Maas, A. I., Menon, D. K., Adelson, P. D., Andelic, N., Bell, M. J., Belli, A., ... & Francony, G. (2017). Traumatic brain injury: integrated approaches to improve prevention, clinical care, and research. *The Lancet Neurology*, 16(12), 987-1048. [https://doi.org/10.1016/S1474-4422\(17\)30371-X](https://doi.org/10.1016/S1474-4422(17)30371-X).
- Maegele, M. (2019). The long journey towards uniform epidemiological monitoring of TBI around the globe. *Lancet Neurol*, 18(3), 228-229. Epub 2019 Feb 12. PMID: 30784547. [https://doi.org/10.1016/S1474-4422\(19\)30019-5](https://doi.org/10.1016/S1474-4422(19)30019-5)
- Maier, K. J., & Al'Absi, M. (2017). Toward a biopsychosocial ecology of the human microbiome, brain-gut axis, and health. *Psychosomatic medicine*, 79(8), 947-957. <https://doi.org/10.1097/PSY.0000000000000515>.
- Majdan, M., Plancikova, D., Brazinova, A., Rusnak, M., Nieboer, D., Feigin, V., & Maas, A. (2016). Epidemiology of traumatic brain injuries in Europe: a cross-sectional analysis. *The Lancet Public Health*, 1(2), e76-e83. Epub 2016 Nov 29. PMID: 29253420. [https://doi.org/10.1016/S2468-2667\(16\)30017-2](https://doi.org/10.1016/S2468-2667(16)30017-2)
- Majdan, M., Plancikova, D., Maas, A., Polinder, S., Feigin, V., Theadom, A., ... & Haagsma, J. (2017). Years of life lost due to traumatic brain injury in Europe: a cross-sectional analysis of 16 countries. *PLoS medicine*, 14(7), e1002331. <https://doi.org/10.1371/journal.pmed.1002331>
- Rytkönen, M. J. (2004). Not all maps are equal: GIS and spatial analysis in epidemiology. *International journal of circumpolar health*, 63(1), 9-24. <https://doi.org/10.3402/ijch.v63i1.17542>
- Mollayeva, T., Sutton, M., Chan, V., Colantonio, A., Jana, S., & Escobar, M. (2019). Data mining to understand health status preceding traumatic brain injury. *Scientific reports*, 9(1), 1-10. <https://doi.org/10.1038/s41598-019-41916-5>
- Nayak, P. P., Pai, J. B., Singla, N., Somayaji, K. S., & Kalra, D. (2021). Geographic information systems in spatial epidemiology: Unveiling new horizons in dental public health. *Journal of International Society of Preventive & Community Dentistry*, 11(2), 125. Published 2021 Apr 15. doi:10.4103/jispcd.JISPCD_413_20
- Nykiforuk, C. I., & Flaman, L. M. (2011). Geographic information systems (GIS) for health promotion and public health: a review. *Health promotion practice*, 12(1), 63-73. <https://doi.org/10.1177/1524839909334624>.
- Peeters, W., van den Brande, R., Polinder, S., Brazinova, A., Steyerberg, E. W., Lingsma, H. F., & Maas, A. I. (2015). Epidemiology of traumatic brain injury in Europe. *Acta neurochirurgica*, 157(10), 1683-1696. <https://doi.org/10.1007/s00701-015-2512-7>.

- Saran, S., Singh, P., Kumar, V., & Chauhan, P. (2020). Review of geospatial technology for infectious disease surveillance: use case on COVID-19. *Journal of the Indian Society of Remote Sensing*, 1-18. <https://doi.org/10.1007/s12524-020-01140-5>
- Shaw, N., & McGuire, S. (2017). Understanding the use of geographical information systems (GIS) in health informatics research: A review. *Journal of Innovation in Health Informatics*, 24(2), 228-233. <https://doi.org/10.14236/jhi.v24i2.940>
- Vitaz, T. W., Jenks, J., Raque, G. H., & Shields, C. B. (2003). Outcome following moderate traumatic brain injury. *Surgical neurology*, 60(4), 285-291. [https://doi.org/10.1016/S0090-3019\(03\)00378-1](https://doi.org/10.1016/S0090-3019(03)00378-1)
- Wang, F. (2020). Why public health needs GIS: A methodological overview. *Annals of GIS*, 26(1), 1-12. <https://doi.org/10.1080/19475683.2019.1702099>.
- Washnik, N. J., Anjum, J., Lundgren, K., & Phillips, S. (2019). A review of the role of auditory evoked potentials in mild traumatic brain injury assessment. *Trends in hearing*, 23, 2331216519840094. <https://doi.org/10.1177/2331216519840094>

Copyrights

Copyright for this article is retained by the author(s), with first publication rights granted to the journal.

This is an open-access article distributed under the terms and conditions of the Creative Commons Attribution license (<http://creativecommons.org/licenses/by/4.0/>).

Analysis of Reasons of Blood Donor Deferral at a Tertiary Care Institute in India and Its Reflections on Community Health Status

Sheetal Malhotra¹ & Gita Negi²

¹ Department of Transfusion Medicine, Postgraduate Institute of Medical Education and Research, Chandigarh, India

² Department of Transfusion Medicine and Blood Bank, AIIMS, Rishikesh, India

Correspondence: Dr Sheetal Malhotra, Assistant Professor, Department of Transfusion Medicine, Postgraduate Institute of Medical Education and Research, Chandigarh 160012, India. Tel: 91-172-275-6440. E-mail: sheetalpgi2007@yahoo.com

Received: September 16, 2021 Accepted: January 29, 2022 Online Published: February 4, 2022

doi:10.5539/gjhs.v14n3p30

URL: <https://doi.org/10.5539/gjhs.v14n3p30>

Abstract

Introduction: Safe blood donors form the backbone of safe blood transfusion services.¹ Donor eligibility policies are a critical layer of blood safety designed to ensure selection of healthy donors and to protect recipients from any harm. This study was planned to analyze the pattern of whole blood donor deferrals, its characteristics and reasons at a tertiary care institute in Northern India, as the pattern varies according to epidemiology of diseases in different demographic areas.

Material and Methods: It was a cross sectional study of 2 years duration from December 2015 to November 2017. The data of the potential donors who were deferred was recorded on a separate proforma which included their demographic details, type of donation- voluntary donor (VD) and replacement donor (RD); first time (FT) and repeat donor (RPT); type of deferrals (permanent and temporary) and the reasons of deferrals.

Results: Three thousand one hundred and thirty-three donors (voluntary-1446 and replacement-1687) donated and 597 donors were deferred (deferral rate- 16%) during this period. Majority of the deferrals i.e. 525 (88%) were temporary, 72 (12%) were permanent. The most common reason of temporary deferral was anemia. The commonest reason of permanent deferrals was a medical history of jaundice.

Conclusion: Our study results indicate that the blood donor deferral can have subtle variations based on regional aspects that should be considered when national policies are developed as pattern of deferral varies according to epidemiology of diseases in different demographic areas.

Keywords: blood donor deferral, temporary deferral, permanent deferral.

1. Introduction

Safe blood donors form the backbone of safe blood transfusion services. The safety of the blood supply is ensured through several procedures from donor selection to testing of donated units. Donor selection is still emphasized even in the era of sensitive transfusion transmitted infections (TTI) screening techniques (Birjandi, 2013). Donor eligibility policies are a critical layer of blood safety designed to ensure selection of healthy donors and to protect recipients from any harm. This study was planned to analyze the pattern of whole blood donor deferrals, its characteristics and reasons at a tertiary care institute in Northern India, as the pattern varies according to epidemiology of diseases in different demographic areas. The reasons of deferral were evaluated with respect to the ethnic and regional differences.

2. Method

It was a cross sectional study of 2 years duration from December 2015 to November 2017. From the time of study initiation till May 2017, data was collected retrospectively and from June 2017 to December 2017, deferred donors were followed prospectively. The data of the potential donors who were deferred was recorded on a separate proforma which included their demographic details, type of donation- voluntary donor (VD) and replacement donor (RD); first time (FT) and repeat donor (RPT); type of deferrals (permanent and temporary) and the reasons of deferrals. The blood donors were selected as per the norms laid down by Drugs and Cosmetics Act, DCA and

Directorate General of Health Services, MOH and FW, Govt. of India (Malik, 2016; Saran, 2013). Individuals between the age group of 18-65 years were accepted for blood donation. Donors having weight of 45 kg or more and Hb (hemoglobin) of 12.5 g/dl or more were eligible for whole blood donation. Donors were screened for Hb by Hemocue Hb 301+ (HemoCue AB, Angelholm, Sweden). For the potential donors to be eligible for donation, interval between two donations was atleast 3 months. The primary objective of the study was to analyze the pattern of whole blood donor deferrals, its characteristics and reasons at our center.

Descriptive analysis to investigate the characteristics and reasons of deferral among different demographic groups was done as gender, first-time/repeat donors, voluntary/replacement donors and temporary/permanent deferrals. Donor deferral rates for various reasons were calculated in percentages. They were compared using Chi square test. A *p* value of <0.05 was considered significant. All statistical analyses were carried out with SPSS software (SPSS, Inc., Chicago, IL, USA).

3. Results

A total of 3,730 potential donors were screened during the study period. Three thousand one hundred and thirty three donors (voluntary-1446 and replacement-1687) donated and 597 donors were deferred (deferral rate- 16%) during this period. Of these 597 deferred donors, 483 (80.9%) were males and 114 (19.1%) were females, (M:F = 4.2:1; *p*=0.009). The mean age of deferred donors was 28.6±9.3 (range 18–47 years). The most common reason of deferral was anemia (169; males- 90, females-79; *p*=0.0001- Table 1), followed by drug intake (86), medical reasons (72); history of jaundice (36), alcohol intake (31), surgery/ear piercing/tattooing (23), high hemoglobin (20), inadequate sleep (17); low weight (16), dog bite (11), recent blood donation (7); unwilling (5), poor venous access (4), underage (4), high risk sexual behavior (3), anxiety due to fear of needle prick (3). The medical reasons included infections and illnesses as- h/o typhoid within the last one year-13, h/o dengue within last six months- 4, flu/cough and cold-8, h/o fever within a week-7, any active fungal infection-4, chicken guinea-1, malaria-4, active wound infection- 4, scabies-1; hemorrhoids-1, severe allergy-2, h/o epilepsy- 4, diabetes on insulin-3, asthma- 4, h/o chest pain-3, cardiac disease with h/o angioplasty-1, TB with incomplete medication history-4, Hepatitis B infection-2, h/o STD-2. In drug intake (86), 80 were temporary deferrals including patients on antibiotics-48, anti-pyretic-17, anti-allergic-10, both anti-allergic and anti-pyretic-1, anti-depressants-2, infertility treatment-1, anti-tubercular drugs-1. Patients on anti-epileptic drugs-3, steroids for severe allergy-2 and h/o cannabis intake-1 constituted permanent deferrals due to drug intake. Among deferrals due to surgery/ear piercing/tattooing, the reasons were cholecystectomy- 3, minor surgery for renal stones-5, dental extraction within a month-2, ear piercing- 7 and tattooing- 6. Among deferrals due to alcohol intake (31), 30 were temporary with the history of alcohol intake within 24 hours. One was deferred on a permanent basis due to history of long term and chronic alcoholism.

Table 1. Reasons for donor deferral in the study cohort

REASON	Male	Female	Total	p Value
Age<18	4	0	4	0.593
Alcohol	31	0	31	0.008***
Anxiety	3	0	3	1
Blood donation<3 months	6	1	7	1
Medical causes	67	5	72	0.0059**
Dog bite	9	2	11	1
Surgery	19	4	23	1
Fasting	1	0	1	1
Drugs	80	6	86	0.0028**
Menstruation	0	1	1	1
Low hb	90	79	169	<.0001**
High hb	20	0	20	0.036*
High risk behaviour	3	0	3	1
Infection	81	1	82	<.0001**

Jaundice	34	2	36	0.045*
Inadequate sleep	17	0	17	0.0537
Low weight	5	11	16	<.0001**
Not willing	4	1	5	1
Poor venous access	3	1	4	1
Vaccination	6	0	6	0.365
TOTAL	483	114	597	

p-value <0.05 – significant; chi square test.

Majority of the deferrals i.e. 525 (88%) were temporary, 72 (12%) were permanent (Table 2). The commonest reason of permanent deferrals was a medical history of jaundice. On subgroup analysis, the frequency of deferral was 396 vs 201 in replacement vs voluntary donors respectively (p=0.002). Similarly, it is much higher in first time donors compared to repeat donors (390 vs 207 respectively).

Table 2. Table enumerating the reasons for temporary and permanent deferral

REASON FOR DEFERRAL	TOTAL
TEMPORARY DEFERRAL	
Age<18	4
Alcohol	30
Anxiety	3
Blood Donation<3 Months	7
Medical Causes	46
Dog Bite	11
Surgery	23
Fasting	1
Drugs	80
Menstruation	1
Low Hb	169
High Hb	20
Infection	82
Inadequate Sleep	17
Low Weight	16
Not Willing	5
Poor Venous Access	4
Vaccination	6
TOTAL	525
PERMANENT DEFERRAL	
Alcohol	1
Medical Causes	26
Drugs	6
High Risk Behaviour	3
Jaundice	36
TOTAL	72

Deferrals due to alcohol intake ($p=0.008$), medical reasons ($p=0.059$), drugs ($p=0.028$) and infections ($p=0.0001$) were significantly more in males than in females. Whereas in females, deferrals due to low weight were statistically significantly higher ($p=0.0001$). Deferrals due to blood donation within the last 3 months was significant in repeat donors ($p=0.009$) whereas in first time, low weight deferrals were more ($p=0.015$).

4. Discussion

Assessment of blood donor deferral in a demographic area gives us an insight of the regional aspects that should be taken into consideration while formulating national policies. The donor deferral rate (16%) was low at our center and comparable to other centers in our country. Sharma et al in a study on deferral of blood donors in a tertiary health care hospital in North India observed the deferral rate to be 17.88% (Mangwana, 2013). Other studies from same region have reported the deferral rate as 5.5% and 9% respectively (Sharma, Singh, & Bhatt, 2013; Bahadur et al., 2009). A deferral rate in the range of 11% to 33% has been quoted by various studies from Western India (Shrivastava et al., 2016; Agnihotri, 2010; Shah, 2013). In the study by Shrivastava et al, the donor deferral rate was 11.5%, majority being temporary deferrals. History of jaundice was the most common cause of permanent deferral and low hemoglobin was the major reason for temporary deferral (Shrivastava, 2016). Another study from the nearby region quoted the donor deferral rate as 11.6% (Agnihotri, 2010). In the study by Shah et al from Western India, the blood donor deferral rate was found to be as high as 33% (Shah et al., 2013). Low hemoglobin (78.30%) was the most common reason of temporary deferral, both in first time and repeat donors (71.00%). The authors concluded that there is a need to increase the efforts to improve hemoglobin in the repeat donors for donor retention and overall blood safety.

Studies from other parts of India have reported the deferral rate as 5.8% and 25% respectively (Sundar et al., 2010; Jashnani, 2011). Literature from across the world shows the donor deferral rate in the range of 20-30%. Two studies from Iran reported it to be as 25.6% and 30.9% respectively (Birjandi et al., 2013; Kasraian & Negarestani, 2015). Ngoma et al observed the donor deferral rate of 14% on retrospectively analysis in Japan (Ngoma et al., 2013). If the rate of donor deferral is high at any center, it points towards a deficiency in the donor awareness and donor education material. Additionally, if the reasons of deferral are not explained properly to the donors, it can have a negative impact on donor's psychology leading to loss of the donors (Ngoma et al., 2013).

Our study shows that the first time donors accounted for 65% of deferrals compared to 35% in repeat donors, a finding consistent with other studies (Kasraian & Negarestani, 2015; Ngoma, 2013; Birjandi et al., 2013). These studies concluded that first time donors are more frequently deferred as compared to the repeat donors. These first time, young donors are the future prospective blood donors who have the potential to increase the donor pool. But temporary deferral may have a negative impact on donor's psychology which can discourage them to return for subsequent donations, an observation based on the conclusion of the following quoted studies. A study by Hillgrove found that 21% of first time donors with low Hb returned as compared to 70% return in donors who were not deferred (Hillgrove et al., 2011). So, it is highly essential to clearly explain them the cause of deferral with relevance to their safety as well as the patient's safety and to motivate them to return for donation after the expiry of the deferral period (Mast, 2014, Ngoma et al., 2013, Ngoma et al., 2014). According to a study, a successful donor is 29% more likely to return as compared to a deferred donor (Ngoma et al., 2014).

Majority of deferrals were temporary (88%) and in replacement (66%), male donors (80.9%). There was a significant difference of deferral in replacement vs voluntary ($p=0.002$) and in males vs females ($p=0.009$). Main reasons of deferral were anemia (28%), medication intake (14%), infections (13%) and medical reasons such as cardiac disease, blood transfusion <3 months back, uncontrolled hypertension or diabetes, history of stroke etc. (12%). In a study by Ngoma et al, temporary causes accounted for 99% of deferrals, out of which 50% were due to low hb (Ngoma et al., 2013). A study from India reported that 91% of deferrals were due to temporary reasons and anemia was the most frequent reason for donor rejection (32.8%). So this group needs to be addressed properly as it leads to apparent permanent deferral in otherwise willing donors. Donors deferred for low Hb are much less likely to return for future donations than the donors that are not deferred (Hillgrove, 2015). A review by Alan et al stated that low Hb deferral occurs in 10% of blood donor deferrals. The author has discussed programs that can be implemented to decrease the anemia in regular donors as- iron tablets and hematinics, prolonging donation interval and monitoring ferritin levels (Mast, 2014).

Our analysis suggested that there is high prevalence of anemia even in first time male donors. A total of 90 males (53% of anemic donors and 15% of total deferred donors), as compared to 79 females, (47% of anemic donors and 13% of total deferred donors $p=0.0001$) were deferred due to anemia, out of which 56 were first time donors. Anemia in females is explainable which may be related to physiological conditions as menstrual loss, pregnancies. But anemia in first time male donors may relate to unrecognized medical illnesses, occult GI bleed, vitamin B12

deficiency, hyperthyroidism (Mast, 2014). Apart from iron supplementation, the donors from this region may be advised for regular deworming as it may be related to worm (hookworm) infestation in this demographic region. In addition, they should be advised medical consultation to rule out any underlying illness. Annen et al. in a study assessing the implications of low hemoglobin deficiency in infrequent donors suggested that donors deferred for low hemoglobin should be provided health information to seek diagnosis and treatment for their anemia (Annen et al., 2015).

Another unusual group of deferrals seen in our analysis was due to high hemoglobin that is $hb > 18$ g%, observed in 3% of deferred donors. Secondary polycythemia is quite common in people residing in higher altitudes to compensate for less ambient oxygen and inadequate tissue oxygenation. As there are differences in hemoglobin reference ranges for various ethnic groups, more demographic studies should be conducted to get epidemiologic evidence to know the extent of low and high Hb in males in this region and hence, may warrant a revision of donor acceptance criteria (Jashnani, 2011; Kasraian & Negarestani, 2015). Some of the deferrals such as due to alcohol intake, inadequate sleep, anxiety, fasting are totally avoidable if we strengthen our donor education and counseling strategies. Jashnani et al postulated that blood donor deferrals will surely decrease if the blood bank officials conduct sessions regarding donor acceptance criteria with the organizing team of the blood donation camps as a routine practice (Jashnani, 2011).

Among permanent deferrals, the main causes of deferral were jaundice (50%) followed by medical reasons (36%). Majority of deferred donors due to jaundice were first time male donors of the age group between 23-44 years (mean \pm S.D – 29.83 \pm 7.33 years). As per DCA guidelines, donors with history of jaundice that are attributed to gall stones, Rh disease, mononucleosis or in neonatal period can be accepted. According to our departmental policy, donors with unaccounted jaundice with no documentation of serological testing results were permanently deferred.

Certain conditions as poor veins were categorized as permanent deferrals. Sometimes, blood bank professionals face a difficulty in distinguishing these conditions as permanent or temporary deferrals and also in justification to the donors (Gonçalez et al., 2013). So these entities should be included in the donor deferral criteria by the policy makers.

Concluding, our study results indicate that the blood donor deferral can have subtle variations based on regional aspects that should be considered when national policies are developed as pattern of deferral varies according to epidemiology of diseases in different demographic areas, emphasizing the need for “Community prioritization”. Similar studies should be conducted in other centers of the region to gather more evidence so that the results can be generalized.

Competing Interests Statement

The authors declare that there are no competing or potential conflicts of interest.

References

- Agnihotri, N. (2010). Whole blood donor deferral analysis at a center in Western India. *Asian journal of transfusion science*, 4(2), 116-122. <https://doi.org/10.4103/0973-6247.67035>
- Annen, K., Delaney, M., Leitch, D., & Mast, A. E. (2015). The health implications of low hemoglobin deferral in infrequent blood donors. *Transfusion*, 55(1), 86-90. <https://doi.org/10.1111/trf.12801>
- Bahadur, S., Jain, S., Goel, R. K., Pahuja, S., & Jain, M. (2009). Analysis of blood donor deferral characteristics in Delhi, India. *The Southeast Asian journal of tropical medicine and public health*, 40(5), 1087-1091.
- Birjandi, F., Gharehbaghian, A., Delavari, A., Rezaie, N., & Maghsudlu, M. (2013). Blood donor deferral pattern in Iran. *Archives of Iranian medicine*, 16(11), 657-660.
- Gonçalez, T. T., Sabino, E. C., Schlumpf, K. S., Wright, D. J., Mendrone, A., Lopes, M., ... & NHLBI Retrovirus Epidemiology Donor Study-II (REDS-II), International Component (2013). Analysis of donor deferral at three blood centers in Brazil. *Transfusion*, 53(3), 531-538. <https://doi.org/10.1111/j.1537-2995.2012.03820.x>
- Hillgrove, T., Moore, V., Doherty, K., & Ryan, P. (2011). The impact of temporary deferral due to low hemoglobin: future return, time to return, and frequency of subsequent donation. *Transfusion*, 51(3), 539-547. <https://doi.org/10.1111/j.1537-2995.2010.02881.x>
- Jashnani, K. D., & Patil, L. N. (2011). Blood donor deferrals: Can this be reduced?. *Asian journal of transfusion science*, 5(1), 60. <https://doi.org/10.4103/0973-6247.76011>
- Kasraian, L., & Negarestani, N. (2015). Rates and reasons for blood donor deferral, Shiraz, Iran. A retrospective study. *Sao Paulo medical journal = Revista paulista de medicina*, 133(1), 36-42.

<https://doi.org/10.1590/1516-3180-2013-7110002>

- Malik, V. (2016). *Laws related to Drugs and Cosmetics Act 1940* (25th ed., pp. 372-403). Lucknow: Eastern Book Company.
- Mangwana, S. (2013). Analysis of blood donor deferral pattern: Scenario in a Tertiary Health Care Hospital in India. *Asian journal of transfusion science*, 7(2), 160-161. <https://doi.org/10.4103/0973-6247.115595>
- Mast, A. E. (2014). Low hemoglobin deferral in blood donors. *Transfusion medicine reviews*, 28(1), 18-22. <https://doi.org/10.1016/j.tmr.2013.11.001>
- Ngoma, A. M., Goto, A., Sawamura, Y., Nollet, K. E., Ohto, H., & Yasumura, S. (2013). Analysis of blood donor deferral in Japan: characteristics and reasons. *Transfusion and apheresis science: official journal of the World Apheresis Association: official journal of the European Society for Haemapheresis*, 49(3), 655-660. <https://doi.org/10.1016/j.transci.2013.06.020>
- Ngoma, A. M., Goto, A., Nollet, K. E., Sawamura, Y., Ohto, H., & Yasumura, S. (2014). Blood Donor Deferral among Students in Northern Japan: Challenges Ahead. *Transfusion medicine and hemotherapy: offizielles Organ der Deutschen Gesellschaft fur Transfusionsmedizin und Immunhamatologie*, 41(4), 251-256. <https://doi.org/10.1159/000365406>
- Saran, R. K. (2003). *DGHS Technical Manual* (2nd ed., pp. 7-21). New Delhi: Mehta Offset Pvt. Ltd.
- Sharma, T., Singh, B., & Bhatt, G. C. (2013). Profile of deferral of blood donors in regional blood transfusion center in North India. *Asian journal of transfusion science*, 7(2), 163-164. <https://doi.org/10.4103/0973-6247.115603>
- Shrivastava, M., Shah, N., Navaid, S., Agarwal, K., & Sharma, G. (2016). Blood donor selection and deferral pattern as an important tool for blood safety in a tertiary care hospital. *Asian journal of transfusion science*, 10(2), 122-126. <https://doi.org/10.4103/0973-6247.187938>
- Shah, R., Tulsiani, S., Harimoorthy, V., Mathur, A., & Choudhury, N. (2013). Analysis of efforts to maintain safe donor in main donor pool after completion of temporary deferral period. *Asian journal of transfusion science*, 7(1), 63-67. <https://doi.org/10.4103/0973-6247.106742>
- Sundar, P., Sangeetha, S. K., Seema, D. M., Marimuthu, P., & Shivanna, N. (2010). Pre-donation deferral of blood donors in South Indian set-up: An analysis. *Asian journal of transfusion science*, 4(2), 112-115. <https://doi.org/10.4103/0973-6247.67037>

Copyrights

Copyright for this article is retained by the author(s), with first publication rights granted to the journal.

This is an open-access article distributed under the terms and conditions of the Creative Commons Attribution license (<http://creativecommons.org/licenses/by/4.0/>).

Health Workers' Experience on Directly Observed Treatment Short Courses Strategy to Stop TB Transmission in Khomas Redion, Namibia

Carolina Texeira¹ & Emmanuel Magesa¹

¹ Clara Barton School of Nursing, Welwitchia Health Training Centre, Windhoek, Namibia

Correspondence: Emmanuel Magesa, Welwitchia Health Training Centre, 183 Industria Street, Lafrenz, Windhoek, Namibia. Tel: +264-813-689-057. E-mail: emagesa2002@yahoo.com

Received: November 11, 2021 Accepted: January 19, 2022 Online Published: February 7, 2022

doi:10.5539/gjhs.v14n3p36

URL: <https://doi.org/10.5539/gjhs.v14n3p36>

Abstract

Background: Directly Observed Treatment short courses programme is the key strategy on national efforts to end the TB disease by 2035. The aim of this study was to explore experiences of health care workers who care for patients receiving treatment under DOTS strategy at public health facilities in Windhoek, Namibia.

Methods: A qualitative explorative, descriptive research design was employed and a purposive sampling considering diversity was used to select participants who met the inclusion criteria for the study. A semi-structured interview guide was used to collect data. The study was conducted in the Windhoek district of the Khomas region, with a sample of 14 health care workers. Data was analysed by means of content analysis, a process of organizing and integrating narrative, qualitative data according to emerging themes and concepts.

Results: One theme emerged from data, which is the experiences of health care workers when attending to patients on DOTS. Participants shared their experiences on DOTS services and as result, shortage of staff, movements of patients from residential address, alcohol abuse and lack of enough food was repeatedly viewed as a barrier to DOTS services.

Conclusion: To achieve the goal of reduction of TB cases by 95% by 2030, more training on the DOTS is needed for all health care workers.

Keywords: Directly Observed Treatment Short Course (DOTS), Experiences, Health Care Workers, qualitative research, Tuberculosis

1. Introduction and Background

Globally, estimated 10 million people fell ill and 1.5 million people died due to Tuberculosis (TB) in 2020, this makes TB a 13th leading cause of death and the second deadly infectious disease after COVID-19 (WHO, 2021). The largest number of new TB cases occurred in the South-East Asian Region, with 43% of new cases, followed by the African Region, with 25% of new cases and the last is Western Pacific with 18% (Subbaraman, 2020). Despite recent progress in reducing the incidences and mortalities from TB, millions still suffer and die each year. Hence far from reaching global target as agreed at the UN high level meeting on TB (as cited Endjala et al., 2017).

In Sub Saharan Africa (SADC), it is estimated that, five deaths occur every hour due to TB (Falzon & Raviglione, 2016). Namibia which is under SADC region is among the thirty high tuberculosis burden countries in the world, with 700 people estimated to have died as a result of TB in 2018 alone. The highest number was recorded in Khomas region, Namibia (Falzon & Raviglione, 2016). However, according to 2020 TB report, Namibia has experienced a steady decline in the number of TB deaths by 7% from 2019 to 2020 (as cited in Kigozi et al., 2016). Despite the decline of TB deaths in Namibia, more effort is needed as the target is to reduce TB deaths by 95 percent in 2035 (Mathema et al., 2017). Most of these deaths could be prevented with early diagnosis and appropriate treatment (Mathema et al., 2017). One of the key strategies to achieve 95% reduction of TB deaths in the country, is to effectively implement the Directly Observed Treatment Short Course (DOTS) (Noé, 2017). Directly Observed Treatment Short Course is regarded as the best method to ensure full adherence and treatment success as the patient is psychological and morally supported throughout the treatment (Olaru, 2016).

This strategy is cost effective and has resulted in an estimated 10.1 million lives saved in the African region (Olaru, 2016). This strategy features the following five elements: Sustained political commitment to TB control, expressed in terms of adequate human and financial resources access to quality acquired network of sputum smear

microscopy; Standardised short-course chemotherapy for all cases of TB under proper case management conditions, including directly observed treatment; Uninterrupted supply of quality assured anti-TB medicines. Recording and reporting system enabling treatment outcome, assessment of all patients and assessment of overall program performance (Serapelwane, 2016). The focus of this study is on healthcare worker's experiences of DOTS strategy in the Windhoek district, of the Khomas region. This study seeks to explore and to understand the problem in the Khomas Region's low treatment success rate of 83% among new smear-positive cases. The foregoing is still below the WHO's global target of 95% success rate (WHO, 2020). One possible explanation for the above statistics could be attributed to health care workers' inappropriate experiences which could contribute to low treatment and success experienced in the region. Therefore, the purpose of the study is to explore experiences of health care workers, specifically focus on health care workers who deal with TB patients on DOTS at public health facilities in Khomas Region. Such health workers Health care workers get first-hand experiences, as they spend a considerable amount of time with them. This is supported by a study conducted in by Shrestha (2017) on the nurses' roles and experiences with enhancing adherence to tuberculosis treatment among patients. The study indicated that nurses had experienced that most of the patients who were under their care on DOTS had followed well the schedules of their treatment. The study also indicated that indeed these nurses were at the forefront of TB care and that they play a critical role in informing about opportunities and obstacles to patients' adherence to TB treatment (Shrestha, 2017). The study further reveals that nurses' experienced that indiscipline among patients was also described as a reason for defaulting or incorrect treatment. Other study showed that health workers in TB clinic experience difficulties in handling TB patients due to complexity of TB such as Multidrug resistance and fluctuation in economy (Byberg et al., 2019). The patients do not listen to the nurses when they try to teach them about the disease and treatment, then they do not do as they were told (Shrestha, 2017; Serapelwane, 2016). Study done in South India, indicates that, the nurses believed that there was a difference among men and women regarding adherence to treatment as all nurses reported observing better adherence among women than men (Yellappa, 2016). This study also indicates that the experience by participants showed that TB patient with co-morbidity like HIV were struggling to follow the treatment compared to patients who suffered only from TB (Skinner, 2016). Finally, study done by Yusuf, et al. (2015) found that the experience of patients with TB and their care takers is indissolubly linked to their experience with DOTS. It was observed that having TB was not solely an individual patient's problem but, in most cases, a family issue. Some patients were found more vulnerable than others because of the relative level of poverty and social support they possessed.

2. Design and Methods

To explore the in-depth reality of experience of the health care workers who cares for the TB patients on DOT, a qualitative, phenomenological study design was employed to explore lived experiences of health workers on DOTS. This study design helps to describe experiences as they are lived and examines the uniqueness of individual health worker lived situations. In order to ensure credibility and to establish dependability inquiry audit was used, research process and data analysis was reviewed and examined to ensure that the findings are consistent and could be repeated and also the findings were base don participants response.

The population of interest was health care workers who work at TB clinic for not less than 6 months at Primary Health Care (PHC) facilities in Khomas region, Namibia. All PHC facilities in the region were included in the study, namely: Katutura Health Centre, Khomasdal Health Centre, Wanaheda Clinic, Okuryangava Health Centre, Otjomuise Clinic, Donkherhook Clinic, Hakahana Clinic and Robert Mugabe Clinic. Purposive sampling was used, as the researcher established a set of criteria to select participants who have experienced the phenomenon of interest and were able to describe those experiences.

2.1 Procedure and Analysis

A semi-structured interview guide with probing questions was used for data collection. The interviews were focused on the following aspects: Experiences of health care workers regarding DOTS services in the Windhoek district of the Khomas Region and how health workers deal with patients who miss their appointments for the DOTS. Data were collected due to diversity and saturation; hence, fourteen participants were interviewed. Prior to interview an informed consent to participate in the study was given to each participant. Data analysis was done by means of content analysis, a process of organizing and integrating narrative, qualitative data according to emerging themes and concepts. All interviews were transcribed verbatim and data analysis was based on the content of all the transcribed individual semi-structured interviews. Data analysis was adhered to the steps of content analysis (as cited in Leavy, P. 2017). These steps were as follows:

Step 1. Printed out transcripts, gathered notes, documents, or other materials.

Step 2. Read the data repeatedly to get a sense of what it contains.

Step 3. Coded the data. In this case and organised the collected data by categorizing the images and texts; and then labelled the categories with a term.

Step 4. The reviewed of codes and combined them into themes.

Step 5. Advanced the way themes and descriptions were to be represented in the qualitative research.

Step 6. Marked interpretation of the findings.

One document was analysed at a time to determine the prevalence of any underlying information. The verbatim transcriptions from the audio recordings made during the interviews, as well as the notes taken during the same interviews, provided a record of the raw data. The data collected were stored electronically as audio recordings to use as a form of backup. The transcriptions and notes were stored as Microsoft Word files which were protected by a password to ensure security and confidentiality. Data from individual interviews were analysed by means of content analysis, a process of organizing and integrating narrative, qualitative data according to emerging themes and concepts. The following abbreviations were used: Tran = Transcript, Par = Participant and Pg = Page, to be able to identify the origin of the verbatim quotations in the transcripts (page and transcript) as well as the participant's number.

2.2 Ethical Approval

The ethics committees of the Ministry of Health and Social Services (MoHSS), Khomas health Region Directorate and incharge of PHC facilities approved this study. The written informed was shared by the participants prior to data collection. Confidentiality of the participants was protected by the researcher whereby no names and site were recorded or noted down during the interviews, rather a coding system was always used.

3. Findings

3.1 Description of the Participants

The sample consisted of 14 health care workers who were working at Windhoek District Primary Health Care Centres and Clinics of the Khomas region. These health care workers consisted of 2 registered Nurses, 5 enrolled Nurses, 1 health assistant, and 6 community TB field promoters as indicated in Table 1.

Table 1. Demographic information of the Participants

Participant	Gender	Position	Period of allocation
P 1	Female	Enrolled Nurse	2 years
P 2	Male	Health Assistant	5 years
P 3	Female	Enrolled Nurse	1 year
P 4	Female	TB Field Promoter	7 months
P 5	Female	TB Field Promoter	7 Months
P 6	Female	Enrolled Nurse	1 Year
P 7	Male	Enrolled Nurse	3 Years
P 8	Female	TB Field Promoter	10 year
P 9	Female	TB Field Promoter	6 Months
P 10	Female	TB field Promoter	9 Months
P 11	Female	Registered Nurse	4 Years
P 12	Female	Enrolled Nurse	6 Months
P 13	Female	TB Field Promoter	11 Years
P 14	Female	Registered Nurse	5 Years

Participants in the study met the inclusion criteria to participate, which was to be a health care worker for a minimum of 6 months at the DOTS point. However, it was found that some participants were not trained on those guidelines or lacked some knowledge about them.

Only, one theme was emerged from the data analysis, that is experiences of health care workers when attending to

the patients on DOTS strategy.

Table 2. Theme and Codes

Theme	Codes
Theme. The experiences of health care workers when attending to patients on the DOTS strategy.	1.1.-Barriers to DOTS support-negative experiences
	1.2.-Health education of difficult patients
	1.3.-Management of workload
	1.4.-Follow up of defaulters
	1.5.-Follow up of defaulters/recommendations
	1.6.-Language preferences
	1.7.-Convenient place for DOTS/ recommendations

Theme. -The experiences of health care workers when attending to patients on DOTS.

Code 1.1.-Barriers to DOTS support-negative experiences

Although some patients are fortunate enough to find good support during their treatment, others are not so lucky. Health care workers expressed that there are some barriers encountered by patients to DOTS support. One of these barriers, which were commonly identified, was too much movement of patients from one location to another and, in most instances, without the patients' informing their health care workers about their intentions to do so.

"The patients' movement in the Khomas region which is just too much even our percentage goes down because the patients are moving too much. It's like there are too many patients and it looks like we are managing them but it's just that a person will be diagnosed in Windhoek but then they go home to another city and won't come back anymore". (Tran 6 Par 6 Pg 7)

Other health workers experienced that; insufficient personnel allocated at DOTS points in the community constituted a barrier. Such lack of personnel provokes that patient have to wait for long periods of time before they can be attended to, discouraging them from going to the clinic for treatment.

"Currently the problem is that patients are a lot and not everyone can come for DOT and sometimes the patients a lost because of that but...maybe more health workers can be there for DOT. Currently there is no point in the locations in the community so everyone comes to the clinic, and not everyone can come to the clinic". (Tran 1 Par 1 Pg 2)

Nurses are particularly affected when there is a shortage of staff in the clinic they work at because, in those occasions, they are expected to help in other services that are also provided at the same clinic, leaving the DOTS point unattended. This situation constitutes a barrier to DOTS because, when patients come to the DOTS point and do not find the nurse there, they go back home thinking that there is no one to help them. This situation discourages the already exhausted patient to come back to the DOTS points to collect the treatment.

"There are difficulties like in this case in our work, it's a bit difficult because you are forever not in the TB room, you are assisting in the clinic doing screenings...so it will be a bit difficult to DOT your patients". (Tran 7 Par 7 Pg 7)

Code 1.2.-Health education of difficult patients.

Health care workers give health education to difficult patients to make them understand the importance of treatment adherence and the daily follow-up to take pills at the DOTS points. Health care workers said that they deal with a lot of patients who are difficult, but they usually make them understand the risks of not taking the medication. They also talk to family members of patients so that they too can help in making sure that the patients finish the course of their treatment.

"Yes, we have a lot of difficult patients, but what we do we go to their houses, and we have TB field promoters who go there. We go there and we give health education, continuous health education we talk to the family and the DOT supporter the family members so that they can understand what the risks are". (Tran 1 Par 1 Pg 3)

Health workers try to understand the patients' reasons as to why they missed some days without coming to take their medication.

“Some of them are saying, “every day coming here, my legs are painning... the tablets are a lot... I cannot take them” but as a field promoter, you have to do health education- ongoing health education so that the patient can understand why he or she has to come every day to take his DOTS”. (Tran 8 Par 8 Pg 3)

Health education remains one of the most important and appropriate basic strategy through which enable people to increase control over, and to improve, their health.

Code 1.3.-Management of workload

Health care workers find some difficulties in managing the DOTS points due to the workload. Whenever there is a shortage of staff, they are expected to help with other duties in the same clinic. In some cases, nurses and TB field promoters have arrangements whereby, when the nurse is busy in the clinic and a patient comes, the TB field promoter goes and calls the nurse to attend to the patient.

“There is always communication between the field promoter and the nurse. Sometimes you make appointments to meet them and discuss about the patients. Otherwise, you can just contact each other through mobile telephones”. (Tran 7 Par 7 Pg 7)

Despite these arrangements between nurses and TB field promoters in managing the workload, some nurses found it tiring to move up and down between the TB room and to the rest of the clinic.

“It is very difficult because you are removed from the room, you left there the patient while you are turning your back going to where you are going to help, there is a patient who is coming in and it irritates the patient when you tell them, please wait for a few minutes in about 30 minutes. That 30 minutes might turn into an hour or one and a half hours. You go back when you finish, help the patient and when you go back to help again another patient comes. It's very difficult”. (Tran 11 Par 11 Pg 4)

Code 1.4.-Follow up of defaulters

When a patient does not come to the DOTS points for a certain period, health care workers follow up on them to find out what is the problem with the patient. Health care workers, especially the TB field promoters, go to the physical address of the patient and look for him/her. Sometimes they find them, but not always.

“I have to follow up and go to their house but there are things that are beyond our control. If I go and trace and I go there, I will only find the treatment supporter, but the patient is not there. Sometimes the patient is there, and we talk and try to solve the problem. If the patient is not there I will try to follow up”. (Tran 4 Par 4 Pg 7)

Health workers also try to phone their patients, but some of them do not answer if they recognize that the number calling might be from the health care worker at the DOTS point.

“For the defaulter it's difficult because sometimes when you go to the house, you find the house is closed and you try also the number like if he defaulted, when he sees that number is calling, he can even not pick up the phone”. (Tran 13 Par 13 Pg 6)

Code 1.5.-Follow up of defaulters/recommendation

To improve the treatment outcome of TB in the Windhoek district of the Khomas Region, health care workers involved on the treatment of TB patients need to put in extra efforts to make this journey as normal as possible, so that patients feel comfortable and free to express themselves on issues that affect their adherence to treatment. The following are some of the recommendations that health care workers made on what they think could assist in keeping patients on treatment without interruptions.

“Know your patients also. if you do not know your patients a patient can be lost to follow up and you will not even notice because you don't know them. So you should know very well your patients, know when they are supposed to come and record keeping is also very important”. (Tran 1 Par 1 Pg 5)

Health care workers also emphasised their recommendations on recognizing early enough that the patient did not come to take treatment, and not to wait until they become defaulters.

“If they don't come today and tomorrow, then I have to start to react today. I have to wonder, what happened to my patient, why is this person not coming? It is possible to know where this patient is staying because I can even take tablets to the person and even find out why this person did not come and drink these tablets”. (Tran 8 Par 8 Pg 6)

The Ministry describes a TB patient who did not start treatment or whose treatment was interrupted for 2 consecutive months or more as “lost to follow up” (previously known as “defaulters”). To minimise the default rate in the district, all health care workers involved in the care of TB patients need to be alert in recognizing patient who did not come after a few days, and not wait until a patient becomes defaulter as indicated in reporting system for

Tuberculosis (WHO, 2016).

Code 1.6.-Language preferences

On their daily engagement with patients on DOTS, health care workers experienced that some patients prefer being spoken to in their mother languages for them to better understand what is being explained to them.

“Previously before I come in there was Mr...and he was Herero speaking, sometimes patients prefer him because of the language issue so that they can talk in Otjiherero”. (Tran 1 Par 1 Pg 5)

“Most of the time, we focus on too much on health education, sometimes we are giving health education to someone who cannot understand the language. And then also, you must be very much smart on that. So, if you see that there is patient who is not very good in that language, you have to look for someone related to that person to come, or who knows that language”. (Tran 2 Par 2 Pg 6)

Namibia is a multicultural country with different ethnic groups, each of them speaking their own mother language. On many occasions, health care workers treat patients who do not understand the official language and who might not speak same mother language. This creates a barrier in communication. In this situation, the best solution is to find someone to translate the information which is being conveyed to the patient and vice versa.

Code 1.7.-Convenient place for DOTS / recommendation.

Health care workers expressed their views on the convenient place for the patients to receive treatment under DOTS. For patients to successfully complete their treatment and be cured, some health care workers prefer that DOTS should be given at the clinic.

“Like, for the successfully cured, I want my patient to take the medication here, so I can observe when they are drinking because if I give them to take home, I don't know if they are really swallowing it. They just say they are swallowing but they didn't. Especially those who are staying alone”. (Tran 5 Par 5 Pg 5)

Other health care workers think that the convenience of DOTS should be in the community because community leaders can work together with the health workers who are at those DOTS points.

“Sometimes it's convenient in the community. We can have the community leaders. The community leaders work together with us because as a community leader he knows that this patient of mine is taking TB treatment so I can even take the responsibility of my community TB patient so that we cannot have a lot of TB spreading in our community”. (Tran 8 Par 8 Pg 9)

It is recommending that DOTS be provided at health facilities that are situated conveniently close to the patient's home or on his way to work. The patient takes the medicines every day under observation by the health care worker, except on weekends when the patient will take his/her anti-TB medicines at home. Other options to DOTS are community-based DOT, workplace DOT, guardian-based DOT, and community health worker-assisted DOT (United States Agency for International Development 2016).

The study found that, participants shared their experiences on DOTS services and as result, shortage of staff, movements of patients from residential address, alcohol abuse and lack of enough food was repeatedly viewed as a barrier to DOTS services.

4. Discussion

The findings of the study revealed that patients in Windhoek were very mobile. This means that patients changed home addresses very often according to the availability of work opportunities. This was reported as one of the reasons why patients were defaulting treatment at one particular DOTS point, since they did not inform their health care workers in advance that they were moving out of that area. This finding is supported by the study done in Papua Province in Indonesia, which indicates that moving residence is one of the factors contribute to poor DOTS adherence (Ruru et al., 2018). This gives the impression that patients are defaulting while, in reality they are taking their medications at another DOTS point, near to their new residential place. Also, it was found that health care workers experience difficulties in rendering good services to patients due to shortage of staff. This finding is supported by a study conducted in the Northwest Province, South Africa, by Serapelwane (2016). In that study, it was found that the shortage of staff was a major barrier to DOTS, due to the increase in workloads. Therefore, health workers had difficulties in executing their daily tasks in managing the health services for TB patients (Serapelwane, 2016). This situation increased the level of stress on the health care workers, which consequently resulted in burnout, with some staff taking decisions to resign. Consequently, this situation may result in poor services rendered to the patients, and it was even worse because there was also an increase in the number of patients who needed the services (WHO, 2017). Staff shortage creates a burden on health care workers hence

patients need to wait a little longer before getting the service. This may frustrate TB patients and compromise adherence as supported in the study done by Skinner and Claassens (2016). It is found that health workers are experiencing some challenges regarding tracing defaulters, which was also mentioned in one study conducted in Ethiopia (Yusuf et al., 2015). Interrupting treatment may lead to drug resistance. Therefore, it is very important that TB field promoters, in collaboration with TB nurses and other health workers, identify those patients who are lost to follow up and establish the barriers for taking the treatment. At this point, the dangers of interrupting treatment, must be explained to the patients and then, together with the DOT supporter, take all the necessary measures to overcome barriers. Working out with the patient and his/her family members or DOT supporter is the best way to avoid interruption of the treatment after the visit (WHO, 2020). At times, when the health care worker needed to give health education and the patient did not understand the language; the health care worker had to arrange for someone to help translate the information that the patient needed to get, the issue of language was also indicated in the study which was conducted in Nepal (Shrestha et al., 2017). The health care workers reported that there are not enough DOTS points located in the communities. Therefore, DOTS points at the clinics are often overcrowded, and that this situation discourages some patients to go for their treatment as they believe that the locations of the DOTS points are far from their homes. Alcohol and lack of food was reported by health care workers as contributing factors for the patients to miss their appointments at the DOTS points because they simply forget about it because of alcohol and they said that, on their experience in working with DOTS, patients who had no food complained that they could not take the pills in an empty stomach as this would make them feel sick. These factors were also mentioned in the study conducted by Zhang, et al 2016. TB field promoters reported that when they trace down patients in the location, these patients tend to be arrogant and sometimes aggressive to them if it is found that the patients had been taking alcohol. The study found that, record keeping is a problem to the TB focal nurse: When the usual nurse is on vacation or off-duty, the relieving health care worker did not keep good records of what he/she had given and done to the patients. This created an impression that patients missed appointments while it was just poor record-keeping on the part of the health care workers.

4.1 Limitation

This study was conducted in one region in Namibia; therefore, the findings cannot be generalized as the true reflection of DOTS health care workers in the country.

5. Conclusion

To achieve the goal of reduction of TB cases by 95% by 2030, holistic approach is needed, this includes training health care workers on the DOTS strategy, improving documentation and public awareness campaign on TB and its treatment.

Competing Interests Statement

The authors declare that there are no competing or potential conflicts of interest.

References

- Adebanjo, O. D., & Malangu, N. (2015). Knowledge and practices about multidrug-resistant tuberculosis amongst healthcare workers in Maseru. *African Journal of Primary Health Care and Family Medicine*, 7(1), 1-5. <https://doi.org/10.4102/phcfm.v7i1.774>
- Byberg, L., Väster, K., Lepp, M., & Rosengren, K. (2019) Nurses' Experiences of Caring for Patients with Tuberculosis - An Interview Study in Indonesia. *Int Arch Nurs Health Care*, 5, 136. doi.org/10.23937/2469-5823/1510136
- Dlwati, L. V., Mavundla, T. R., & Mbengo, F. (2017). Facilitators for and barriers to the implementation of national tuberculosis management guidelines. *Africa Journal of Nursing and Midwifery*, 19(3), 20-pages. <https://doi.org/10.25159/2520-5293/2862>
- Endjala, T., Mohamed, S., & Ashipala, D. O. (2017). Factors that contribute to treatment defaulting amongst tuberculosis patients in Windhoek District, Namibia. *Clinical Nursing Studies*, 5(4), 12. <https://doi.org/10.5430/cns.v5n4p12>
- Falzon, D., & Raviglione, M. (2016). The Internet of Things to come: digital technologies and the End TB Strategy. *BMJ global health*, 1(2), e000038. <https://doi.org/10.1136/bmjgh-2016-000038>
- Kigozi, G., Heunis, C., Chikobvu, P., Botha, S., & Van Rensburg, D. (2017). Factors influencing treatment default among tuberculosis patients in a high burden province of South Africa. *International Journal of Infectious Diseases*, 54, 95-102. <https://doi.org/10.1016/j.ijid.2016.11.407>

- Leavy, P. (2017). *Research design: Quantitative, qualitative, mixed methods, arts-based, and community-based participatory research approaches*. New York: The Guilford Press.
- Mathema, B., Andrews, J. R., Cohen, T., Borgdorff, M. W., Behr, M., Glynn, J. R., ... & Wood, R. (2017). Drivers of tuberculosis transmission. *The Journal of infectious diseases*, 216(suppl_6), S644-S653. <https://doi.org/10.1093/infdis/jix354>
- Noé, A., Ribeiro, R. M., Anselmo, R., Maixenchs, M., Sitole, L., Munguambe, K., ... & García-Basteiro, A. L. (2017). Knowledge, attitudes and practices regarding tuberculosis care among health workers in Southern Mozambique. *BMC pulmonary medicine*, 17(1), 1-7. <https://doi.org/10.1186/s12890-016-0344-8>
- Olaru, I. D., Lange, C., Indra, A., Meidlinger, L., Huhulescu, S., & Rumetshofer, R. (2016). High rates of treatment success in pulmonary multidrug-resistant tuberculosis by individually tailored treatment regimens. *Annals of the American Thoracic Society*, 13(8), 1271-1278. <https://doi.org/10.1513/AnnalsATS.201512-845OC>
- Polit, D. F., & Beck, C. T. (2008). *Nursing research: Generating and assessing evidence for nursing practice*. Lippincott Williams & Wilkins.
- Republic of Namibia Ministry of Health and Social Services. (2010). *National Strategic Plan on Tuberculosis (TB). Medium-Term Plan II (MTP-II): 2010-2015*. Windhoek.
- Ruru, Y., Matasik, M., Oktavian, A., Senyorita, R., Mirino, Y., Tarigan, L. H., ... & Alisjahbana, B. (2018). Factors associated with non-adherence during tuberculosis treatment among patients treated with DOTS strategy in Jayapura, Papua Province, Indonesia. *Global health action*, 11(1), 1510592. <https://doi.org/10.1080/16549716.2018.1510592>
- Serapelwane, M. G., Davhana-Maselesele, M., & Masilo, G. M. (2016). Experiences of patients having tuberculosis (TB) regarding the use of directly observed treatment short-course (DOTS) in the North West Province, South Africa. *Curationis*, 39(1), 1-9. <https://doi.org/10.4102/curationis.v39i1.1629>
- Shrestha, A., Bhattarai, D., Thapa, B., Basel, P., & Wagle, R. R. (2017). Health care workers' knowledge, attitudes and practices on tuberculosis infection control, Nepal. *BMC infectious diseases*, 17(1), 1-7. <https://doi.org/10.1186/s12879-017-2828-4>
- Skinner, D., & Claassens, M. (2016). It's complicated: why do tuberculosis patients not initiate or stay adherent to treatment? A qualitative study from South Africa. *BMC infectious diseases*, 16(1), 1-9. <https://doi.org/10.1186/s12879-016-2054-5>
- South Africa National Aids Council. (2016). *South African HIV and TB Investment Case Summary Report Phase 1*. March 2016. Pretoria: South Africa National Aids Council.
- Subbaraman, R., Jhaveri, T., & Nathavitharana, R. R. (2020). Closing gaps in the tuberculosis care cascade: an action-oriented research agenda. *Journal of clinical tuberculosis and other mycobacterial diseases*, 19, 100144. <https://doi.org/10.1016/j.jctube.2020.100144>
- United States Agency for International Development. (2016). Committed to End TB. Tuberculosis Report to Congress. Washinton D.C. Retrieved from <https://www.usaid.gov/sites/default/files/documents/1864/USAID-TB-ARTC-2018-508.pdf>
- World Health Organization [WHO]. (2015). *Global Tuberculosis Report*. Geneva. Retrieved from http://apps.who.int/iris/bitstream/10665/191102/1/9789241565059_eng.pdf
- World Health Organization [WHO]. (2016). *Global Tuberculosis Report*. Geneva. Retrieved from <http://apps.who.int/iris/bitstream/10665/250441/1/9789241565394-eng.pdf>
- World Health Organization [WHO]. (2017a). *Global Tuberculosis Report*. Geneva.
- World Health Organization [WHO]. (2017b). *The End TB Strategy. Global strategy and targets for tuberculosis prevention, care, and control.; Geneva*. Retrieved from http://www.who.int/tb/strategy/End_TB_Strategy.pdf?ua=1
- World Health Organization [WHO]. (2021). *Framework for implementing the "End TB Strategy" in the world*. Geneva.
- Yellappa, V., Lefèvre, P., Battaglioli, T., Narayanan, D., & Van der Stuyft, P. (2016). Coping with tuberculosis and directly observed treatment: a qualitative study among patients from South India. *BMC health services research*, 16(1), 1-11. <https://doi.org/10.1186/s12913-016-1545-9>
- Yusuf, K. O., Seifu, M. F., Gelaw, B. K., Gebremariam, E. T., & Mohammed, M. (2015). Non Adherence and its

Contributing Factors to Anti-TB Drug in Children at Adama Referral Hospital, Oromia, Ethiopia. *Global Journal of Medical Research*, 15(2). Retrieved from https://globaljournals.org/GJMR_Volume15/3-Non-Adherence-and-its-Contributing.pdf

Zhang, H., Ehiri, J., Yang, H., Tang, S., & Li, Y. (2016). Impact of community-based DOT on tuberculosis treatment outcomes: a systematic review and meta-analysis. *PloS one*, 11(2), e0147744. <https://doi.org/10.1371/journal.pone.0147744>

Copyrights

Copyright for this article is retained by the author(s), with first publication rights granted to the journal.

This is an open-access article distributed under the terms and conditions of the Creative Commons Attribution license (<http://creativecommons.org/licenses/by/4.0/>).

Level of Sexual Health Knowledge and One-Night Stand Relationships among University Students

Shayesteh Jahanfar Ph.D.¹ & Zahra Fazli Khalaf Ph.D.²

¹ Department of Public Health & Community Medicine, Tufts University School of Medicine, 136 Harrison Ave, Boston, MA 02111, USA

² Department of Psychology, North Carolina A&T State University, 1601 E Market St, Greensboro, NC 27411, USA

Correspondence: Zahra Fazli Khalaf, Department of Psychology, North Carolina A&T State University, 1601 E Market St, Greensboro, NC 27411, USA. E-mail: zfazlikhalaf@ncat.edu

Received: December 18, 2021 Accepted: January 31, 2022 Online Published: February 15, 2022

doi:10.5539/gjhs.v14n3p45

URL: <https://doi.org/10.5539/gjhs.v14n3p45>

Abstract

Knowledge of sexual and reproductive health is believed to improve healthy sexual attitudes and behaviors, and decrease sexual risk-taking behaviors. Casual sexual relationships, such as one-night stand relationships, have become pervasive practices among heterosexual college students in the United States, despite imposing negative consequences on individuals' sexual and reproductive health outcomes. This study employed a cross-sectional method to explore the relationship between the knowledge of sexual and reproductive health and a belief in one-night stand relationships among 804 university students in the United States. Participants answered a questionnaire from the World Health Organization, administered through Qualtrics software. Descriptive statistics, bivariate analysis, and logistic regression analyses were performed. Significant findings were reported by unadjusted and adjusted odds ratios with 95% CI. The findings of this research showed that there was a positive relationship between the level of knowledge and a belief in a one-night stand relationship. The findings also showed that male students are more likely to report a belief in one-night stand relationships compared to female students. In addition, a large number of students did not receive information about condom use, and there was a significant negative correlation between being religious and a belief in one-night stands. This study offers insight into the inadequacy of sexual health knowledge among university students. It also suggests that gender-specific knowledge should be a necessary part of the sexual and reproductive health education programs. Clinical and public health implications are discussed.

Keywords: sexual health, sex education, one-night stand relationship, university students

1. Introduction

Sexual health encompasses the rights of all individuals to access the knowledge and have the opportunity to enjoy "a safe and threat-free sexual life" (WHO, 2010). The sexual health of young people has been a significant public health issue due to the increased rates of Sexually Transmitted Diseases (STDs) among this population (Katavić et al., 2020; Tsevat et al., 2017). According to the report by the Centers for Disease Control and Prevention (CDC) in 2018, adolescents aged 15–19 years and young adults aged 20–24 years are at higher risk of acquiring STDs. The report indicated that men and women aged 20–24 years had the highest rate of Chlamydia and Gonorrhea cases compared with other age groups, with 50% of new infections occurring within these populations (Habel et al., 2018; CDC, 2018). The age group of 20–24 years old comprises the majority of college students, which have been identified as a high-risk population with an increased prevalence of sexual risk-taking behaviors (Habel et al., 2018; Katavić et al., 2020).

Casual sexual relationships, such as one-night stands and hookups, have become pervasive practices among heterosexual college students in the United States, despite inherent physical, emotional, and social consequences on individuals' lives (Garcia & Reiber, 2008; Gray et al., 2019; Napper et al., 2016). A one-night stand is a single sexual encounter in which the participants do not expect further relationships. It is defined as "sexual activity without emotional commitment or future involvement" (Turner, 2009). Studies on casual sexual relationships have

raised concerns that sex with casual partners may lead to a higher risk of STDs (Ann Lyons, 2017; Kuperberg & Padgett, 2017; Lu et al., 2009) and have a detrimental effect on the mental health of young adults (Christianson et al., 2003; Townsend & Wasserman, 2011). A survey on 'sex differences in emotional reactions in sexual hookups among college students' reported that, when women engaged in casual sexual relations, they expressed worry and vulnerability, and "the more significant number of partners was associated with increased worry-vulnerability felt by women" (Townsend & Wasserman, 2011). Another research on chlamydia trachomatis (CT) infected youth with the experience of one-night stand relationships reported an "uneven distribution of responsibility concerning condoms". Males expected females to be "condom promoters"; and "by catching CT infection, females experienced guilt while males felt content through knowing the source of contamination" (Christianson et al., 2003). Most of the studies show a persistent gender difference in casual sexual experience, with men reporting more positive responses compared to women (Piemonte et al., 2019). Although casual sex is usually considered as a harm-producing practice, there are some reports that highlighted the positive reactions following casual sex in both men and women, including improved confidence and self-knowledge, sexual satisfaction, and better social and academic engagement (Owen & Fincham, 2011; Owen et al., 2015). However, most research on the mental health consequences of casual sex has reported links between casual sex and decreased wellbeing, especially among women (Vrangalova, 2015).

Knowledge of sexual and reproductive health has a strong positive relationship with improved sexual health attitudes and behaviors, such as increased use of condoms and contraceptives, and decreased risky sexual behaviors, such as casual sex (Francis et al., 2016; Frost et al., 2012; WHO, 2010). Young people choose different sources of sexual health knowledge, such as peers, school teachers, the internet, social networks, and healthcare professionals. Communication between parents and young people on sexual health issues rarely occurs, and if it does, it mostly consists of strict warnings to prevent unhealthy sexual behaviors (Faludi & Rada, 2019). The research highlighted that sexual health education programs must emphasize the communication about condom use in HIV/STD prevention, which is an important element of sexual health knowledge that affects the attitudes about risky sexual encounters (Widman et al., 2014). Overall, sexual health education programs have a significant impact on improving safer sexual attitudes and behaviours (Breuner & Mattson, 2016; Evans et al., 2020; et al., 2007; WHO, 2010). However, young people still report engaging in significantly risky behaviors with a person not well known, despite having knowledge about risk factors (Hoehn et al., 2016; Jadack et al., 1995).

To shed light on how sexual health knowledge associates with young people's belief in casual sexual relationships, we studied the association between social-demographic characteristics, sources of knowledge, and level of knowledge with belief in one-night stand sexual relationship among a group of young adult college students.

2. Method

This research adopted a cross-sectional quantitative method. The sample comprised of 804 university students recruited through random sampling. For a random sampling, the list of students enrolled at the university was used as a framework. A population of 27,000 students registered at the university in on-campus and online courses. Health students were excluded from this study because they have prior knowledge on health concepts, and their responses might have diluted the study results. "The required sample size through a computerized sampling technique was 379 participants, according to Rao soft software, based on the University student population" To account for an expected 20% nonresponse rate among participants, the sample size was adjusted to 474 students using the formulae $N = n / (1 - q)$, in which N is the adjusted sample size (474), n is the calculated sample size (379), and q is the expected percentage of nonresponse among students. The power calculation at the end of the study recruitment was conducted to ensure the sufficiency of the sample for this analysis based on the study objective. According to an online calculator from Power and Sample Size.com, the power and alpha for this study were 0.90 and 0.001, respectively" (Ankomah et al., 2021)

2.1 Data Collection and Measures

The study instrument was an adapted World Health Organization self-administered questionnaire. This instrument consists of the following questions:

Sociodemographic questions

"What is your gender?", "What is your educational level?", "Are you currently working?", "What is your monthly income?", "What is your religion?"

In addition, relationship status was inquired via several questions listed in Table 1. The total level of knowledge included knowledge on contraception, STD/HIV, and knowledge of condom use. These sections correspond to sections 11, 7, and 9 of the WHO questionnaire.

2.2 Data Analysis

Data was collected using a social demographic questionnaire and a standard WHO questionnaire for Sexual and Reproductive Health Knowledge of young people. Statistical analysis of this data was done using IBM SPSS Statistics, version 26.0, released in 2019 (IBM Corp., Armonk, NY, USA). Descriptive analysis, bivariate, and linear regression were performed to analyze the data. Logistic regression analysis was conducted to find the predictive relationship between the relationship between social-demographic characteristics, sources of knowledge (family or health professionals), and level of knowledge with belief in one-night stand sexual attitude. The results are presented as odds ratio (OR) and 95% confidence intervals (CI).

2.3 Ethical Considerations

“The protocol of the study was approved by the Ethics committee of the Institutional Review Board (IRB: 1031916-4). We first sent an email to participants. In that invitation letter, the purpose of the study was explained. Students were asked to spend 20 minutes to fill up the questionnaire. Students were assured that the data would be confidential as no identification was collected from the students. The risk and benefits of participation in the study were explained to the participants. General publications and reports coming out of this study were sent to students for general education purposes. Students who participate in the study were eligible to receive a coupon for Pizza. Students were free to refuse participation or discontinuation of the study at any time point. They could also report any insensitivity in handling the research by researchers to the IRB committee” (Jahanfar et al., 2021).

3. Results

The social-demographic findings of this research have been shown in Table 1. The majority of the participants were female (68.8%), undergraduate students (68.2%), and identified as being religious (60.7%) and single (95.4%). The total score of sexual and reproductive health knowledge was 31.31 ± 3.11 . Table 2 shows the bivariate analysis of the relationship between social-demographic characteristics, sources of knowledge (family or health professionals), and level of knowledge with belief in one-night stand sexual attitude. The findings of this research showed that there was a significant positive correlation between the level of knowledge and belief in one-night stand relationships. Table 3 shows the regression analysis of the relationship between social-demographic characteristics, sources of knowledge (family or health professionals), and level of knowledge with belief in one-night stand sexual attitude. The adjusted OR for the total score of knowledge was 1.14 (1.04–1.24). This means that students who agreed to the one-night stand had a higher level of knowledge compared to those who did not agree. The effect size was 1.14. This means $1.14 - 1 = 0.14 * 100 \gg$. The odds of the one-night stand were 14% higher among those with a higher level of knowledge.

Similarly, the odds ratio of the one-night stand was 205% times more likely in males compared to females adjusted for all other variables. This indicates that male are more likely to have a belief in one-night stands than female students are. Religion seems to be a protective factor as the odds ratio is 63% lower in those students who had one type of religion compared to those who did not believe in any religion.

Table 1. Sociodemographic characteristics (n=804)

Variables	N (%)
Age (Mean±SD)	23.87±7.56
Gender	
Male	167 (18.1)
Female	636 (68.8)
Education	
Undergraduate	549 (68.2)
Graduate	256(31.8)
Work	
Yes	520(68.8)
No	236(31.2)
Income	
\$1000 or less	721 (78.0)
More than \$1000	203 (22.0)
Are you a religious person?	
Yes	471(60.7)
No	305(39.3)
Relationship status	
Single	601(95.4)
No single	29(4.6)
Discussed sex-matters with family member	
Yes	262(87.6)
No	37(12.4)
Sources of information _Poster	
Yes	195(69.6)
No	85(30.4)
Sources of information _Brochures	
Yes	134(47.9)
No	146(52.1)
Sources of information _talks about condom	
Yes	91(32.4)
No	190(67.6)
Did the doctor or nurse talk to you about: Contraception	
Yes	233(83.2)
No	47(16.8)
Did the doctor or nurse talk to you about: STD/HIV	
Yes	198(71.0)
No	81(29.0)
Did the doctor or nurse talk to you about: Pregnancy	
Yes	186(67.4)
No	90(32.6)
Receive information from doctor of nurse about condom, contraception, pregnancy, and STD/HIV	
Yes	65(23.6)
No	210(76.4)
Total score of knowledge	31.31±3.11

Table 2. Bivariate analysis relationship between social demographic characteristics, sources of knowledge (family or health professionals) and level of knowledge with believe in one-night stand sexual attitude (n=804).

Variables	One-night stand + N (%)	One-night stand - N (%)	P
Age (Mean±SD)	23.31 ±6.49	22.92±6.89	0.14
Gender			
Male	68(76.4)	21(23.6)	0.02
Female	208(63.6)	119(36.4)	
Education			
Undergraduate	102(34.0)	198(66.0)	0.78
Graduate	38(32.5)	79(67.5)	
Work			
Yes	85(32.5)	179(67.5)	0.85
No	47(33.3)	94(66.7)	
Income			
\$1000 or less	73(29.8)	172(70.2)	0.59
More than \$1000	34(34.0)	66(66.0)	
Are you a religious person?			
Yes	108(42.5)	146(57.5)	0.01
No	32(19.6)	131(80.4)	
Relationship status			
Single	112(30.9)	251(69.1)	0.43
No single	5(41.7)	7(58.3)	
Discussed sex-matters with family member			
Yes	12(57.1)	9(42.9)	0.08
No	53(37.6)	88(62.4)	
Receive information from health professional			
Yes	15(23.1)	50(76.9)	0.22
No	66(31.4)	144(68.6)	
Total score of knowledge	31.58±2.99	30.86±3.22	0.05

Table 3. Regression analysis relationship between social demographic characteristics, sources of knowledge (family or health professionals) and level of knowledge with believe in one-night stand sexual attitude (n=804).

Variables	Unadjusted OR 95%CI	Adjusted OR 95%CI
Total score of knowledge	1.07(0.99-1.16)	1.14(1.04-1.24)
Age (Mean±SD)	1.01(0.98-1.04)	1.00(0.96-1.04)
Gender		
Male	1.85(1.08-3.17)	3.05(1.47-6.35)
Female	1	1
Education		
Undergraduate	1.07(0.68-1.69)	-
Graduate	1	
Work		
Yes	1.04(0.67-1.61)	-
No	1	

Income		
\$1000 or less	1.21(0.74-1.99)	-
More than \$1000	1	
Are you a religious person?		
Yes	0.33(0.21-0.52)	0.37(0.22-0.64)
No	1	1
Relationship status		
Single	1.60(0.45-5.15)	-
No single	1	
Discussed sex-matters with family member		
Yes	0.45(0.18-1.14)	-
No	1	
Informed by health professional		
Yes	0.66(0.34-1.25)	-
No	1	

4. Discussion

The results of this research showed that there is a positive relationship between the level of knowledge and a belief in a one-night stand relationship. This indicates that students who agreed to one-night stands had a higher level of knowledge compared to those who did not agree. This seems to be strange, as it is usually believed that the knowledge of sexual health has a positive impact on improving safer sexual practices (Evans et al., 2020; Visalli et al., 2019; WHO, 2010). However, it may speak to the inadequacy of the education they receive, or the positive effect of knowledge of sexual health on motivations in casual sex. Although a review of three decades of research provides evidence for the effectiveness of sexual health education programs (Goldfarb & Lieberman, 2020) research has shown that not all sex education programs provide equally effective knowledge, as the accuracy of content, emphasis, and effectiveness is extensively varied (ACOG, 2016; Visalli et al., 2019). The protective influence of sex education emphasizes the issues of contraception, condom use, and reproductive health outcomes rather than “if or when to have sex” (Lindberg & Maddow-Zimet, 2021). Sexual health education in the United States, which mostly relies on the federally funded “Abstinence-Only Until Marriage (AOUM)” program, has not been effective in reducing sexual risk behaviors, or improving reproductive health outcomes. It has been widely criticized by medical and public health professionals, sexuality educators, and the human rights community because “AOUM withholds information about condoms and contraception, and promotes religious ideologies and gender stereotypes” (Hall, et al., 2016). It lacks a wide range of medically accurate, evidence-based, age-appropriate, and culturally based information that should be provided for students to improve attitudes, skills, and values to make healthy choices (ACOG, 2016; Kirby et al., 2007; et al., 2019). Our findings showed that a large number of respondents did not receive information about condom use, while topics on contraception, STD/HIV, and pregnancy have been discussed by the source of information. Most of the research on HIV and STDs prevention highlights the urgency of emphasizing communication about condom use (Hoehn et al., 2016; Visalli et al., 2019). Communication about condom use is critical for the health of sexually active youth, and sex education without communicating condom use may result in an ineffective outcome.

The findings also showed a significant relationship between gender and belief in a one-night stand relationship, as male students more frequently reported belief in one-night stand relationship compared to female students. The research has persistently reported that men are more likely to engage in risk-taking behaviors, such as one-night stands (Piemonte et al., 2019). A few studies have emphasized the role of masculinity ideology in men’s interest in such practices. For instance, stereotyped masculinity norms regulate men’s sexuality through an emphasis on performing well in one-night stands (Elmerstig et al., 2014), and display of sexual prowess in casual relationships (Chan, 2019). Research has also highlighted the relationship between lower physical self-concept and higher sexual risk-taking among men (Potard et al., 2019). This indicates that it is necessary to include gender-specific knowledge, such as the masculinity norms, in sexual education programs, which is an important factor in promoting the sexual wellbeing of young men.

4.1 Strength and Limitation

The cross-sectional nature of this study makes it susceptible to temporal bias as cause and effect concepts cannot be substantiated. Moreover, there is a possibility of recall bias. We assume that the information bias, resulting from a boosting about sexual activities under peer pressure among students, or shying away from stating the truth about private sex life, are avoided. These are often named as information bias.

The strength of this study was in several facts: Firstly, the sample size was relatively large compared to similar studies. Secondly, we utilized a standard WHO questionnaire which have been used in similar research in other countries. This makes our research comparable to that of others. Unlike some developing countries that had to change the questionnaire dramatically to adjust to the cultural and religious beliefs (Soltani et al., 2017), we used a relatively intact questionnaire with not much change. Using Qualtrics as a platform for this study gave the students ease and comfort to fill up the questionnaire on their own time. Hence, not disturbing their daily routine of study schedule.

4.2 Clinical and Public Health Implications

This study offers insight into the inadequacy of sexual health knowledge in preventing belief in casual sexual behaviors among university students. The positive correlation between the knowledge of sexual health and belief in one-night stand relationships indicates that sexual health education programs should provide specific knowledge about risk-taking behaviors. The major (desired) outcome of sexual health education programs is the prevention of risky sexual behavior. Therefore, specific knowledge about condom use is promoted. Another outcome is the positive correlation between the level of knowledge and a belief in a one-night stand relationship. Hence, a strictly 'technical' extension of the education program with information about risks and vulnerabilities could have adverse effects in terms of boosting this correlation. Therefore, a comprehensive sex education that includes social and emotional consequences (e.g., worry/vulnerability) is highly recommended in order to provide sufficient knowledge of sexual health behaviors. Our findings revealed that although doctors and nurses have discussed the topics of pregnancy, contraceptives, and STD/HIV with students, most of the students did not receive information about condom use. Therefore, a belief in one-night stand relationship with lack of knowledge of condom use may put sexually active youth at a greater risk of sexually transmitted infections. Our findings also confirmed that male students more frequently reported a belief in one-night stand relationships. This finding suggests that sexual health programs should communicate more gender-specific topics in their curriculum in order to improve the adequacy of knowledge in preventing risky sexual behaviors.

4.3 Research Implications

The findings of this cross-sectional study suggest that general sexual health knowledge does not prevent a belief in one-night stand relationships. Therefore, we recommend an in-depth exploration of beliefs about such a risk-taking sexual relationship among university students, and the reasons behind the beliefs about one-night stands through qualitative methods. It is also important to investigate how sexual health knowledge changes or shapes beliefs about one-night stand relationships, and what factors motivate university students to engage in these behaviors. Since our study focused only on the beliefs about one-night stands, we recommend future longitudinal studies to look into the actual engagement in risky sexual behaviors, including one-night stands, among the university students who have received sexual health education.

Competing Interests Statement

The authors declare that there are no competing or potential conflicts of interest.

References

- ACOG. (2016). *Comprehensive Sexuality Education*. Committee opinion: American College of Obstetricians and Gynecologist. Retrieved 15 July, 2020, from <https://www.acog.org/clinical/clinical-guidance/committee-opinion/articles/2016/11/comprehensive-sexuality-education>
- Ankomah, S., Jahanfar, S. & Inungu, J. (2021). A study of sexual health information among Central Michigan University students. *Journal of Public Health, 29*, 913-919. <https://doi.org/10.1007/s10389-020-01192-4>
- Ann Lyons, H. (2017). Heterosexual Casual Sex and STI Diagnosis: A Latent Class Analysis. *International journal of sexual health: official journal of the World Association for Sexual Health, 29*(1), 32-47. <https://doi.org/10.1080/19317611.2016.1210711>
- Burgess, S. (2014). Sample size and power calculations in Mendelian randomization with a single instrumental variable and a binary outcome. *International Journal of Epidemiology, 43*(3), 922-929. <https://doi.org/10.1093/ije/dyu005>

- CDC. (2018). *STDs in Adolescents and Young Adults*. Sexually Transmitted Disease Surveillance 2018. Retrieved from <https://www.cdc.gov/std/stats18/adolescents.htm>
- Chan, L. S. (2019). Paradoxical Associations of Masculine Ideology and Casual Sex Among Heterosexual Male Geosocial Networking App Users in China. *Sex Roles, 81*(7), 456-466. <https://doi.org/10.1007/s11199-019-1002-4>
- Christianson, M., Johansson, E., Emmelin, M., & Westman, G. (2003). "One-night stands" - risky trips between lust and trust: qualitative interviews with Chlamydia trachomatis infected youth in north Sweden. *Scandinavian Journal of Public Health, 31*(1), 44-50. <https://doi.org/10.1080/14034940210134158>
- Elmerstig, E., Wijma, B., Sandell, K., & Berterö, C. (2014). Sexual interaction or a solitary action: young Swedish men's ideal images of sexual situations in relationships and in one-night stands. *Sex Reprod Healthc, 5*(3), 149-155. <https://doi.org/10.1016/j.srhc.2014.06.001>
- Evans, R., Widman, L., Stokes, M., Javidi, H., Hope, E., & Brasileiro, J. (2020). Sexual Health Programs for Latinx Adolescents: A Meta-analysis. *Pediatrics, 146*(1), e20193572. <https://doi.org/10.1542/peds.2019-3572>
- Faludi, C., & Rada, C. (2019). Gender differences in sexual and reproductive health education in the family: a mixed methods study on Romanian young people. *BMC Public Health, 19*(1), 1103. <https://doi.org/10.1186/s12889-019-7321-0>
- Francis, C., Bradley, J., Bass, C., Scipio, K., & Braithwaite, R. (2016). *Black college women sexual health peer education at Clark Atlanta University*. <https://doi.org/10.21633/jgpha.6.2s07>
- Frost, J. J., Lindberg, L. D., & Finer, L. B. (2012). Young Adults' Contraceptive Knowledge, Norms and Attitudes: Associations with Risk of Unintended Pregnancy. *Perspectives on Sexual and Reproductive Health, 44*(2), 107-116. <https://doi.org/10.1363/4410712>
- Garcia, J. R., & Reiber, C. (2008). Hook-up behavior: A biopsychosocial perspective. *Journal of Social, Evolutionary, and Cultural Psychology, 2*(4), 192-208. <https://doi.org/10.1037/h0099345>
- Goldfarb, E. S., & Lieberman, L. D. (2021). Three decades of research: The case for comprehensive sex education. *Journal of Adolescent Health, 68*(1), 13-27. <https://doi.org/10.1016/j.jadohealth.2020.07.036>
- Gray, P. B., Garcia, J. R., & Gesselman, A. N. (2019). Age-related patterns in sexual behaviors and attitudes among single U.S. Adults: An evolutionary approach. *Evolutionary Behavioral Sciences, 13*(2), 111-126. <https://doi.org/10.1037/ebs0000126>
- Habel, M. A., Coor, A., Beltran, O., Becasen, J., Pearson, W. S., & Dittus, P. (2018). The state of sexual health services at U.S. Colleges and Universities. *Journal of American College Health, 66*(4), 259-268. <https://doi.org/10.1080/07448481.2018.1431896>
- Hall, K. S., McDermott Sales, J., Komro, K. A., & Santelli, J. (2016). The State of Sex Education in the United States. *The Journal of adolescent health: official publication of the Society for Adolescent Medicine, 58*(6), 595-597. <https://doi.org/10.1016/j.jadohealth.2016.03.032>
- Hoehn, E. F., FitzGerald, M. R., Bhatt, S. R., Robinson, V. M., Lippe, J. E., & Reed, J. L. (2016). Do Adolescents With Higher Knowledge of HIV Have Lower Sexual Risk Behaviors? *Pediatr Emerg Care, 32*(12), 846-850. <https://doi.org/10.1097/PEC.0000000000000612>
- Jadack, R. A., Hyde, J. S., & Keller, M. L. (1995). Gender and knowledge about HIV, risky sexual behavior, and safer sex practices. *Res Nurs Health, 18*(4), 313-324. <https://doi.org/10.1002/nur.4770180405>
- Jahanfar, S., Abedi, P., & Siahkal, S. F. (2021). Sexual Behavior Prevalence and Its Predictors Among Students in an American University. *Sexuality & Culture, 25*, 1547-1563. <https://doi.org/10.1007/s12119-021-09816-x>
- Katavić, S. S., Martinović, I., & Kim, S. U. (2020). College students' sexual health information needs and source preferences in relation to worry about sexual health outcomes. *Information Research, 25*(1). Retrieved from <http://informationr.net/ir/25-1/paper853.html>Snježana
- Kirby, D. B., Laris, B. A., & Rolleri, L. A. (2007). Sex and HIV education programs: their impact on sexual behaviors of young people throughout the world. *The Journal of adolescent health: official publication of the Society for Adolescent Medicine, 40*(3), 206-217. <https://doi.org/10.1016/j.jadohealth.2006.11.143>
- Kuperberg, A., & Padgett, J. E. (2017). Partner Meeting Contexts and Risky Behavior in College Students' Other-Sex and Same-Sex Hookups. *The Journal of Sex Research, 54*(1), 55-72.

- <https://doi.org/10.1080/00224499.2015.1124378>
- Leung, H., Shek, D. T. L., Leung, E., & Shek, E. Y. W. (2019). Development of Contextually-relevant Sexuality Education: Lessons from a Comprehensive Review of Adolescent Sexuality Education Across Cultures. *International journal of environmental research and public health*, 16(4), 621. <https://doi.org/10.3390/ijerph16040621>
- Lindberg, L. D., & Maddow-Zimet, I. (2021). Consequences of sex education on teen and young adult sexual behaviors and outcomes. *Journal of Adolescent Health*, 51(4), 332-338. <https://doi.org/10.1016/j.jadohealth.2011.12.028>
- Lu, F., Jia, Y., Bin, S., Li, C., Limei, S., Kristensen, S., . . . Vermund, S. H. (2009). Predictors for casual sex and/or infection among sexually transmitted disease clinic attendees in China. *International journal of STD & AIDS*, 20(4), 241-248. <https://doi.org/10.1258/ijsa.2008.008290>
- Miller, M. J. (2019). *US Army Primary Care: Nursing Practice Environment, Team Performance, and Outcomes. Paper presented at the 45th Biennial Convention 2019 Theme: Connect. Collaborate. Catalyze*, Washington, DC, USA.
- Napper, L. E., Montes, K. S., Kenney, S. R., & LaBrie, J. W. (2016). Assessing the Personal Negative Impacts of Hooking Up Experienced by College Students: Gender Differences and Mental Health. *The Journal of Sex Research*, 53(7), 766-775. <https://doi.org/10.1080/00224499.2015.1065951>
- Owen, J., & Fincham, F. D. (2011). Young Adults' Emotional Reactions After Hooking Up Encounters. *Archives of Sexual Behavior*, 40(2), 321-330. <https://doi.org/10.1007/s10508-010-9652-x>
- Owen, J., Fincham, F. D., & Moore, J. (2011). Short-Term Prospective Study of Hooking Up Among College Students. *Archives of Sexual Behavior*, 40(2), 331-341. <https://doi.org/10.1007/s10508-010-9697-x>
- Piemonte, J. L., Conley, T. D., & Gusakova, S. (2019). Orgasm, gender, and responses to heterosexual casual sex. *Personality and Individual Differences*, 151, 109487. <https://doi.org/10.1016/j.paid.2019.06.030>
- Potard, C., Lancelot, C., & Courtois, R. (2019). Examining Relationships Between Sexual Risk-Safety Behaviors and Physical Self-Concept by Gender: A Cluster Analytical Approach. *Emerging Adulthood*, 7(1), 31-44. <https://doi.org/10.1177/2167696817750802>
- Soltani, F., Sattari, M., Parsa, P., & Farhadian, M. (2017). Sources of Adolescents' Information about Sexual and Reproductive Health: Gender Similarities and Differences. *Journal of Pharmaceutical Sciences and Research*, 9(9), 1624-1628.
- Townsend, J. M., & Wasserman, T. H. (2011). Sexual Hookups Among College Students: Sex Differences in Emotional Reactions. *Archives of Sexual Behavior*, 40(6), 1173-1181. <https://doi.org/10.1007/s10508-011-9841-2>
- Tsevat, D. G., Wiesenfeld, H. C., Parks, C., & Peipert, J. F. (2017). Sexually transmitted diseases and infertility. *American Journal of Obstetrics & Gynecology*, 216(1), 1-9. <https://doi.org/10.1016/j.ajog.2016.08.008>
- Turner, J. S. (2009). *American Families in Crisis: A Reference Handbook* (2nd ed.): ABC-CLIO.
- Visalli, G., Cosenza, B., Mazzù, F., Bertuccio, M. P., Spataro, P., Pellicanò, G. F., . . . Facciola, A. (2019). Knowledge of sexually transmitted infections and risky behaviours: a survey among high school and university students. *Journal of preventive medicine and hygiene*, 60(2), E84-E92.
- Vrangalova, Z. (2015). Does Casual Sex Harm College Students' Well-Being? A Longitudinal Investigation of the Role of Motivation. *Archives of Sexual Behavior*, 44(4), 945-959. <https://doi.org/10.1007/s10508-013-0255-1>
- Widman, L., Noar, S. M., Choukas-Bradley, S., & Francis, D. B. (2014). Adolescent sexual health communication and condom use: A meta-analysis. *Health Psychology*, 33(10), 1113-1124. <https://doi.org/10.1037/hea0000112>
- World Health Organization. (2010). *Developing sexual health programmes: a framework for action*. Geneva: World Health Organization.

Copyrights

Copyright for this article is retained by the author(s), with first publication rights granted to the journal.

This is an open-access article distributed under the terms and conditions of the Creative Commons Attribution license (<http://creativecommons.org/licenses/by/4.0/>).

E-Waste and Its Consequence for Environment and Public Health: Perspectives in Covid-19 Pandemic Times

Joselito Nardy Ribeiro¹, Angelo Fernando Melo Barbosa², Araceli Veronica Flores Nardy Ribeiro²,
Madson de Godoi Pereira³, Jairo Pinto de Oliveira¹, Alan Bragança Zordan¹ & André Romero da Silva⁴

¹ Science Health Center, Federal University of Espirito Santo-UFES, Vitoria-ES, Brazil

² Federal Institute of Espirito Santo-IFES, Vila Velha-ES, Brazil

³ Department of Earth Science, University of Bahia State, Salvador-BA, Brazil

⁴ Federal Institute of Espirito Santo-IFES, Aracruz-ES, Brazil

Correspondence: Joselito Nardy Ribeiro, Science Health Center, Federal University of Espirito Santo-UFES, Vitoria-ES, Brazil. E-mail: rinajokrauser@gmail.com

Received: December 26, 2021 Accepted: February 9, 2022 Online Published: February 17, 2022

doi:10.5539/gjhs.v14n3p54

URL: <https://doi.org/10.5539/gjhs.v14n3p54>

Abstract

Every year the electronics industry increases its production and earns billions of dollars. This increase is associated to the growth electronic waste production that, unfortunately, is not followed by the proportional recycling increase. An extensive quantity of e-waste containing several toxic chemical residues, that provoke serious toxic effects for human health, is released in the environment every day. This work it is a mini review about the issue of electronic waste production and its chemical contamination capacity for soil, water, plants, animals, food, and humans. Finally, this mini-review finalize with a small reflection about e-waste in Covid-19's Pandemic times.

Keywords: e-waste, environment, public health, Covid-19

1. Introduction

Despite various governments, industrial sectors, and environmental organizations to report a considerable evolution in the reuse and recycle of electronic waste, the reality is not so exciting. A lot of documentaries from tv and videos channels, besides news sites, books, and scientific articles have been show the negative effects of nonconventional and rudimentary methods to recycle metals from e-waste. These informal activities are considered dangerous because to generate large amounts of residues containing extremely toxic metals and organic chemical pollutants that cause serious health problems and dramatically decrease the life expectancy of the population, mainly around contaminated areas near e-waste (Sthiannopkao, 2013; Bradley, 2014; Lecher, 2019; Bazilian, 2020; Hameed, 2020). This informal subsistence economy is the only source income a lot of populations located in some areas of many countries such as: Ghana (Buzuev, 2015), Nigeria (Nnorom and Osibanjo, 2008), India (Borthakur and Singh, 2012), Pakistan (Iqbal et al., 2017), Philippines, Indonesia, Vietnam (Youshida et al., 2016), Mexico (Cruz-Sotelo et al., 2017), Malaysia (Suja et al., 2014), Hong Kong (Bhattacharya, 2017), and several other parts of the world, mainly in poor and developing countries (Maphosa et al., 2017). In Ethiopia, for example, the high rate of broken cell phones, the accelerated increasing of obsolescence rate, and the demand for new technology are the main causes for the e-waste generation. Commonly storing is the major practiced disposal method as well as recycling and donating. However, Kitila and Woldemikael (2021) demonstrate that absence of efficient recycle and appropriate disposal methods are the main factors for the storage, improper disposal and rudimentary. In other article published in 2019, the same authors reported several problems to treat the electronic waste from educational institutions and government sector offices of Addis Ababa (Kitila and Woldemikael, 2019).

Recent data collected from The Global E-Waste Statistics Partnership Website demonstrate that Ghana situation is not different (Global E-Waste: Ghana, 2019). Interestingly this important website does not reveal the amount of e-waste imported from US, and Europe by Ghana. Perhaps due to the lack of data provided by the local government. However, it should not be difficult to measure the many tons of e-waste discarded in this African country by developed countries. In the e-waste import zone situated in Agbogbloshie, a region localized in the heart of Accra Province, the view it reveals a catastrophic scenario showing various unconventional treatment

points of toxic e-waste containing fume and water probably contaminated by chemical pollutants, beside urban conflicts between pickers, and other social problems (Minter, 2016; Daum et al., 2017; Petricca et al., 2020). The e-waste problem is also a reality in South America. For example, in Paraguay does not exist official data about e-waste produced by Paraguayan population. Data collected from the Global E-Waste Statistics Partnership (Global E-Waste: Paraguay, 2019) provides an idea about the e-waste formally collected. However, it does not reveal the amount of e-waste collected by pickers that living directly of this informal job. So, you ask yourself: what is the fate of this material? It is likely to be delivered to recyclers using unconventional and dangerous methods for metals recuperation. Paraguay does not have a specific law for e-waste. However, in its constitution, there are several items that protect the right to a protected environment and good life quality (ABC, 2006). But in relation to e-waste, data presented in 2014 reveal that in Paraguay, each person produces 4.9 kg of this kind of waste, while in its neighboring country ,Brazil, much more populous, each person produces 7.7 kg. Therefore, the problem of electronic waste in Paraguay cannot be disregarded (Baldé et al., 2014).

In Brazil, Country frontier with Paraguay, recent data collected from The Global E-Waste Statistics Partnership demonstrate that the situation in this Country is worrying. Brazil generated, in 2019, approximately 2143 kt of electronic waste and its formal recycling rate was 0% (Global E-Waste: Brazil, 2019). Considering that in Brazil the consumption of electronic devices, mainly cell phones (Lopes, 2018), is extremely high, the data presented by the Global E-Waste Statistics Partnership are worrying. The rates of formal e-waste collect obtained from the Global E-Waste Statistics Partnership Website (Global E-Waste: Brazil, 2019) allowed the elaboration of the graph presented in Figure 1. Its possible verified that in Latin America, Brazil does not have formal e-waste collect (0%) while Argentina and Chile formally collect around 3%, and Peru and Colombia collect around 1%. However, in some informal meetings with pickers that living in the streets of Vitória-ES (20°19'09' south latitude and 40°20'50' west longitude), Espírito Santo State Capital, we have been informed that a large part of this electronic waste is exploited by conventional and unconventional methods (Figure 2) as a secondary source of valuable metals. Some small companies buy this e-waste for possible recycle or to sell to large companies. However, there are no official data to support this information. The reasons for the lack of this official data are also unknown. We can suggest that for these companies, the unconventional e-waste collect has a lower cost because the e-waste is obtained from pickers that accept low payments to their survive.

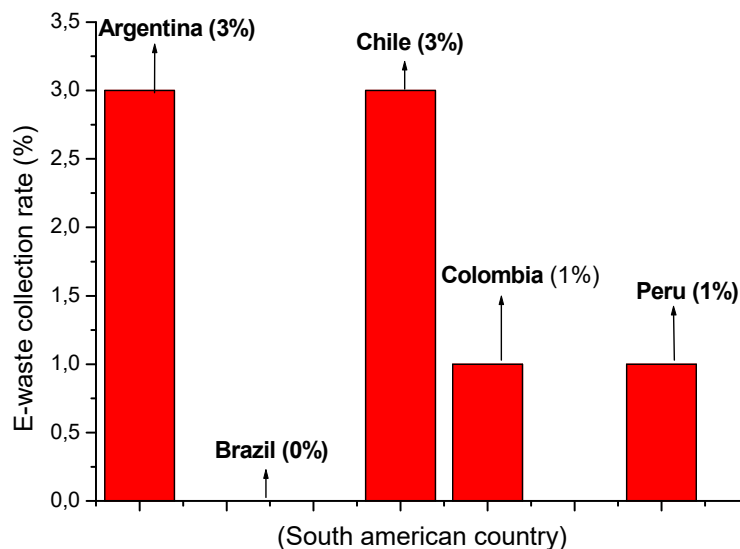


Figure 1. South American countries with formal e-waste collect in comparison with Brazil. (These data were obtained from The Global E-Waste Statistics Partnership, 2019)



Figure 2. Small deposit of e-waste informally collected in Vitoria-ES, Brazil (Photo: Gustavo Malini Barcelos)

In this mini review the problems caused by chemical pollutants due excessive number of electronic devices discharged in environmental in the last times. It is currently verified that the significant amount e-waste occurs because some important factors such as: the planned obsolescence induced by electronic device industries and the incessant search by news technologies that involve avid consumers hypnotized by globalist media. This behavior provokes serious environmental impacts. Do you think that your old cell phone disappears after use time to another spatial dimension? Your discarded cell phone is part of e-waste destined to poor and developing countries. In these places, the e-waste deposits are used for unconventional and rude recycle, to obtain metals of considerable economic value. These methods are responsible by several environmental problems.

2. Objectives

This mini review aims to help clarify the impacts caused by the high e-waste disposal in the environment as well as the harm caused by it in environment and health. In addition, it warns to the increase in disposal caused by the growth consumption during COVID-19 pandemic. Finally, it suggests environmental education as a means of preventing worse damage.

3. Material and Methods

Were used the following data banks to obtain the sources present in this mini review: Portal Capes of Brazilian Government, WebofScience, PubMed, Google Scholar and Brazil's Scielo as well as sources from geography sites, online newspapers, online magazines, and blogs.

In this mini review were use "e-waste" word combinate with following keywords: cell phone", contamination, metals, chemical organic pollutants, disease, water, fume, air, soil, animal, plants, humans, milk, blood, Covid-19, and other.

4. Results and Discussion

4.1 E-Waste Contamination

The Figure 3 represents the consumption dream of many people. But for most of them, the final disposal of these products does not matter.



Figure 3. Cell phone store in a typical mall's Brazilian city (Photo: Angelo Fernando Melo Barbosa)

Do you have knowledge about as your cell phone is discarded in environmental? Do you have knowledge about the chemical composition of your cell phone (Singh et al., 2018) (Figure 4) and its consequence to the environment and public health?

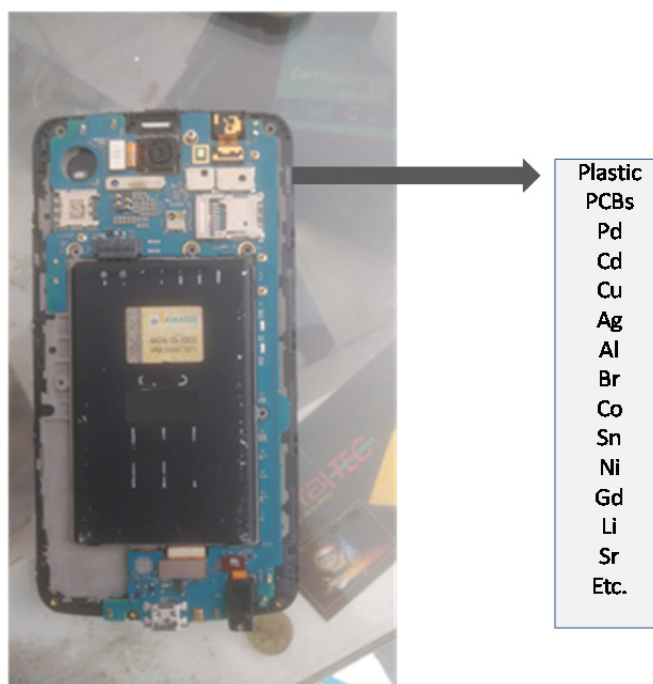


Figure 4. Plastic, polychlorinated biphenyls (PCBs), and metals present in cell phone (Photo: Angelo Fernando Melo Barbosa)

The e-waste presents several metals of economic, strategic, technological interest such as: Fe, Cu, Al, Co, Ni, Sn, Pb, Cd, Zn, and valuable metals (Au, Ag, Pt and Pd), which represent great interest for their economic value (Alsheyab, 2015). However, there are estimated 1000 toxic substances from e-waste that can threaten the living beings and the environment if not properly treated. Toxic metals and organic compounds such as polycyclic aromatic hydrocarbons (PAHs) and polychlorinated biphenyls (PCBs) are the main concerns (Abdelbasir et al., 2018). Utilizing the keywords: "e-waste and pollution" in the Brazilian Government Data Bank's scientific articles (Capes, 2000), between year's 2010 to 2020, was possible to determine the evolution number of scientific articles published in the world about environmental contamination by e-waste (Figure 5) and recycling (Figure 6).

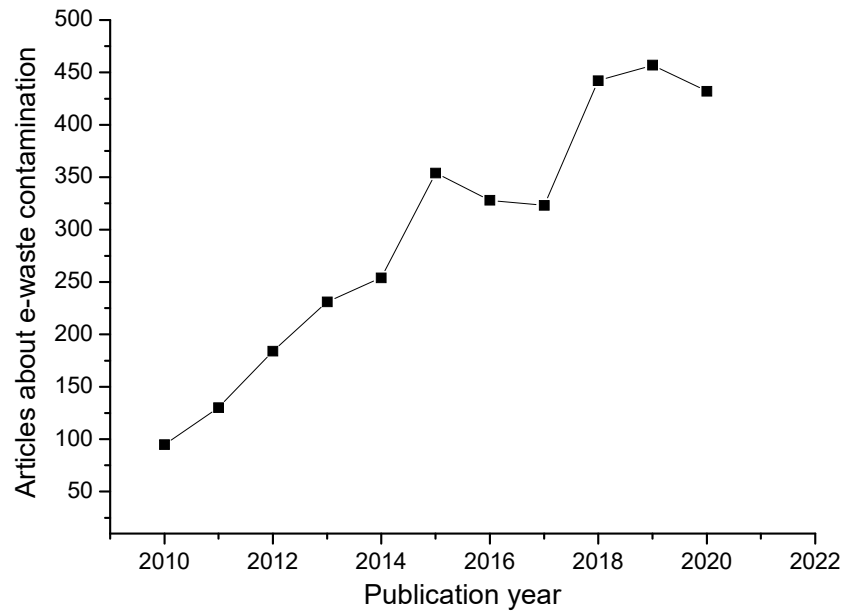


Figure 5. Number of articles about e-waste environmental contamination between year’s 2010 and 2020. These data were obtained from Brazilian Government Data Bank for scientific publications, between year’s 2010 to 2020 (Capes, 2000)

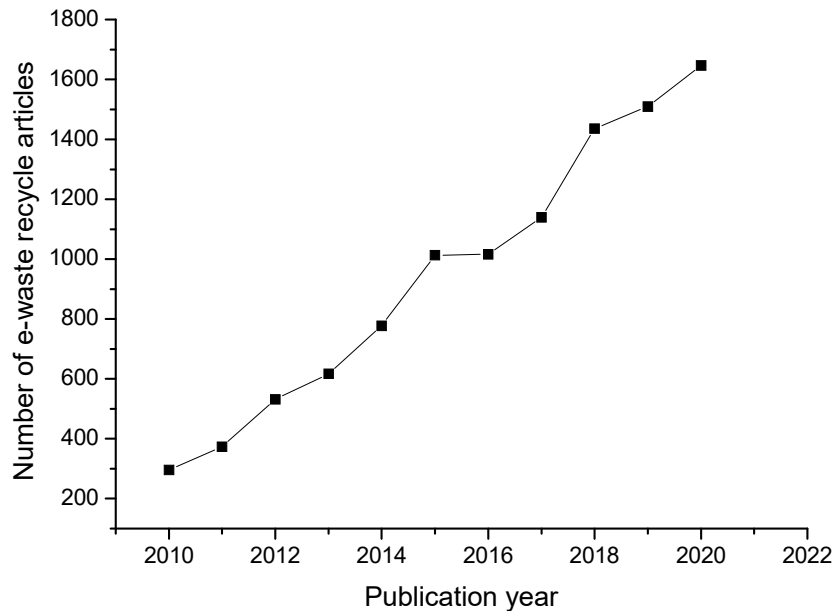


Figure 6. Number of articles about e-waste recycle between year’s 2010 and 2020. These data were obtained from Brazilian Government Data Bank for scientific publications, between year’s 2010 to 2020 (Capes, 2000)

The articles about contamination really represents the presence of e-waste chemical pollutants in the water (Wu et al., 2015), soil (Quan et al., 2015), plants (Wang et al., 2012), animals (Wu et al., 2016), and humans (Asante et al., 2012) near recycling areas (Figure 5). The articles about recycling (Figure 6) represents not only formal recycle, but mainly unconventional and dangerous recycle methods for environment.

In the following pages we present the chemical contamination of environment and humans caused by the simple presence of e-waste in the environment, and by rude and nonconventional recycling. Utilizing Brazilian Government Search Site Capes (Capes, 2000), it was possible determine the approximate number of different kinds of contaminated samples by e-waste last twenty years (Figure 7). These data were obtained using keywords combinations such as: e-waste/soil, e-waste/river, e-waste/food, e-waste/animal, e-waste/vegetables, e-waste/humans, and others. This search reveal that water (water place + river + lake), soil, food, and humans are the most affected by e-waste.

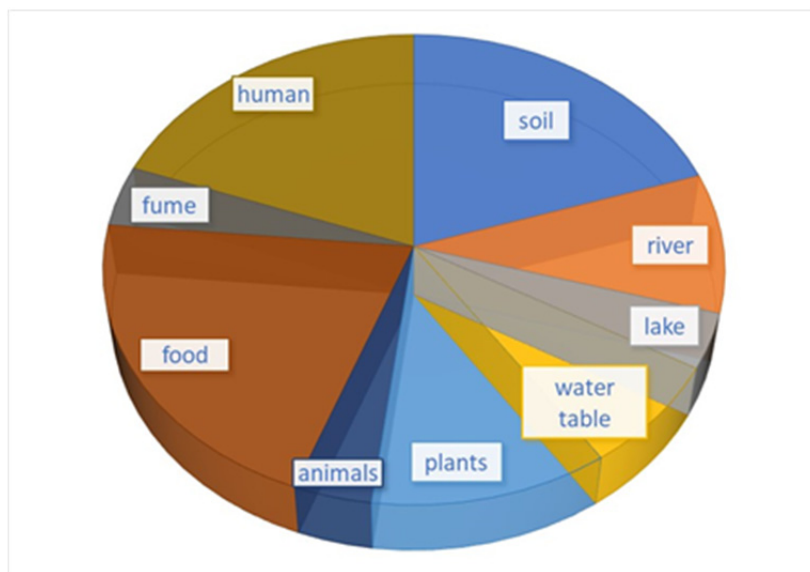


Figure 7. Different environmental samples contaminated by chemical pollutants from e-waste. These data were obtained from Brazilian Government Data Bank for scientific publications, between year's 2010 to 2020 (Capes, 2000)

4.1.1 Soil

China and U.S.A are the largest responsible by e-waste production of the world (Tiseo, 2021). However, some procedures for diminish the environment impact have been adopted. In China, for example, pollution control policies have been implemented since 2012. These policies diminished Pb present in the soil, but the high concentrations of Cd, Ni, Cu, and Zn weren't impacted. The soil contamination in different locals of China occurs not only by activity of large recycling industries, but mainly by small e-waste dismantling workshops where the more rigorous pollution control would need. In these local cancer diseases occurrence increased, demonstrating that policies of pollution control need be more effective (Yang et al., 2020). In a study performed in some e-waste areas of Qingyuan (Guangdong Province, China), Chinese researchers detected largest metals concentrations in e-waste sites with active recycle than abandoned e-waste sites. The rude techniques to e-waste recycle utilizing, for example, acid lixiviation, cause increases in Pb, Cd, Cu, and Sb concentrations in the soil. This kind of recycle activity represents serious risks for public health (Ádám et al., 2021).

In other Chinese study was evaluates total concentrations of some metals on surface, middle, and deep soils. The samples were collected from recycle areas of Guyu near a paddy field. The results of analyses showed that areas utilizing acid-leaching were severely contaminated by Ni, Cu, Zn, Cd, Sn, Sb, and Pb. Was demonstrate that contamination occur especially on surfaces soils (Quan et al., 2015).

Recently, Thailand's researchers evaluated soil samples collected from five places e-waste recycling, and five place without recycling. All places studied are localized in the Buriram region, a Thailand's Province. The sample soils were analyzed for the toxic metal's contents utilizing an atomic absorption spectrophotometer. The results showed environmental risks and public health problems can be possible in this local. The toxic metals presence was mainly attributed to the high levels of Cu, As, Cd, and Pb for the surface and subsurface soils. The concentrations of these chemical elements were higher in places e-waste recycling than no recycling places (Amphalop et al., 2020). The presence of this kind pollutant in environment is extremely dangerous because of the different disease resulting from toxic metals human exposure (Leston et al., 2010; Zeng et al., 2016; Waalkes,

2020).

In a study realized at Chemistry's Department of Ambo University, Ethiopian researchers revealed surface dusts from electronic and electrical material maintenance workshops may to provoke chemical environmental contamination by toxic metals. In this study, surface dust samples were collected from electronic and electrical device maintenance workshops located in Ambo, Gedo, and Nekemte in Ethiopia. Results from analysis, utilizing the atomic absorption spectroscopy, revealed the presence of significant amount of Pb on surface dust samples (Getwachew et al., 2019). This study can be an alert for local population and health authorities. The danger is real and policies for diminish the dust from e-waste need to be immediately adopted.

In another study carried out in India, soil and dust samples were collected from e-waste recycling sectors in Chandigarh and Ludhiana (Punjab Province). The results obtained, through coupled plasma-optical emission spectrometer (ICP-OES), revealed high concentration of Ba, Cu, Pb, and Zn in both sample (Singh et al., 2018).

Japanese and Vietnamese researchers collected garden's soil and floor dust samples from five households that living in an e-waste-processing area from village of Bui Dau (Hung Yen Province, Vietnam). Using an inductively coupled plasma mass spectrometer (ICP-MS), they estimated that garden soil and floor dust can be the main responsible to daily Pb intake by these households. These results were published in 2018 (Oguri et al., 2018).

In addition to regions in China, Ethiopia, India, Vietnam, and Thailand, Accra, in Ghana, is among the areas that has the biggest e-waste in the world. Tons of e-waste from United States and Europe are release in this African country. Approximately 200,000 people live daily with fume, water, soil, animals, and plants contaminated by chemical pollutants. The massive presence of the e-waste in Ghana is a classic example of the lack of human empathy. It is an example of the total lack of awareness about the planet we live on. It is a classic example in which thousands of innocents pay for the consuming and greedy habits of others (Daum et al., 2017). That's why investigations of several researchers are so important to alert the people and provide arguments for governments to adopt strict measures in activities involving e-waste. Therefore, several studies have been carried out using different types of samples from Ghana (Daum et al., 2017). For example, some Ghanaian researchers, from Institute for Environment and Sanitation Studies of Ghana's University, verified that soil and vegetation samples from Korle Lagoon area in Accra was contaminated with high metals concentrations, mainly soils samples near dumps containing e-waste. The Soil analysis showed that the Pb, Cd, and Cu concentrations exceeded their WHO/FAO thresholds for agricultural soils (Fosu-Mensah et al., 2017). These metals can contaminate water, animal, and vegetation. Photos present in the Environmental Justice Atlas show domestic animals drinking water and feeding in the e-waste area from Accra (Lepawsky and Akese 2015). Previously, in another study, soil/ash mixtures samples from Agbogbloshie e-waste recycling area in Accra, Ghana, were analyzed to verify the metals variation and distribution. Using an analytical methodology including a portable X-ray fluorescence spectrometer, researchers make it that human exposure to Pb, Cu, As, and other metals is significant. According to these authors, the soil contamination is provoked mainly by ash from burning e-wastes (Itai et al., 2013).

However, not only metals are the responsible for soil contamination around e-waste (Abdelbasir et al., 2018). In a recent study, German and Nigerian researchers demonstrate that soil samples collected from Abuja's dumpsites in Nigeria, containing e-waste, are contaminated by polybrominated diphenyl ethers (PBDEs). In addition, PBDEs were found in samples such as: chicken eggs, bentgrass, spinach, tomatoes, pumpkin, and sweet potatoes (Oloruntoa et al., 2021). These compounds are utilized in electronic devices and other products as flame retardant.

In another investigation, PBDEs and Octa brominated diphenyl ether-79 (OctaBDE-79) were analyzed in sample soils from areas where waste electrical and electronic equipment plastics have been dumped and dismantled, over a long period, at different locations of Benin, Edo State, Nigeria. These soil sample were analyzed by gas chromatography-mass spectrometry (GC-MS). The results revealed that PBDEs concentration were no expressive, but OctaBDE-79 concentration was significant (Edene et al., 2020). PBDEs and its derivatives are known by its high toxicity (Viberg et al., 2006; Kaihan et al., 2020). Decabromodiphenyl ether (BDE-209), for example, can be provoke the negative effects such as: thyroid hormone disruption, neurobehavioral toxicity, and cancer (Li et al., 2014). BDE-209 and other toxic organic compounds were found in samples soil collected from four e-waste sites localized in Karachi City in the Pakistan (Iqbal et al., 2017).

Figures 8, 9 and 10 summarize research involving soils contaminated by pollutants generated by e-waste as well as their potential to contaminate humans.

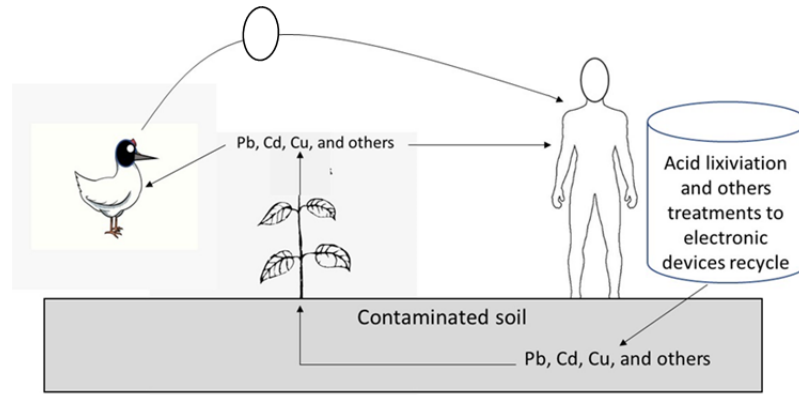


Figure 8. Chemical contamination of soil, plants, animals, eggs, and humans by rude activities to electronic devices recycle

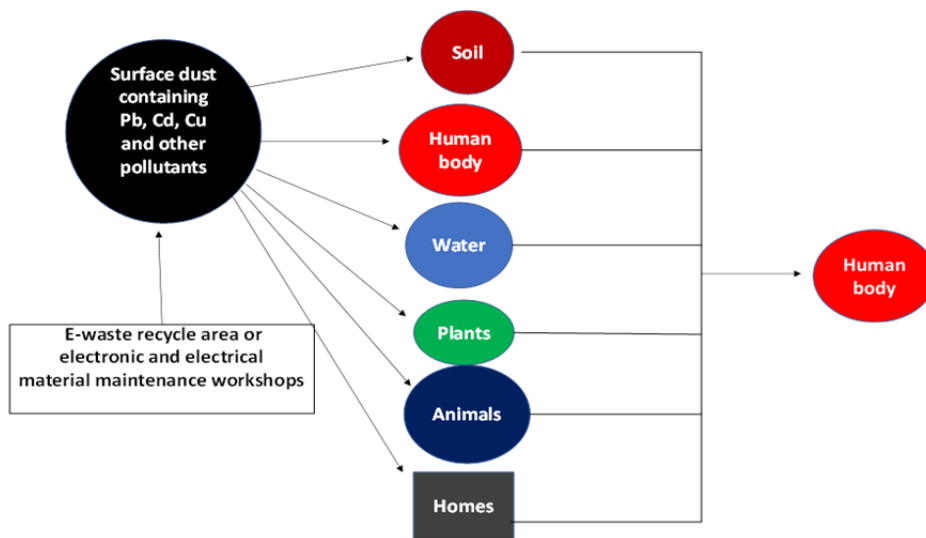


Figure 9. Surface dust distribution in the environment and its presence in the human body

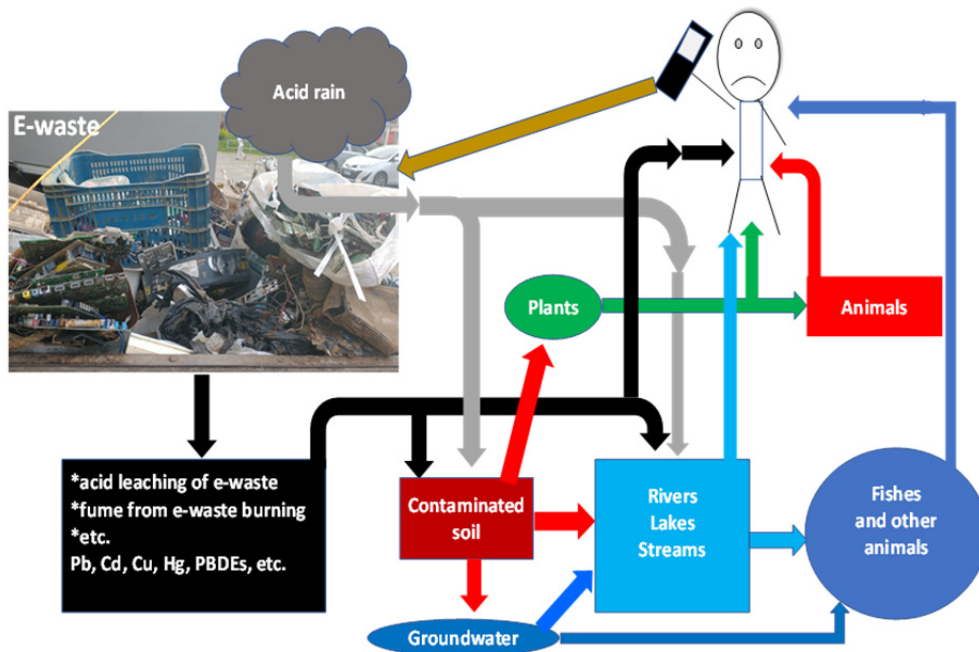


Figure 10. Human contamination by pollutants from e-waste dump

4.1.2 Water and Sediments

Natural water sources such as: groundwater, streams, rivers, lakes, and others can be contaminated by chemical pollutants from e-waste, through different ways. In a review published in 2018, researchers focused on the Ganges River, India, contaminated by metals. This pollution is provoked by different sources. Among these sources, recycle activities in areas containing e-waste stand out. This review correlated the Ganges River pollution with different pathologies described in medical literature (Sankhla et al., 2018).

But these problems are not restricted to India. In various world places can be found natural water sources contaminated by e-waste pollutants. In a study published in 2007, researchers from the University of Hong Kong and Baptist University of Hong Kong, using ICP-MS, revealed that the Lianjiang and Nanyang rivers are contaminated by different metals. The samples of both rivers were collected near a region of Guiyu City, situated in Chaozhou region of Guangdong Province, South China. These rivers provide water supply for a large population. Were found metals such as: As, Cr, Li, Cd, Cu, Ni, and Pb. This pollution was correlated with the numerous informal recycling sites of obsolete electronic devices near rivers. According to the authors, the contamination may have been caused by improper recycling such as acid leaching (Wong et al., 2007).

Several studies about chemical rivers pollution investigate different kinds of pollutants considering its presence in water as much as sediment. The physical chemistry characteristics of water as well as sediment may vary with pH, salinity, oxygen demand, and other parameters. Furthermore, pollutants such as metals and toxic organic compounds, that have some affinity by sediments, can be release to water (Figure 11) due natural and anthropogenic factors. A study utilizing water and sediment samples from San Francisco River near Petrolina City (Pernambuco State, Brazil) concluded that the metals concentrations bioavailable in sediments show alarming values (Pereira et al., 2017). Inorganic pollutants can readily accumulate in benthic organisms and disseminate through the food chain (Amin et al., 2009).

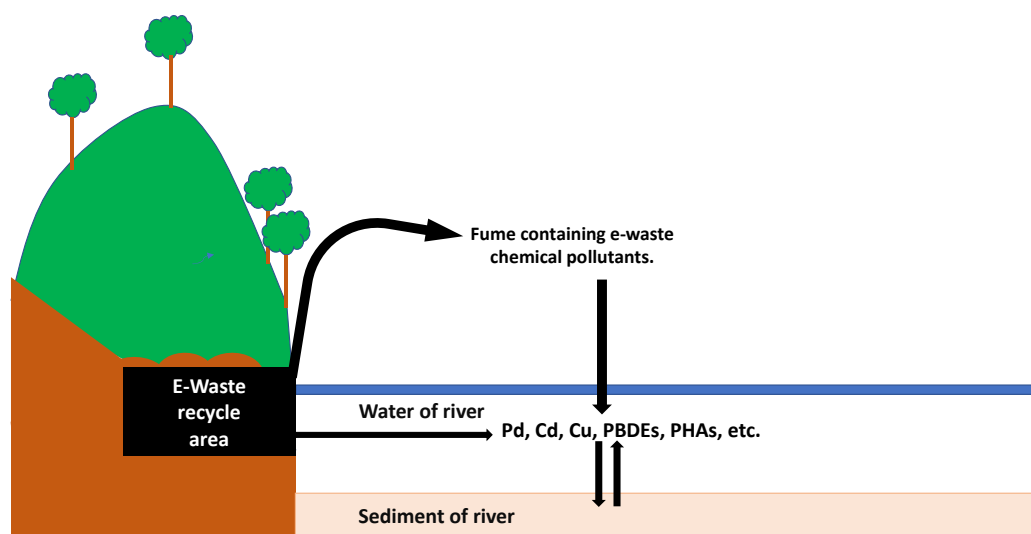


Figure 11. Natural water polluted by e-waste recycle activities and chemical pollutants present between water and sediments

In a research realized in Akure, Nigeria, was detect bioaccumulation of some toxic metals in the tissue of *Oreochromis niloticus* (tilapia) fish. The fishes were in contact with water samples contaminated with different mass of e-waste soil. After five days, some toxic metals were detected in the fish tissues using an atomic absorption spectrophotometer. It was observe the bioaccumulation of Pb, Cd, Mn, Co, Ni, and other. The author concluded that e-waste can contaminate the soil in recycle area, wich represent a contamination risk to fishes in water near e-waste (Sanusi, 2016). In other Nigerian study study was investigated the possible contamination of water and soil samples from alaba, an International Electronics Market (AIEM) situated in Lagos. Utilizing an atomic absorption spectrometer, the researchers found metals such as Pb and Cd in soil and sources of water near Lagos. The main findings of this work were the significative levels of Pb and Cd in the groundwater (Otache et al., 2014).

In addition to Nigeria, Ghana also faces serious water contamination problems due chemical pollutants from e-waste. Researchers of Hohai University, Nanjing, China, wrote a review about the e-waste disposal effects on the

aquatic environment in Accra. The large amount of electronic waste exposed near natural water sources represents a serious public health problem. Electronic devices dumps are constantly exposed to heavy rains. This situation causes water contamination by different pollutants that reach Odaw River and the Korle Lagoon. According to the authors, pollutants from e-waste limit the aquatic life diversity. Worrying amounts of metals such as: Pb, Cd, and Cu as well as organic pollutants were detected, by some authors, in water samples from these local (Huang et al., 2014). Chama et al. (2014), for example, collected Odaw River sediments samples from areas near e-waste recycle activities and from other without apparent activity. The data obtained using an atomic absorption spectrometer revealed that sediments collected from areas near e-waste with recycle activity contain metals in concentrations higher than sediments collected from areas without recycle activity. This kind of contamination is a worrying fact, because can provoke the toxic metals migration from groundwater to the plants, animals, and finally to the humans (Figure 10). So, what can you do to diminish the negative effects of this problem? Some simple projects that are occurring some places of the world maybe change this scenery in the future. In Mumbai, India, for example, a group of students walking around a tiny area of Powai Lake, for one day, collected e-waste such as: mobile phones, circuit boards, DVDs, and CDs. These materials were collected for disposal in an appropriate local. It was an important day about the practice environmental conscientization and a type of good example that should be followed by other schools in several countries (Earth, 2020).

4.1.3 Vegetables and Animals

Can we imagine that soil and water, polluted by e-waste, cause vegetable and animal contaminate? For sure this event is occurring. Several studies show the vegetables and animal chemical contamination by organic compounds and metals in areas near e-waste. In 2012, for example, different concentrations of hexabromocyclododecane (HBCD) isomers were found on terrestrial birds in the e-waste, urban, and rural areas near Pearl River Delta situated in South of China. The muscle's samples collected from birds living near e-waste area, situated in Qingyuan, demonstrated the presence of α -HBCD in *Pycnonotus sinensis*, *Lanius schach*, and *Copsychus saularis* species. The presence of δ -HBCD was detected only in *Copsychus saularis* (Sun et al., 2012). This is an important discovery due the HBCD toxicity. The electronic devices industry and other industrial sectors use HBCD as additive. The human exposure to the HBCD provokes endocrine disruption, neurotoxic effects, and alterations in reproductive and immune systems (Schecter et al., 2012).

In another study published in 2017 was investigated the presence of PHAs in fishes from Lianjiang River as well as its possible adverse effects in persons residents in Haimen Bay, near Lianjiang River estuary. This estuary is localized less than 30 km from Guiyu City (China), that contain one of the largest e-waste recycling sites of the world. The results showed the presence of worrying concentrations of PAHs in these fish samples. In Haimen Bay, PAHs represent a higher risk to cancer occurrence compared with areas less contaminated by them (Shi et al., 2017). It was possible correlate the cancer incidence with the number of persons contaminated by PAHs presents different fish species from Lianjiang River near Guiyu e-waste dumpsites. Through the Figure 12, we can imagine as occur the human contamination by PAHs from e-waste.

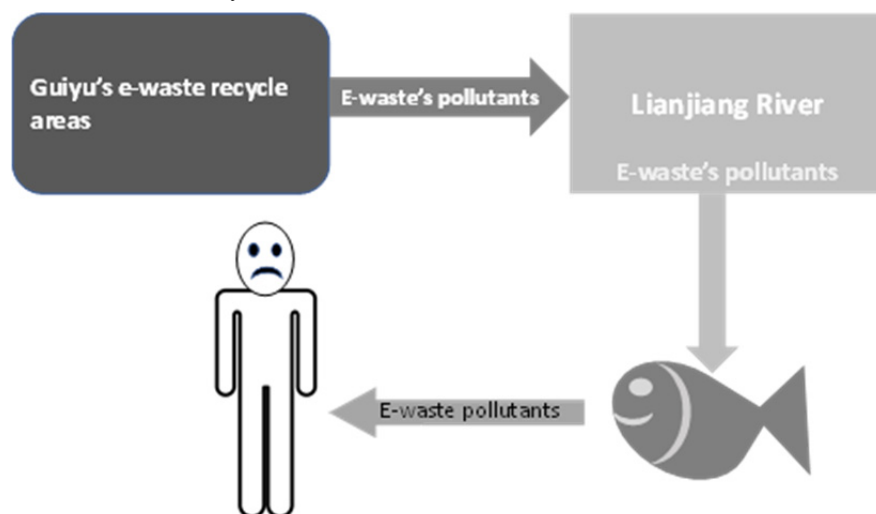


Figure 12. The PAHs's pathways from e-waste until humans through fishes

Toxic organic compounds from e-waste really are an important pollutant class present in biological samples. The U.S. Environmental Protection Agency (EPA) warning to toxic effects provoked by these compounds. PBCs, for example, are known by its carcinogenic potential, besides its negative effects in immune, reproductive, nervous, and endocrine systems (EPA, 2021).

In a study using fishes, Chinese researchers collected 48 samples including 24 mud carp and 24 northern snakehead fish from a pond located in Qingyuan Count near an e-waste area. The results demonstrated the presence of halogenated organic pollutants (HOPs) in serum of both species. Moreover, the PCBs were the main HOPs found (Zeng et al., 2014). PCBs also were found in some species of fish, prawn, waterbird, frog, lizard, and watersnake in samples collected from a pond and its terrestrial area situated in Longtang Town, Qingyaun County at Guandong Province, China (Liu et al., 2018). This lake and its region are contaminated by chemical pollutants from an e-waste area where occur non-conventional recycle activities (Wu et al., 2008). In another study carried out far from Qingyaun, researchers of Ghana's University found PBDEs in different samples collected in an Agbogbloshie e-waste recycling site, including vegetables (Oteng-Ababio et al., 2014)

In addition to PBDEs, heavy metals also are frequently found in biological samples (Pereira et al., 2017) and its toxicity is very known (Balali-Mood et al., 2021). But despite being toxic in high concentrations, some metals are essential in small amounts (Zhang et al., 2018). For example, in a simple experiment for environmental education class realized in our laboratory, was possible to demonstrate the difference of copper effects in low and high concentrations in the growth of *Allium cepa* root (ACR). It was demonstrated that occurs ACR growth inhibition in the solutions containing 200 mg/g copper, while a considerable ACR growth it was observed in aqueous solutions containing 0.2 mg/L copper (Figure 13). The cytogenetic analyze demonstrated that cell division it is more evident at copper low concentration than at high concentration (Figure 14).

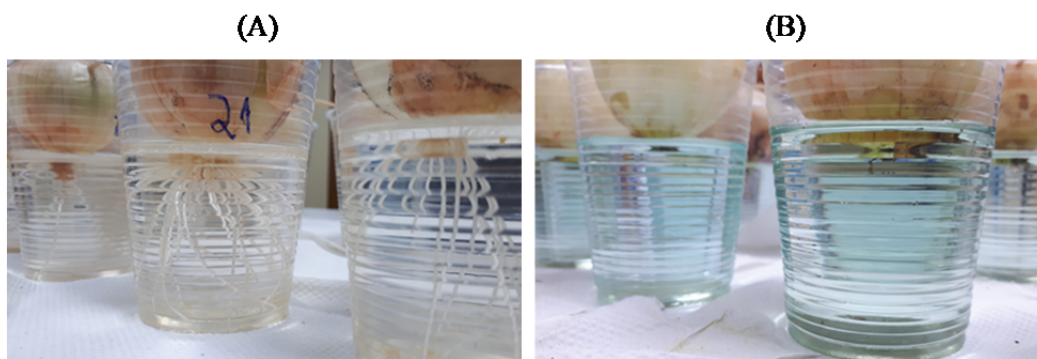


Figure 13. ACR growth in the solution containing 0.2 mg/L (A) and 200 mg/g copper (B). Experiment for environmental education class in our laboratory (Health Science Center, Federal University of Espírito Santo, Vitória-ES City, Brazil)

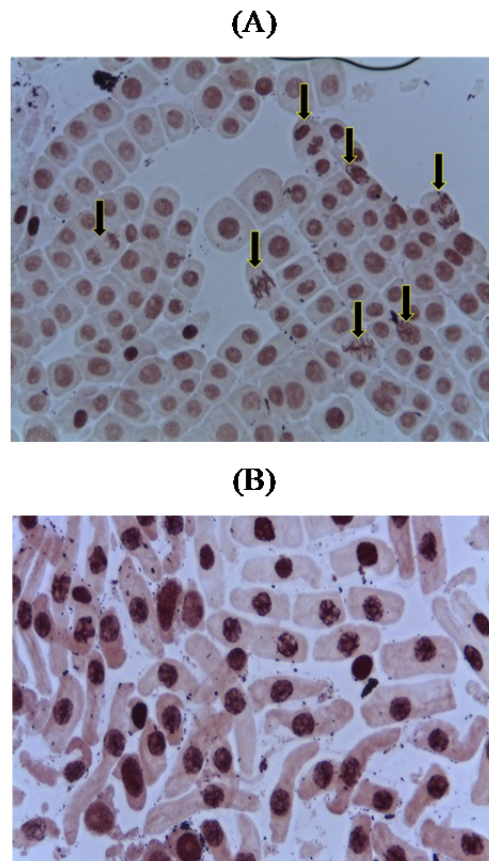


Figure 14. ACR cell division, indicated by arrows, in the solution containing 0.2 mg/L (A) and 200 mg/g copper (B), respectively. Experiment for environmental education class in our laboratory (Health Science Center, Federal University of Espírito Santo, Vitória-ES City, Brazil)

Heavy metals have been frequently found in vegetables samples collected near e-waste areas (Liu et al., 2021). In a study carried by Chinese researchers, the metals pollution in areas around of a primitive e-waste processing facility, Guangdong province of south China, was investigated. These researchers concluded that paddy fields and vegetable gardens in these areas were contaminated by metals such as: Cu, Pb, Cd, and Zn (Luo et al., 2011). Posteriorly, in 2019, researchers of Guangzhou's University and Adelaide's University published an article about the rice plants contamination by chemical pollutants from an abandoned e-waste recycling site in Guiyu, south China. The analyzes for metals revealed considerable concentrations of Sb and Sn in rice plants (Wu et al., 2019). This contamination associated to the high rice consumption near e-waste areas can represent a real risk for human contamination (Figure 15). Despite the implementation regulatory laws and rise of sophisticated recycle technologies for much e-waste areas in China, the contamination risk of some food source by chemical pollutants continues (Fu et al., 2013). Studies realized between 2006 and 2010 by some Chinese researchers in Fengjiang Town, located in the southeast of Zhejiang Province, China confirm it. This local is an important e-waste recycling and rice crops. Among other findings, some authors demonstrated the dangerous chemical concentrations of some metals such as: Cu, Pb, As, and Cd in rice samples. According to these authors is necessary stricter implementation of regulatory measures to controlling the release of metals from e-waste to the environment to diminish the risk of human contamination (Fu et al., 2013).

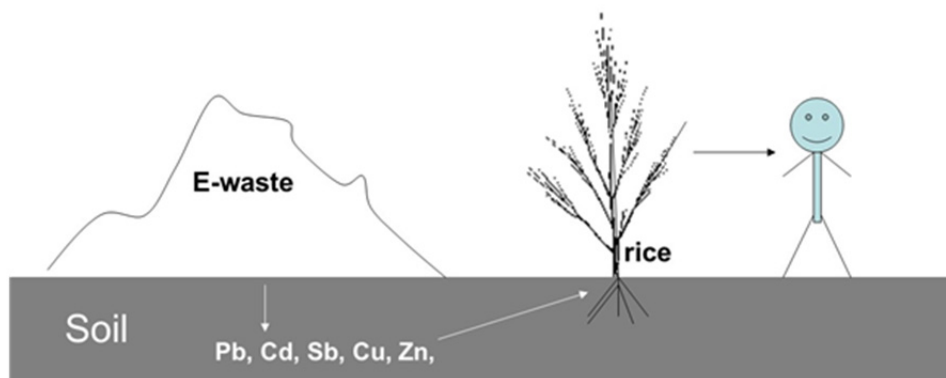


Figure 15. The high rice consumption near e-waste areas can represent a real risk for human contamination

Metals have been also found in animals near e-waste areas. Recently published work about the capacity of *Anabas testudineus* species fish to adapt to heavy metals and toxic organic compounds released in the aquatic environment by e-waste. Several physiological and biochemical responses were observed such as: oxidative stress, apoptosis, and increase in defensive responses, including increase in DNA repair, and oxidative stress response by endoplasmic reticulum (Zhang et al., 2019). This fish species is an important food source for many people living around water contaminated by e-waste. The nutrient profile of this fish (Paul et al., 2017) makes it an attractive food source and gives the false feeling that the natural water sources of these localities are not severely contaminated, since this species persists and reproduces (Zhang et al., 2019).

In other study involving samples fish was demonstrated that *Channa striata* species, from water around e-waste dumping area located on Khong Chai district (Kalasin province, Northeastern Thailand), were contaminated by Cr, Cd and Pb. These inorganic pollutants can induce chromosomal aberrations, serum biochemical parameter changes, and liver histopathological alterations. According to the authors, these observations can be as warning to human health conditions in contaminated locals (Phoonaploy et al., 2019).

4.1.4 Humans

Different kinds of pollutants are released every day in soils, air, rivers, lakes, and other water bodies by e-waste areas around the world. The environment is contaminated from e-waste pollutants such as: plastic material, toxic metals, toxic organic compounds, and other (Hashmi & Varma, 2019). The negative effects of these pollutants to humans occur mainly due to chemical toxic mechanisms and probably by radiation emission from e-waste metals (Alayande et al., 2016). However, the chemical e-waste effects are more known than radiation effects. In 2016, for example, Nigerian researchers published an article (Alayande et al., 2016) about radiation measures in three major e-waste from AIEM in Ojos, Lagos State, Nigeria. These authors concluded that even with high amounts of toxic metals presence, the radiation wasn't show serious risk for human health. The radiation, however, measured on the spot, could be an efficient method for metals amount variation in e-waste (Alayande et al., 2016).

Chemically, toxic metals pose a real threat to life. We need to remember that toxic metals such as: Pb, Cd, and Hg are practically incompatible with life. There are several scientific publications that describe the deleterious effects on human body provoked by different metals (Kumar et al., 2018). Pb, for example, can provoke inhibition of heme biosynthesis resulting in low amounts of hemoglobin and severe anemia (Figure 16) (Lubran, 1980; Skerfving and Bergdahl, 2007). Cadmium interacts with biomolecules such as: DNA, RNA, proteins, and other. This heavy metal reacts with thiol groups damaging structures of different proteins (Figure 17), and consequently inhibiting their functions (Pereira et al., 1998). Furthermore, the chemical interaction between Cd and glutathione peptide (GSH) can provoke dangerous oxidative stress on cell and consequently its death (Orlando et al., 2021).

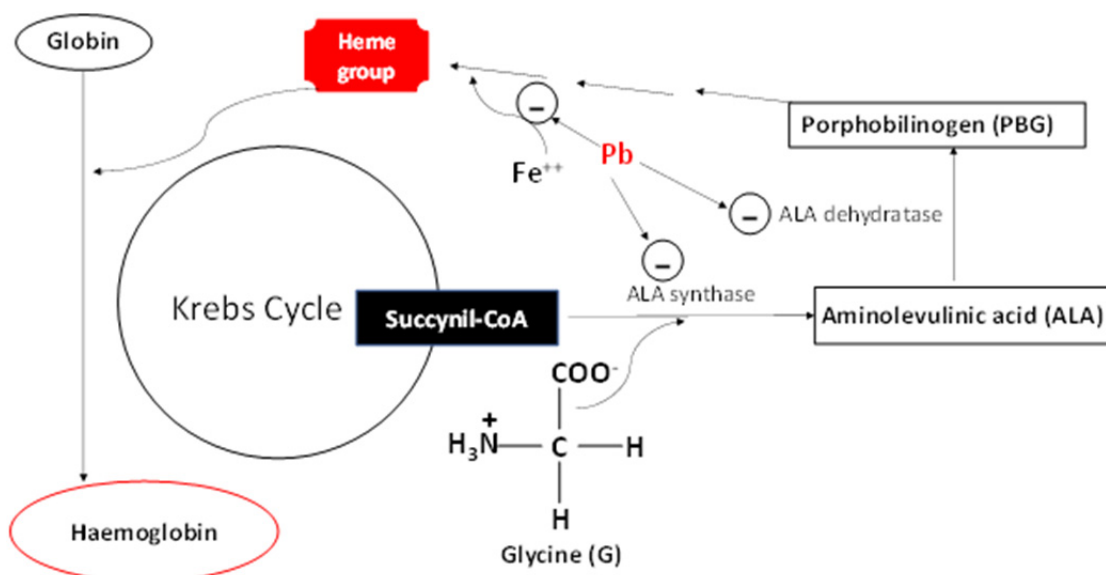


Figure 16. Some points of heme biosynthesis inhibited by Pb. ALA synthase and ALA dehydratase inhibition, and iron addition inhibition in porphyrin during heme synthesis, decreasing hemoglobin production. (Adapted from Skerfving and Bergdahl, 2007)

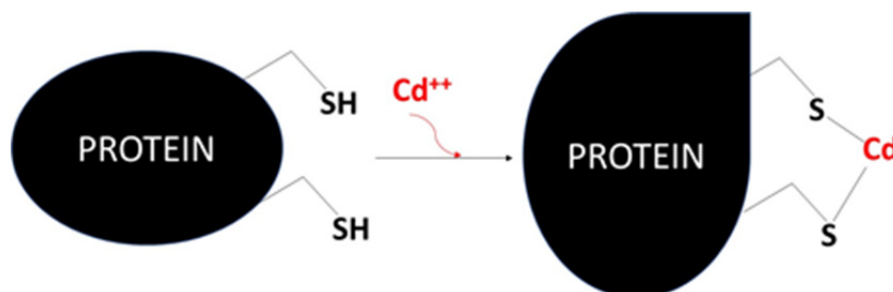


Figure 17. Cadmium reacts with thiol groups of proteins, damaging their structures and consequently inhibiting their functions.

The Pb concentration from some Chinese children's blood samples were analyzed using a graphite furnace atomic absorption after children immunization against to measles, mumps, and rubella (MMR). The study used blood samples from children who lived near e-waste areas in Guiyu and Haojiang, China. Was investigated the immune responsiveness for MMR. The Pb levels in the children's blood, that live in the areas near e-waste higher than Pb children's blood levels living in other farther area. Furthermore, the antibodies concentration against MMR were lower in children near e-waste areas. The authors concluded that these children exposition to the e-waste is associate to the low antibodies production against the MMR (Lyn et al., 2016).

In other Chinese work, researchers published a work about the correlation between blood contaminated with Pb and sex hormone levels in males exposed to e-waste dismantling area localized in Taizhou, Zhejiang Province. The results demonstrated that correlation between the male sex hormones and blood Pb concentration was significant. In some samples, the male follicle stimulating hormone and luteinizing hormone levels increase while the testosterone level reduced because Pb concentration growth (Yan et al., 2013).

Recently, Zhang et al. (2019) demonstrated that toxic metals urinary concentrations were significantly elevated in samples of human's urine obtained from e-waste dismantling areas in Qingyuan City, Guangdong province, China. In another work using blood samples from 267 exposed peoples to the e-waste area in Guyu, were found worrying Pb and Cd concentrations. These samples were compared with other blood samples obtained from 167 peoples no exposed to the e-waste area. The Pb and Cd concentrations from exposed peoples were higher than no exposed peoples. All 267 participants were hospitalized, and their toxic metal levels were associated with elevated liver toxicity (Chen et al., 2019).

Nigerian and English researchers investigated the Pb, Cu, Mn, and Zn concentrations in blood samples of e-waste pickers in AIEM, Lagos, Nigeria. They collected 30 blood samples from adult males. These samples were analyzed using an atomic absorption spectrophotometer. High Pb and Mn concentrations were found (Popoola & Popoola, 2019).

Between years 2010 and 2014, researchers of Department of Toxicology in Montevideo, Uruguay, south America, evaluated the Pb concentration in blood samples of children and teenagers exposed to e-waste material. The Pb levels were considerably high in all samples. According to the authors, the manual gathering electronics process is the most common source of Pb exposure (Pascale et al., 2016).

In a review published by Zeng et al. (2016), the authors discussed about some children health problems provoked by toxic metals such as: Pb, Cd, Hg, As, and Cu from e-waste areas. Were mentioned health problems such as: lower lung function, hepatitis B, low antibody levels, higher prevalence of attention, deficit and hyperactivity disorders, and mutagenicity.

In a review published by Zeng et al. (2016), the authors discussed about some children health problems provoked by toxic metals such as: Pb, Cd, Hg, As, and Cu from e-waste areas. Were mentioned health problems such as: lower lung function, hepatitis B, low antibody levels, higher prevalence of attention, deficit and hyperactivity disorders, and mutagenicity. Two years later, results from an environmental investigation revealed the presence of high Pb, Cr, and Zn concentrations in dermal samples collected from adults and children living in e-waste areas situated in Chandigarh and Ludhiana, Punjab, India (Singh et al., 2018).

A study realized in Benin, demonstrated the fragility of the exposure of workers to the e-waste. Among the workers surveyed, few reported using any type of personal protective equipment (PPE). Most are completely exposed to different stages of recycling such as: dismantling, sorting, and incinerating. These workers reported several problems in respiratory system, heart, eyes, kidney, and cancer's cases that could be linked to their activity in e-waste areas (Houessionon et al., 2021). Another study, realized in Palestine, revealed a worrying scenario about the high childhood lymphoma occurrence and its link with e-waste burn sites. Another observation demonstrated strong evidence of correlation between e-waste recycle and cancer cases that occurs in West Bank (Davis and Garb 2019).

Sometimes the toxic metals from e-waste are not a problem for only the BRICs, CIVETS, and other emergent or poor countries. In developed countries, workers of formal recycling plants can be contaminated by chemical pollutants from e-waste. For example, in Sweden, researchers collected blood and urine samples from workers of two e-waste formal plants. The results showed high concentrations of Cr, Co, In, Pb, and Hg in both samples (Julander et al., 2014). Studies like this should be carried out in other developed countries.

In addition to metals, some toxic organic compounds from e-waste also occur in samples human (Siddiqi et al., 2003). In 2017 was published a work containing results from an evaluation realized to verify the presence of some chemical pollutants in dust's samples from e-waste recycling areas in south China. The PBDEs, PCBs, dechlorane plus, and decabromodiphenyl ethane concentrations were considered high and dangerous for human exposure (He et al., 2017). Evidence suggests that the PDBEs, for example, provoke several health problems such as: fatigue, reduced capacity to work, headache, endocrine disorders, hepatic tumors, thyroid problems, and dizziness (Siddiqi et al., 2003). Urine samples collected from workers living e-waste recycling areas, localized in an Accra suburb, showed high PHAs concentrations. The authors observed that a significative number of workers, with contaminated urine, presented cough and chest pain (Feldt et al., 2014).

Analyzing human breast milk samples obtained from some Vietnamese workers living in e-waste recycling sites from Trang Minh (suburb of Hai Phong city), Dong Mai, Bui Dau (Hung Yen province), and Hanoi, Japanese and Vietnamese researchers found significative amounts of PCBs, PBDEs, and HBCDs (Tue et al., 2010).

In a review published in 2011, the authors suggest that pregnant women and children living in e-waste areas are more vulnerable when constantly exposed at the risk of contamination by neurotoxicants agents such as: PBDEs, PCBs, and PHAs. These neurotoxic agents can provoke possible perturbations in fetus and child neurodevelopment (Chen et al., 2011).

4.1.5 E-Waste and COVID-19

The consumption of electronic devices such as: computers, TV sets, cell phones, and other electronic devices has considerably increased in COVID-19 pandemic times. This elevated consumption will cause an increase in disposal of electronic waste around world. This high consumption is so true that even the raw material sources for the electronic devices manufacture already show signs of supply limitations. Therefore, it can be suggested that there will not only an environmental impact, but also an increase in the prices of electronic devices as well as

increase in technological inequality (Dutta et al., 2021).

The e-waste problems are not restricted to the health impact caused by its metals and toxic organic compounds such as: respiratory problems (Zeng et al., 2016), cancer (Siddiqi et al., 2003), hormonal dysfunction (Yan et al., 2013), and other. Some authors suggest that electronic material maybe transmit the COVID-19 virus when discarded in e-waste. The virus prevalence in plastic and metallic materials could be a real contamination form (Dutta et al., 2021). However, this is just a hypothesis. Furthermore, the main environmental problem generated by the people confinement at homes is the increase in electronic devices consumption and, consequently, their disposal in e-waste (Balde & Kuehr, 2021).

In Brazil, several pickers are responsible for around 90% e-waste recycling are therefore at greater risk of infection by the coronavirus. To ensure their survival, they cannot remain in lockdown, becoming more exposed to the virus both through social contact as well as through contact with e-waste probably contaminated by coronavirus (Ferraz, 2020).

Statistical data reveal that the first months of 2020 the drop in initial consumption of electronic products may have occurred in developing countries more than rich countries (Balde & Kuehr, 2021). However, the lower consumption scenario in the initial confinement phase no represents the consumption in COVID-19 advance. The continuous use not only of computers and cell phones, but also of electronic games, TV sets, air conditioners, light bulbs could cause an increase in the disposal of e-waste and consequently an increase in environment negative effects. For example, after one year of pandemic, the online electronic devices sales increased 600% only Brazil (E-Commerce Brasil, 2021). Furthermore, environmental risks are not restricted to the exaggerated consumption of these products. A significant increase in mining activity to obtain raw material for the manufacture of electronic products represents another serious risk to the environment (Althaf & Babbitt, 2021).

5. Perspectives in COVID-19 Pandemic Times

Only in Latin America, approximately 1.5 million lives were lost due COVID-19 pandemic. The governments took containment measures to avoid an even major catastrophe. In several Brazil and other countries places we could see empty streets, closed stores, public transport absence, industries with low operating capacity, unemployment, hunger, overwhelmed health system, stopped schools and colleges, cancelled flights, and other very atypical events. COVID-19 pandemic brought many uncertainties. But we can conclude that significant changes have taken. One of those was change in certain consumption habits. The significant increase in the electronic device's consumption is one of these habits.

Was the notable increase in electronics sale. These devices, with their programmed obsolescence, long before the pandemic were the main consumer items in modern society. However, in COVID-19 pandemic, they are main tools for work, study, leisure, and other needs. Billions of electronics tons are often improperly discarded into the environment every year. This amount, which was already worrying before the pandemic, could be significantly increased in the coming years. This will worsen if the pandemic persists, causing an increase in e-waste production and, consequently, more negative impacts in ecosystem. E-waste affects the environment through toxic metals, PHAs, PCBs, PBDEs, and other several pollutants that contaminate the soil, water, wildlife, domestic animals, eggs, milk, vegetable, humans and other. So, what can we do?

Governments, companies, research institutions, and society can take preventive measures to reduce environmental impacts during and after pandemic. For example, in an environmental education project proposed to the Government of the State of Espírito Santo (Brazil), our group intends to make high school youth aware of the real existence of this problem, and how it has become even more worrisome due to the COVID-19 pandemic. It will be shown how unconventional and clandestine recycling can be is just as dangerous as uncontrolled disposal. To raise awareness entire community school, a selective e-waste collection will be held at school. These students will go to all school places to explain the project proposal and request the receipt of electronic waste. After collection, the segregation of this waste will be carried out, and the choice devices that will be worked in the next stage of the project. The components of some electronic equipments such as: cell phones, computers, among others, will be disassembled and its chemical constitution identified from scientific literature. For demonstrate e-waste toxicity, we will use experiments to assess the effects of these waste in the growth of onion roots. Afterwards, the team (teachers and students) will propose methods to avoid excessive consumption, as well as safe recycling processes to reuse as much as possible this e-waste. Also, at the end of the project, students will develop an educational video about the subject. This video can help people's awareness toward to protection the Planet. Projects like this can be adopted by governments around the world. The environmental education is one of the alternatives to change behavior and reduces negative impacts in the environment.

Competing Interests Statement

The authors declare that there are no competing or potential conflicts of interest.

References

- ABC. (2006). *La calidad de vida a nivel nacional*. Retrieved Nov 12, 2021, from <https://www.abc.com.py/>
- Abdelbasir, S. M., Hassan, S. S. M., Kamel, A. H., & El-Nasr, R. S. (2018). Status of electronic waste recycling techniques: a review. *Environmental Science and Pollution Research*, 25(17), 16533-16547. <https://doi.org/10.1007/s11356-018-2136-6>
- Ádám, B., Goen, T., Scheepers, P. T. J., Adliene, D., Batinic, B., Budnik, L. T., ... & Wau, W. W. (2021). From inequitable to sustainable e-waste processing for reduction of impact on human health and the environment. *Environmental Research*, 194, 110728. <https://doi.org/10.1016/j.envres.2021.110728>
- Alayande, S. O., Ofudje, A., Ezeh, G. C., Seglo, G., Omosalewa, A. O., & Tobosun, I. (2016). Evaluation of radiation emission and elemental analysis in e-waste dumpsites. *FUW Trends in Science & Technology Journal*, 1(1), 267-271.
- Alsheyab, M. A. T. (2015). Potential recovery of precious metals from waste laptops in Jordan. *Rare Metals*, 34, 517-521. <https://doi.org/10.1007/s12598-014-0337-9>
- Althaf, S., & Babbitt, C. H. (2021). Disruption risks to material supply chains in the electronics sector. *Resources, Conservation and Recycling*, 167, 105248. <https://doi.org/10.1016/j.resconrec.2020.105248>
- Amim, B., Smail, A., Arshad, A., Yap, C. H., & Kamarudin, M. S. (2009). Anthropogenic impacts on heavy metal concentrations in the coastal sediments of Dumai, Indonesia. *Environmental Monitoring and Assessment*, 148, 291-305. <https://doi.org/10.1007/s10661-008-0159-z>
- Amphalop, N., Suwantararat, N., Prueksasit, T., Yachusr, C., & Srithongouthai, S. (2020). Ecological risk assessment of arsenic, cadmium, copper, and lead contamination in soil in e-waste separating household area, Buriram province, Thailand. *Environmental Science and Pollution Research*, 27, 44396-44411. <https://doi.org/10.1007/s11356-020-10325-x>
- Asante, K. A., Agusa, T., Biney, C. A., Agyecum, W. A., Bello, M., Otsuka, M., Itai, T., ... & Tanabe, S. (2012). Multi-trace element levels and arsenic speciation in urine of e-waste recycling workers from Agbogbloshie, Accra in Ghana. *Science of the Total Environment*, 424, 63-73. <https://doi.org/10.1016/j.scitotenv.2012.02.072>
- Balali-Mood, M., Naseri, K., Tahergorabi, Z., Khazdair, M. R., & Sadeghi, M. (2021). Toxic mechanisms of five heavy metals: mercury, lead, chromium, cadmium, and arsenic. *Frontiers in Pharmacology*, 12, 643972, 1-19. <https://doi.org/10.3389/fphar.2021.643972>
- Balde, C. P., Wang, F., Kuehr, R., & Huisman, J. (2015). The global e-waste monitor – 2014, United Nations University, IAS – SCYCLE, Bonn, Germany.
- Balde, C. P., & Kuehr, R. (2021). *Impact of the COVID-19 Pandemic on E-waste in the First Three Quarters of 2020*. United Nations University (UNU)/United Nations Institute for Training and Research (UNITAR) – co-hosting the SCYCLE Programme, Bonn (Germany).
- Bazilian, S. (2020). E-waste in developing countries: treasure to trash? *Borgen Magazine*. Retrieve Mar 10, 2021, from <https://www.borgenmagazine.com/e-waste-developing-countries/>
- Bhattacharya, A. (2017). For every person in Hong Kong, there are 48 pounds of electronic waste per year. *Quartz*. Retrieve May 8, 2021, from <https://qz.com/895504/asia-has-a-growing-e-waste-problem-and-hong-kong-is-its-hidden-villain/>
- Borthakur, A., & Singh, P. (2012). Electronic waste in India: Problems and policies. *International Journal of Environmental Sciences*, 3(1), 353-362. doi:10.6088/ijes.2012030131033
- Bradley, L. (2014). E-waste in developing countries endangers environment, locals.: *U.S.News*. Retrieve May 10, 2021, from <https://www.usnews.com/news/articles/2014/08/01/e-waste-in-developing-countries-endangers-environment-locals>
- Buzuev, V. (2015). ToxiCity. The story of Agbobloshie, a graveyard for electronics and people. *RTA Documentary Channel*. Retrieved Apr 19, 2021, from <https://rtd.rt.com/films/toxicity/>
- Capes. (2000). Retrieved May 17, 2021, from <https://www.gov.br/capes/pt-br>

- Chama, M. A., Amankwa, E. F., & Oteng-Ababio, M. (2014). Trace metal levels of the Odaw River sediments at the Agbogbloshie e-waste recycling site. *Journal of Science and Technology*, 34(1), 1-8. <https://doi.org/10.4314/just.v34i1.1>
- Chen, A., Dietrich, K.N., Huo, X., & Ho, Shuk-mei. (2011). Developmental neurotoxicants in e-waste: an emerging health concern. *Environmental Health Perspectives*, 119(4), 431-438. <https://doi.org/10.1289/ehp.1002452>
- Chen, Y., Xu, X., Zeng, Z., Lin, X., Qin, Q., & Huo, X. (2019). Blood lead and cadmium levels associated with hematological and hepatic functions in patients from an e-waste-polluted area. *Chemosphere*, 220, 531-538. <https://doi.org/10.1016/j.chemosphere.2018.12.129>
- Cruz-Sotelo, S. E., Ojeda-Benitez, S., Sesma, J. J., Velazquez-Victorica, K. I., Santillan-Soto, N., Garcia-Cueto, O. R., ... & Alcantara, C. (2017). E-Waste Supply chain in Mexico: challenges and opportunities for sustainable management. *Sustainability*, 9(4), 503-520. <https://doi.org/10.3390/su9040503>
- Daum, K., Stoler, J., & Grant, R. J. (2017). Toward a more sustainable trajectory for e-waste policy: a review of a decade of e-waste research in Accra, Ghana. *International Journal of Environmental Research and Public Health*, 14(2), 135-152. <https://doi.org/10.3390/ijerph14020135>
- Davis, John-Michael, & Garb, Y. (2019). A strong spatial association between e-waste burn sites and childhood lymphoma in the West Bank, Palestine. *International Journal of Cancer*, 144, 470-475. <https://doi.org/10.1002/ijc.31902>
- Dutta, D., Arya, S., Kumar, S., & Lichtfouse, E. (2021). Electronic waste pollution and the COVID-19 pandemic. *Environmental Chemistry Letters*. <https://doi.org/10.1007/s10311-021-01286-9>
- E-Commerce Brasil. (2021). Com um ano de pandemia, venda online de eletrônicos aumenta 600% no Brasil. Retrieved Nov 11, 2021, from <https://www.ecommercebrasil.com.br/noticias/venda-online-eletronicos-aumenta-brasil-coronavirus/>
- Earth 5R. (2020) E-waste found around Powai Lake. *Sustainable Development Goals*. Retrieved on Jul 3, 2021, from <https://earth5r.org/e-waste-found-around-powai-lake/>
- Edene, O. A., Edene, S. O., Eigbike, C. O., Onaiwu, D. J., Olorunfemi, D. I., & Onoagbe, I. O. (2020). Assessment and quantification of polybrominated diphenyl ethers (PBDEs) in soils of e-waste dumpsites in Benin City, Nigéria. *African Scientist*, 21(1), 245-252.
- EPA: United States Environmental Protection Agency. (2021). Learn about Polychlorinated Biphenyls (PCBs). Health effects of PCBs. Retrieved Jul 12, 2021, from <https://www.epa.gov/pcbs/learn-about-polychlorinated-biphenyls-pcbs>
- Feldt, T., Fobil, J.N., Wittsiepe, J., Wilhelm, M., Till, H., Zoufaly, A., Burchard, G., & Göen, T. (2014). High levels of PAH-metabolites in urine of e-waste recycling workers from Agbogbloshie, Ghana. *Science of the Total Environment*, 466-467, 369-376. <https://doi.org/10.1016/j.scitotenv.2013.06.097>
- Ferraz, C. (2020). Waste pickers responsible for 90% of Brazil's recycling at greater risk of coronavirus. *RioOnWate Community Reporting on Rio*. Retrieved Nov 27, 2021, from <https://riononwate.org/?p=59928>
- Fosu-Mensah, B. Y., Addae, E., Yirenya-Tawiah, D., & Nyame, F. (2017). Heavy metals concentration and distribution in soils and vegetation at Korle Lagoon area in Accra, Ghana. *Cogent Environmental Science*, 3, Article ID: 1405877. <https://doi.org/10.1080/23311843.2017.1405877>
- Fu, J., Zhang, A., Wang, T., Qu, G., Shao, J., Yuan, B., Wang, Y., & Jiang, G. (2013). Influence of e-waste dismantling and its regulations: temporal trend, spatial distribution of heavy metals in rice grains, and its potential health risk. *Environmental Science & Technology*, 47, 7437-7445. <https://doi.org/10.1021/es304903b>
- Getwachew, B., Amde, M., & Danno, B. L. (2019). Level of selected heavy metals in surface dust collected from electronic and electrical material maintenance shops in selected Western Oromia towns, Ethiopia. *Environmental Science and Pollution Research*, 26, 18593-1860. <https://doi.org/10.1007/s11356-019-05018-z>
- Global E-Waste Statistics Partnership. (2019). Retrieved Nov 12, 2021, from <https://globalewaste.org/>
- Global E-Waste Statistics Partnership. (2019). Brazil: Data collected in the year 2019. Retrieved May 2, 2021 from <https://globalewaste.org/statistics/country/brazil/2019/>

- Global E-Waste Statistics Partnership. (2019). Ghana: Data collected in the year 2019. Retrieved Apr 17, 2021 from <https://globalewaste.org/statistics/country/ghana/2019/>
- Global E-Waste Statistics Partnership. (2019) Paraguay: Data collected in year 2019. Retrieved May 2, 2021 from <https://globalewaste.org/statistics/country/paraguay/2019/>
- Hameed, H. B., Ali, Y., & Petrillo, A. (2020). Environmental risk assessment of E-waste in developing countries by using the modified-SIRA method. *Science of The Total Environment*, 733, 138525-138537. <https://doi.org/10.1016/j.scitotenv.2020.138525>
- Hashmi, M. Z., & Varma, A. (2019). Electronic waste pollution: environmental occurrence and treatment technologies. *Soil Biology*, 57, 355. Springer International Publishing. <https://doi.org/10.1007/978-3-030-26615-8>
- Han, Y., Tang, Z., Sun, J., Xing, Zang, M., & Cheng, J. (2019). Heavy metals in soil contaminated through e-waste processing activities in a recycling area: Implications for risk management. *Process Safety and Environmental Protection*, 125, 189-196. <https://doi.org/10.1016/j.psep.2019.03.020>
- He, Chun-Tao., Zheng, Xiao-Bo., Yan, X., Zheng, J., Wang, Mei-Huan., Tan, X., Quiao, L., ... & Mai, Bi-Xian. (2017). Organic contaminants and heavy metals in indoor dust from e-waste recycling, rural, and urban areas in South China: Spatial characteristics and implications for human exposure. *Ecotoxicology and Environmental Safety*, 140, 109-115. <https://doi.org/10.1016/j.ecoenv.2017.02.041>
- Houessionon, M. G. K., Basu, N., Bouland, C., Kedote, N. M., Fayomi, B., Fobil, N. J., & Ouendo, Edgard-Marius. (2021). Knowledge, practices, and environmental and occupational health risks associated with electronic waste recycling in Cotonou, Benin. *Occupational Diseases and Environmental Medicine*, 9, 33-48. <https://doi.org/10.1289/isee.2020.virtual.P-0615>
- Huang, J., Nkrumah, N. P., Anim, D. O., & Mensah, E. (2014). E-waste disposal effects on the aquatic environment: Accra, Ghana. *Reviews of Environmental Contamination and Toxicology*, 229, 19-34. https://doi.org/10.1007/978-3-319-03777-6_2
- Iqbal, M., Syed, J. H., Breivik, K., Chaudhry, M. J. I., Li, J., Zhang, G., & Malik, R. N. (2017). E-waste driven pollution in Pakistan: The first evidence of environmental and human exposure to flame retardants (FRs) in Karachi City. *Environmental Science & Technology*, 51, 13895-13905. <https://doi.org/10.1021/acs.est.7b03159>
- Itai, T., Otsuka, M., Asante, K.A., Muto, M., Opoku-Ankomah, Y., Ansa-Asare, O. D., & Tanabe, S. (2013). Variation and distribution of metals and metalloids in soil/ash mixtures from Agbogbloshie e-waste recycling site in Accra, Ghana. *Science of the Total Environment*, 470-471, 707-716. <https://doi.org/10.1016/j.scitotenv.2013.10.037>
- Julander, A., Lundgren, L., Skare, L., Grander, M., Palm, B., Vahter, M., & Liden, C. (2014). Formal recycling of e-waste leads to increased exposure to toxic metals: an occupational exposure study from Sweden. *Environment International*, 73, 243-251. <https://doi.org/10.1016/j.envint.2014.07.006>
- Kaihan, C., Qingbin, S., Wenyi, Y., Jujun, R., Huabo, D., Ying, L., & Jinhui, L. (2020). Human exposure to PBDEs in e-waste areas: a review. *Environmental Pollution*, 267, 115634. <https://doi.org/10.1016/j.envpol.2020.115634>
- Kitila, A. W., & Woldemikael, S. M. (2019). Waste electrical and electronic equipment management in the educational institutions and governmental sector offices of Addis Ababa, Ethiopia. *Waste Management*, 85, 30-41. <https://doi.org/10.1016/j.wasman.2018.12.007>
- Kitila, A. W., & Woldemikael, S. M. (2021). Electronic waste management in Addis Ababa: The case of Bole and Nefas Silk Lafto sub-cities. *African Journal of Science, Technology, Innovation and Development*, 13(2), 235-246. <https://doi.org/10.1080/20421338.2020.1712014>
- Kumar, A., Singh, N., Pandey, R., Gupta, V. K., & Sharma, B. (2018). Biochemical and Molecular Targets of Heavy Metals and Their Actions. In: Rai M., Ingle A., Medici S. (eds), *Biomedical Applications of Metals*. Springer, Cham. 2018. https://doi.org/10.1007/978-3-319-74814-6_14
- Lecher, C. (2019). American trash: How an e-waste sting uncovered a shocking betrayal. *The Verge Science*. Retrieved on May 5, 2021, from <https://www.theverge.com/2019/12/4/20992240/e-waste-recycling-electronic-basel-convention-crime-total-reclaim-fraud>

- Lepawsky, J., & Akese, G. (2017). Sweeping Away Agbogbloshie. Again. Discard Studies. Used as source's material for: "Korle Lagoon Restoration Project and displacement from Accra's Old Fadama Slum, Ghana". *Environmental Justice Atlas*. Retrieved on Jun 3, 2021, from <https://ejatlas.org/conflict/accras-agbogbloshie-electronic-waste-dump>
- Leston, J.G., Mendez, J., Pasaro, E., & Laffon, B. (2010). Genotoxic effects of lead: an updated review. *Environmental International*, 36(6), 623-636. <https://doi.org/10.1016/j.envint.2010.04.011>
- Li, M., Liu, Z., Gu, L., Yin, R., Li, H., Zhang, X., Cao, T., & Jiang, C. (2014). Toxic effects of decabromodiphenyl ether (BDE-209) on human embryonic kidney cells. *Frontiers in Genetics*, 5(118), 1-7. <https://doi.org/10.3389/fgene.2014.00118>
- Liu, Y., Luo, X. J., Huang, L. Q., Tao, L., Zeng, Y. H., & Mai, B. X. (2018). Halogenated organic pollutants in aquatic, amphibious, and terrestrial organisms from an e-waste site: habitat-dependent accumulation and maternal transfer in watersnake. *Environmental Pollution*, 241, 1063-1070. <https://doi.org/10.1016/j.envpol.2018.06.038>
- Liu, X., Gu, S., Yang, S., Deng, J., & Xu, J. (2021). Heavy metals in soil-vegetable system around E-waste site and the health risk assessment. *Science of the Total Environment*, 779, 146438. <https://doi.org/10.1016/j.scitotenv.2021.146438>
- Lopes, B. (2018). Brazil is the 5th country in smartphone usage. *PagBrasil*. Retrieved on May 8, 2021, from <https://www.pagbrasil.com/insights/smartphone-usage-in-brazil/>
- Lubran, M. M. (1980). Lead toxicity and heme biosynthesis. *Annals of Clinical & Laboratory Science*, 10(5), 402-413.
- Luo, C., Liu, C., Wang, Y., Liu, X., Li, F., Zhang, G., & Xiangdong, Li. (2011). Heavy metal contamination in soils and vegetables near an e-waste processing site, South China. *Journal of Hazardous Materials*, 186(1), 481-490. <https://doi.org/10.1016/j.jhazmat.2010.11.024>
- Lyn, Y., Xu, X., Dai, Y., Zhang, Y., Li, W., & Huo, X. (2016). Considerable decrease of antibody titers against measles, mumps, and rubella in preschool children from an e-waste recycling area. *Science of the Total Environment*, 573, 760-766. <https://doi.org/10.1016/j.scitotenv.2016.08.182>
- Maphosa, V., Maphosa, M., & Tan, A.W.K. (2020). E-waste management in Sub-Saharan Africa: a systematic literature review. *Cogent Business & Management*, 7(1), 1-19. <https://doi.org/10.1080/23311975.2020.1814503>
- Minter, A. (2016). The burning truth behind an e-waste dump in Africa: Ending the toxic smoke rising from an iconic dump in Ghana will take more than curbing Western waste. *Smithsonian Magazine*. Retrieved on May 9, 2021, from <https://www.smithsonianmag.com/science-nature/burning-truth-behind-e-waste-dump-africa-180957597/>
- Nnorom, I. C., & Osibanjo, O. (2008). Electronic waste (e-waste): material flows and management practices in Nigeria. *Waste Management*, 28(8), 1472-1479. <https://doi.org/10.1016/j.wasman.2007.06.012>
- Oguri, T., Suzuki, G., Matsukami, H., Uchida, N., Tue, N. M., Tuyen, L. H., ... & Takigami, H. (2018). Exposure assessment of heavy metals in an e-waste processing area in northern Vietnam. *Science of the Total Environment*, 621, 1115-1123. <https://doi.org/10.1016/j.scitotenv.2017.10.115>
- Oloruntoba, K., Sindiku, O., Osibanjo, O., Herold, C., & Weber, R. (2021). Polybrominated diphenyl ethers (PBDEs) concentrations in soil and plants around municipal dumpsites in Abuja, Nigeria. *Environmental Pollution*, 277, 116794-116803. <https://doi.org/10.1016/j.envpol.2021.116794>
- Orlando, P., Silvestri, S., Cirilli, I., Marcheggiani, F., Falcione, G., Cantarini, M., Galeazzi, R., & Tiano, L. (2021). Involvement of different hemoprotein thiol groups of *Oncorhynchus mykiss* in cadmium toxicity. *Journal of Trace Elements in Medicine and Biology*, 66, 126746. <https://doi.org/10.1016/j.jtemb.2021.126746>
- Otache, M. Y., Musa, J. J., Animashaun, I. M., & Oji, D. M. (2014). Evaluation of the effects of electronic waste on topsoil and groundwater. *International Journal of Science, Engineering and Technology Research*, 3(12), 3469-3473.
- Oteng-Ababio, M., Chama, M. A., & Amankwaa, E. F. (2014). Qualitative analysis of the presence of PBDE in ashes, soils and vegetables from Agbogbloshie e-waste recycling site. *Journal of Environmental Research and Management*, 5(4), 71-80.

- Pascale, A., Sosa, A., Bares, C., Battocletti, A., Moll, M.J., Pose, D., Laborde, A., Gonzáles, H., & Feola, G. (2016). E-Waste informal recycling: an emerging source of lead exposure in South America. *Annals of Global Health*, 82(1), 197-201. <http://doi.org/10.1016/j.aogh.2016.01.016>
- Paul, B. N., Chanda, S., Bhowmick, S., Sridhar, N., Sha, G.S., & Giri, S. S. (2017). Nutrient profile of indian climbing perch, *Anabas testudineus*. *SAARC Journal of Agriculture*, 15(1), 99-109. <https://doi.org/10.3329/sja.v15i1.33156>
- Pereira, M. E. F., Yakushin, S., & Cohen, G. (1998). Disruption of the intracellular sulfhydryl homeostasis by cadmium-induced oxidative stress leads to protein thiolation and ubiquitination in neuronal cells. *The Journal of Biological Chemistry*, 273(21), 12703-12709. <https://doi.org/10.1074/jbc.273.21.12703>
- Pereira, M. G., Souza, C. L. M., Sachdev, R. D. L., Santos, A. V. D., Pinto, P. A. D. C., Souza, L. A..... & Ribeiro, A. V. F. N. (2017). Heavy metals in an important section of the San Francisco River (Northeast Brazil): distribution profile, accumulation mechanisms, and risks of dissemination through the food chain. *Journal of Pollution Effects & Control*, 5(2), ID: 1000193, 2017.
- Petricca, C., Moloo, Z., & Stoisser, M. (2020). Hazardous e-waste recycling in Agbogbloshie, Accra, Ghana. *Environmental Justice Atlas*. Retrieved on Mar 23, 2021, from <https://ejatlas.org/conflict/agbogbloshie-e-waste-landfill-ghana>
- Phoonaploy, U., Tengjaroenkul, B., & Neeratanaphan, L. (2019). Effects of electronic waste on cytogenetic and physiological changes in snakehead fish (*Channa striata*). *Environmental Monitoring and Assessment*, 191, 363. <https://doi.org/10.1007/s10661-019-7509-x>
- Popoola, O.E., Popoola, A.O., & Purchase, D. (2019). Levels of awareness and concentrations of heavy metals in the blood of electronic waste scavengers in Nigeria. *Journal of Health & Pollution*, 9(21), 1-10. <https://doi.org/10.5696/2156-9614-9.21.190311>
- Quan, S-X., Yan, B., Yang, F., Li, N., Xiao, X-M., & Fu, J-M. (2015). Spatial distribution of heavy metal contamination in soils near a primitive e-waste recycling site. *Environmental Science and Pollution Research*, 22, 1290-1298. <https://doi.org/10.1007/s11356-014-3420-8>
- Sankhla, M. S., Kumari, M., Sharma, K., Kushwah, R. S., & Kumar, R. (2018). Heavy metal pollution of Holy River Ganga: a review. *International Journal of Research*, 5(1), 424-436.
- Sanusi, A. I. (2016). Heavy metal profile of *Oreochromis niloticus* harvested from e-waste polluted vials and associated Fungi. *Advances in Microbiology*, 6, 555-565. <https://doi.org/10.4236/aim.2016.68056>
- Schechter, A., Szabo, D. T., Miller, J., Gent, T. L., Malik-Bass, N., Petersen, M., ... & Birnbaum, L. S. (2012). Hexabromocyclododecane (HBCD) Stereoisomers in U.S. Food from Dallas, Texas. *Environmental Health Perspectives*, 120(9), 1260-1264. <https://doi.org/10.1289/ehp.1204993>
- Shi, J., Zheng, G.J.S., Wong, M.H., Liang, H., Li, Y., Wu, Y., Li, P., & Liu, W. (2016). Health risks of polycyclic aromatic hydrocarbons via fish consumption in Haimen bay (China), downstream of an e-waste recycling site (Guiyu). *Environmental Research*, 147, 233-240. <https://doi.org/10.1016/j.envres.2016.01.036>
- Siddiqi, M. A., Laessig, R. H., & Reed, K. D. (2003). Polybrominated diphenyl ethers (PBDEs): new pollutants—old diseases. *Clinical Medicine & Research*, 1(4), 281-290. <https://doi.org/10.3121/cm.1.4.281>
- Singh, N., Duan, H., Yin F., Song Q., & Li, J. (2018). Characterizing the materials composition and recovery potential from waste mobile phones: a comparative evaluation of cellular and smart phones. *ACS Sustainable Chemistry & Engineering*, 6(4), 13016-13024. <https://doi.org/10.1021/acssuschemeng.8b02516>
- Singh, M., Thind, P. S., & John, S. (2018). Health risk assessment of the workers exposed to the heavy metals in e-waste recycling sites of Chandigarh and Ludhiana, Punjab, India. *Chemosphere*, 203, 426-433. <https://doi.org/10.1016/j.chemosphere.2018.03.138>
- Skerfving, S., & Bergdahl, I. A. (2007). Lead. *Handbook on the Toxicology of Metals (Third Edition)*, 2007.
- Sthiannopkao, S., & Wong, M. H. (2013). Handling e-waste in developed and developing countries: Initiatives, practices, and consequences. *Science of the Total Environment*, 463-464, 1147-1153. <https://doi.org/10.1016/j.scitotenv.2012.06.088>
- Suja, F., Rahman, R. A., Yusof, A., & Masdar, M. S. (2014). E-waste management scenarios in Malaysia. *Journal of Waste Management*, 2014, ID 609169. <https://doi.org/10.1155/2014/609169>
- Sun, Yu-xin., Luo, Xiao-jun., Mo, L., He, Ming-jing., Zhang, Q, Chen, She-jun., Zou, Fa-sheng., & Mai, Bi-xian.

- (2012). Hexabromocyclododecane in terrestrial passerine birds from e-waste, urban and rural locations in the Pearl River Delta, South China: Levels, biomagnification, diastereoisomer- and enantiomer-specific accumulation. *Environmental Pollution*, 171, 191-198. <https://doi.org/10.1016/j.envpol.2012.07.026>
- Tiseo, I. (2021). Global e-waste generation by major country. *Statista*. Accessed on May 3, 2021.
- Tue, N. M., Sudaryanto, A., Minh, T.B., Isobe, T., Takahashi, S., Viet, P.H., & Tanabe, S. (2010). Accumulation of polychlorinated biphenyls and brominated flame retardants in breast milk from women living in Vietnamese e-waste recycling sites. *Science of the Total Environment*, 408, 2155-2162. <https://doi.org/10.1016/j.scitotenv.2010.01.012>
- Viberg, H., Johansson, N., Fredriksson, A., Eriksson, J., Marsh, G., & Eriksson, P. (2006). Neonatal Exposure to Higher Brominated Diphenyl Ethers, Hepta-, Octa-, or Nonabromodiphenyl Ether, Impairs Spontaneous Behavior and Learning and Memory Functions of Adult Mice. *Toxicological Science*, 92(1), 211-218. <https://doi.org/10.1093/toxsci/kfj196>
- Waalkes, M. P. (2000). Cadmium carcinogenesis in review. *Journal of Inorganic Biochemistry*, 79, 241-244. [https://doi.org/10.1016/S0162-0134\(00\)00009-X](https://doi.org/10.1016/S0162-0134(00)00009-X)
- Wang, Y., Tian, Z., Zhu, H., Cheng, Z., Kang, M., Luo, C., Li, J., & Zhang, G. (2012). Polycyclic aromatic hydrocarbons (PAHs) in soils and vegetation near an e-waste recycling site in South China: Concentration, distribution, source, and risk assessment. *Science of The Total Environment*, 439, 187-193. <https://doi.org/10.1016/j.scitotenv.2012.08.018>
- Wong, C. S. C., Dugoren-Aydin, N. S., Aydin, A., & Wong, M. H. (2007). Evidence of excessive releases of metals from primitive e-waste processing in Guiyu, China. *Environmental Pollution*, 148, 62-72. <https://doi.org/10.1016/j.envpol.2006.11.006>
- Wu, J. P., Luo, X. J., Zhang, Y., Luo, Y., Chen, S. J., Mai, B. X., & Yang, Z. Y. (2008). Bioaccumulation of polybrominated diphenyl ethers (PBDEs) and polychlorinated biphenyls (PCBs) in wild aquatic species from an electronic waste (e-waste) recycling site in South China. *Environment International*, 34, 1109-1113, 2008. <https://doi.org/10.1016/j.envint.2008.04.001>
- Wu, Q., Leung, J. Y. S., Geng, X., Chen, S., Huang, X., Li, H., ... & Lu, Y. (2015). Heavy metal contamination of soil and water in the vicinity of an abandoned e-waste recycling site: Implications for dissemination of heavy metals. *Science of the Total Environment*, 506-507, 271-225. <https://doi.org/10.1016/j.scitotenv.2014.10.121>
- Wu, P. F., Yu, L. L., Li, L., Zhang, Y., & Li, X. H. (2016). Maternal transfer of dechloranes and their distribution among tissues in contaminated ducks. *Chemosphere*, 150, 514-519. <https://doi.org/10.1016/j.chemosphere.2015.11.008>
- Wu, Q., Leung, J. Y. S., Du, Y., Kong, D., Shi, Y., Wang, Y., & Xiao, T. (2019). Trace metals in e-waste lead to serious health risk through consumption of rice growing near an abandoned e-waste recycling site: Comparisons with PBDEs and AHFRs. *Environmental Pollution*, 247, 46-54. <https://doi.org/10.1016/j.envpol.2018.12.051>
- Yan, Y., Song, L. X., Long, L. D., & Jiang, Y. Y. (2013). Effects of environmental lead pollution on blood lead and sex hormone levels among occupationally exposed group in an e-waste dismantling area. *Biomedical and Environmental Sciences*, 26(6), 474-484. [10.3967/0895-3988.2013.06.008](https://doi.org/10.3967/0895-3988.2013.06.008)
- Yang, S., Gu, S., He, M., Tang, X., Q.Ma, L., Xu, J., & Liu, X. (2020). Policy adjustment impacts Cd, Cu, Ni, Pb and Zn contamination in soils around e-waste area: Concentrations, sources, and health risks. *Science of the Total Environment*, 741, 140442-140450. <https://doi.org/10.1016/j.scitotenv.2020.140442>
- Youshida A., Terazono, A., Ballesteros, F.C., Nguyen, D-Q., Sukandar, S., Kojima, M., & Sakata, S. (2016). E-waste recycling processes in Indonesia, the Philippines, and Vietnam: A case study of cathode ray tube TVs and monitors. *Resources, Conservation and Recycling*, 106, 48-58. <https://doi.org/10.1016/j.resconrec.2015.10.020>
- Zeng, Y. H., Luo, X. J., Zheng, X. B., Tang, B., Wu, J. P., & Mai, B. X. (2014). Species-specific bioaccumulation of halogenated organic pollutants and their metabolites in fish serum from an e-waste site, South China. *Archives of Environmental Contamination and Toxicology*, 67, 348-357. <https://doi.org/10.1007/s00244-014-0040-8>
- Zeng, X., Xu, X., Boezen, H. M., & Huo, X. (2016). Children with health impairments by heavy metals in an e-waste recycling area. *Chemosphere*, 148, 408-415. <https://doi.org/10.1016/j.chemosphere.2015.10.078>

- Zhang, H., Song, Y., Wang, F., Li, Y., Wang, H., & Yang, L. (2018). Identification of Cu-binding proteins in embryos of germinating rice in response to Cu toxicity. *Acta Physiologiae Plantarum*, 40, 158, 2018. <https://doi.org/10.1007/s11738-018-2729-1>
- Zhang, T., Ruan, J., Zhang, B., Lu, S., Gao, C., Huang, L., Bai, X., Xie, L., Gui, M., & Qiu, Rong-liang. (2019). Heavy metals in human urine, foods and drinking water from an e-waste dismantling area: Identification of exposure sources and metal-induced health risk. *Ecotoxicology and Environmental Safety*, 169, 707-713. <https://doi.org/10.1016/j.ecoenv.2018.10.039>
- Zhang, W., Xie, H.Q., Zou, X., Li, J., Xu, L., Li, Y., Zhou, Z., Jin, T., Ma, D., & Zhao, B. (2019). The toxic effects of in situ exposure of a native fish species (*Anabas testudineus*) to electronic waste pollution. *Science of the Total Environment*, 690, 1170-1177. <https://doi.org/10.1016/j.scitotenv.2019.06.479>

Copyrights

Copyright for this article is retained by the author(s), with first publication rights granted to the journal.

This is an open-access article distributed under the terms and conditions of the Creative Commons Attribution license (<http://creativecommons.org/licenses/by/4.0/>).

The Process of Going/Settling on the Streets: The Relations between Gender, Being Homeless and Access the Health Services

Dalvan Antônio de Campos¹ & Rodrigo Otávio Moretti-Pires¹

¹ Public Health Department, Federal University of Santa Catarina, Santa Catarina, Brazil

Correspondence: Dalvan Antônio de Campos, School of Management, Public Health Department, Federal University of Santa Catarina, Florianópolis, Santa Catarina, Brazil. Tel: +55-483-721-4869. E-mail: dalvandecampos@gmail.com

Received: December 3, 2021 Accepted: February 7, 2022 Online Published: February 17, 2022

doi:10.5539/gjhs.v14n3p77

URL: <https://doi.org/10.5539/gjhs.v14n3p77>

Abstract

The objective of this article was to understand the relationship between gender constructions and the process of going/settling on the streets, as well as their effects on access to health services for homeless people in the city of Florianópolis/SC. Gender relations were analyzed in the trajectories of 28 gay, lesbian and heterosexual homeless people in the city of Florianópolis/SC/Brazil, based on a social constructionism research developed from December 2017 to February 2018. Family conflicts and non-acceptance of the gender identities were narrated as a fuse of going to the street and as aggravating for violence situations in the street context. The stigma for being homeless and non-heterosexual was understood as an obstacle to the use of health and social services. It is concluded that gender relations and male domination are related to the process of breaking of family ties and going to the street. Women and LGBT people are more vulnerable. Heterosexual men suffer for maintenance their dominant position. Further studies are recommended to deepen the relationship between gender, homeless and access to public policies.

Keywords: Gender identity, homeless persons, violence

1. Introduction

Sexuality is a contemporary prominence theme and a complex field, with competing narratives in the scientific scenario. Foucault (1979) points out that its regulation in the West emerges as an effect of the foundation of modern *episteme* in the 18th century, which shifted the centrality of the sexual act to the desire and constitution of the subject. The discourses and social practices produce men and women make the central theme in social investigations.

This social construction perspective gained visibility with the emergence of the feminist movement and the concept of gender - social constructions, ways of being and acting performed and reiterated individually according to their condition and power relations in society (Giddens, 2012; Butler, 2003). From this, other categories develop, such as gender identity and expression and sexual orientation: the first refers to individual identification; the second to how the person presents themselves; the third to the affective-sexual orientation (Butler, 2003).

The present work mobilizes such categories under the Butlerian perspective, which comprises gender and sex itself, as an effect of naturalized reiterations, in constant construction, both at the individual level and in social relations. Despite their transitory character, it is clear that some of these naturalizations gain a *social* status of truth (Butler, 2003).

In this sense, male domination and compulsory heterosexuality stand out. The first, according to Bourdieu (1998), is a form of symbolic violence, that is, the imposition of certain meanings as legitimate, masking power relations that support it. In this case, the symbolic domination of the masculine over the feminine. The second is understood as institutions, structures of understanding, and practical guidelines that establish heterosexuality as the only coherent sexual orientation, assuming linearity: sex - gender identity - sexual orientation (Butler, 2003; Berlant, 2002).

This normative regulation falls on heterosexual people, as well as on lesbians, *gays*, bisexuals, transvestites, and transsexuals (LGBT), inducing the construction of masculinities and femininities⁶. However, it is clear that non-heteronormative gender identities and expressions suffer greater discrimination (Silva & Barbosa, 2016;

Warner, 1993).

In the health service, family environment, school, work, or on the streets, those who present characteristics and social practices that are “dissident” in relation to gender and other social norms suffer repression (Garcia, Mendonça-Magro, & Leite, 2015; Sena & Souto, 2017). It is also noticed that the trajectories of going/maintaining on the streets are related to gender “dissidences”, articulated with other deviations, culminating in family conflicts (Campos & Moretti-Pires, 2018).

The homeless population (HP) is understood as a heterogeneous group that has in common extreme poverty, broken or weakened family bonds, and the absence of regular conventional housing. They utilize public places and degraded areas as space for housing and subsistence, temporarily or permanently, as well as reception units for overnight stays or temporary housing (MDS, 2008). Family conflict is an important element of the HP trajectory, accounting for 29.1% of going to the streets, behind unemployment (29.8%), and alcoholism/drugs (35.5%) (Natalino, 2016).

There is a significant increase in the HP in the national and international scenario (Natalino, 2016; ONU, 2015). In 2016, there were approximately 101,854 homeless people (Hp) in Brazil, twice as much as in 2008 (Natalino, 2016; MDS, 2008). This population, in Brazil, is mostly male, black, with a low level of education, living for more than two years on the streets and precariously accessing health services, with urgencies and emergencies being the main doors of entry (MDS, 2008; ICOM, 2017; FIPE, 2015).

The first homeless study to address sexual orientation was the census conducted in the city of São Paulo, in 2015, in which about 91.1% of the Hp identified themselves as heterosexual and 8.9% as non-heterosexual (FIPE, 2015), corroborating with international studies (Keuroghlian, Shtasel, & Bassuk, 2014; Stablein, 2017). Both groups are vulnerable due to living on the streets. Nonetheless, LGBT people suffer more violence, use more drugs, have more difficulty accessing health and social assistance services, and are more affected by diseases, when compared to heterosexuals (FIPE, 2015).

The research questions are: What are the relationships between gender and the social trajectory of homeless people? What are the impacts of gender relations on the access of Hp to public services? The objective of this article was to understand the relationship between gender constructions and the process of going/settling on the streets, as well as their effects on access to health services for Hp in the city of Florianópolis/SC.

2. Methodological Route

Qualitative research that comprises a set of practices that encompass the meanings attributed by individuals to their experiences. A social constructionist posture was adopted as an epistemological support and methodological procedures (Gergen & Gergen, 2010; Spink, 2014).

The research was carried out between September 2017 and February 2018 in the streets of downtown Florianópolis/SC, the region with the highest concentration of Hp. In 2017, Santa Catarina's capital had 499 homeless people, 69% male and 31% female, with no data on gender identities or sexual orientation (ICOM, 2017).

To collect information, an ethnographic posture with daily observation was adopted (Spink, 2014). The researcher frequented daily, at different times, spaces used by homeless people in the city, initially to enter the field (Geertz, 1989), due to the difficulty of access, and later to maintain and reinforce bonds in the research development. Participants were selected from field contacts. Intentional sampling was used with the selection of Hp who had relevant experiences on the investigated theme (Rojas-Soriano, 2004).

For registration, a field diary was used, in which the researcher's perceptions about the spaces, actions, expressions, concerns, doubts, anxieties, and ideas arising from the interaction were written, in addition to reports exposed during the conversations (Spink, 2014). Information of 28 Hp was registered.

After entering the field, semi-structured individual interviews were conducted with 2 lesbians, 2 *gays*, 3 heterosexual men, and 2 heterosexual women. These people had previously been contacted in informal research conversations and were selected for the experiences related to the theme.

The interlocutors were informed about the objectives of the study, signed and received a copy of the Free and Informed Consent Form; however, the vast majority saw no sense in this formalization.

The collection was carried out on sidewalks, benches, and marquees. The interviews were conducted in dialogues, and the interviewees were invited to tell their social trajectory. To direct the conversation, the research used the following topics: Reasons that took them to the street; Process of leaving home; Reasons that keep them on the street; Effects of gender expression on relationships in the street context. The interviews and field diary records

were transcribed in full.

The analysis was carried out by describing and categorizing the discourse in three axes: going to the street; settling/maintenance on the streets; and relationship with health services. The narratives of LGBT and heterosexual people were analyzed separately within the three axes, presenting the existing intersections. Subsequently, a critical reflection was carried out on the meanings constructed by the Hp confronting it with gender, health, and homeless literature.

The study was submitted and approved, under protocol number 104963/2015, by the Ethics Committee in Research with Human Beings of the Federal University of Santa Catarina, according to CNS Resolution 466/12.

3. Results and Discussion

During the six months of the field research, twenty-eight Hp were known. Thus, this research's results were composed of the records in the field diary, derived from these experiences, and the nine interviews conducted with LGBT and heterosexual people living on the streets.

The profile of these interlocutors was composed mostly of male people (71.4%), corroborating the proportion of men in the Brazilian (82%) and Florianópolis (77.8%) HP (MDS, 2008; ICOM, 2017). In relation to LGBT people, 14.3% (n = 4) identified themselves as lesbian (n = 2) or *gay* (n = 2). However, they assumed the identities of “dyke” and “fag”. A higher percentage of LGBT is noted in the present study when compared to the municipal census of São Paulo, in which 8.9% of the Hp identified themselves as non-heterosexual. However, this may be related to the focus on the gender relations of this research (FIPE, 2015).

3.1 Trajectories of Going to the Streets

Among the meanings built on the motivations for leaving home, it was noticed that the difference in family members' values on social gender expectations based on intrafamily conflicts and violence. The exacerbation of these events was the main trigger for going to the streets. Among lesbian women and *gay* men, aggressions occurred, culminating in cases of gender, physical violence, and being kicked out of the house.

“They wanted me to learn to like cock by force! I can't even talk about it much. It was my father and uncle who raped me... at home!” (Interlocutor 22)

“My grandmother didn't even want to hear about me being with other women... But for her, women have to like men and there's no way. Either change or live being beaten.” (Interlocutor 23)

“You know, in my town, everything is very black and white... fagots don't have much whining. [...] At first, the mother tried to face me... except that the father was no longer... he excommunicated me from home.” (Interlocutor 21)

It is noted that the previous scenarios of these homeless people were marked by heteronormative attitudes, considering only heterosexuality as acceptable. Supported by the discourses disseminated socially and corroborated by biomedical perspectives on the sexes, women and men could only be heterosexual, even if it does not suit the wishes of the interlocutors (Berlant & Warner, 2002).

In the international literature, family conflicts are pointed out as a trigger for the departure of LGBT Hp, in general, motivated by the non-acceptance of gender identities (Keuroghlian, Shtasel, & Bassuk, 2014; Mallet, Rosenthal, Keys, & Averill, 2009). However, economic factors interfere in the process; poorer people are more likely to go to the streets (Schmitz & Tyler, 2018).

For heterosexual women, social relations based on male domination, especially in the father figure, motivated controlling behavior and curtailed freedom to the point of causing them to leave home.

“I was 19 and had no choice in anything... I did just what they wanted. [...]. The old man was very jealous. Anyone who looked at me he already wanted to fight and then humiliated me at home, even called me a whore just because I was wearing *shorts*. [...] Then I saw that I had to run and I went to the street.” (Interlocutor 26)

“It was the only way out for me and him [...]. There was no way to give food to my son, you know... or food or rent... It's sad to remember... When we went out on the street, they took him away from me.” (Interlocutor 25)

A study with women living in the city of São Paulo relates going to the streets to three specific situations: violence suffered in the domestic/family context; insufficient income for their livelihood and that of their children; rupture of social bonds (Rosa & Brêtas, 2015). The first and second situations demonstrate the effects of violence directed at women, sustained by the symbolic violence of male domination (Berlant & Warner, 2002).

It is noticed that the gender expectations of “being a woman” motivate violence in the domestic environment, in

the regulation of wives, daughters, sisters, and even mothers. Besides, this same symbolic system delegates the *status* of fragility and the responsibility of caring for children to women, given the predominance of single-parent families headed by women (Gonçalves, 2018). It is noteworthy that the small number of women on the streets, compared to men, is permeated by male domination, since the perception of fragility, attributed to women, causes only those who do not have a strengthened network or who break down with this perception of fragility to reach the streets.

For heterosexual men, not corresponding to the characteristics linked to the hegemonic masculinity imposed a process of constant suffering, which culminated in running away due to shame. In this sense, the normativity established by the reiteration of male domination also places men in a vulnerable situation, imposing the need to think of the concept of masculinity in the plural and observe the peculiarities of homeless men.

“Being a real man means being able to provide for the family... [...] I couldn't get a painting job anymore. And you've seen a betrayed man has no morals, it's a shame... it's just a joke [...]” (Interlocutor 12)

“After the woman asked for a separation, I had no reason to live anymore. For me, the family was everything... I spent everything I had on drugs and whoring and ended up here on the street.” (Interlocutor 12)

Although the HP is mainly formed by men, the absence of discussion about the implications of masculinities (Connell & Messerschmidt, 2013) in going to the streets is highlighted. However, it is identified that the trigger for family conflicts and going to the streets among men occurs in adulthood when the demands of “being a man” and becoming a provider intensify (Rocha, 2012).

It is noticed that the reason for leaving home varied with the gender identity of the Hp. While some were forced to leave and others left to avoid continuing violence and suffering. The effects of gender relations were presented as central and defining points in breaking bonds/going to the streets. However, this process was marked by disaffiliation, usually accompanied by socio-economic vulnerabilities that contributed to settling on the streets (Packer, Higa, Varga, Campos, & Turato, 2015).

3.2 *Settling and Life on the Streets*

Despite the naturalization of living on the street as an imposition of social relations, it is also configured as resistance. In other words, action contrary to the control and violence suffered within the family, the State, and the school, which operate in a logic centered on male domination, privileging heterosexuality.

“It is not easy here [...]. But I do what I want and I'm feeling this way... but we help each other and respect each other... better than at home, right!” (Interlocutor 13)

“My mother even visits me sometimes... she knows that I like this life [...], it is dangerous but that I get used to it and I have many real friends... I'm going out one day but I won't go home... and there are people in the “areas” that I stay in that make me stay around here.” (Interlocutor 24).

The understanding of the street as a space that allows the existence for people for a long time subjected to violent processes in families is perceived in the narratives. As a new shelter, a space for escape from unsustainable situations with families is transformed into a place for building relationships and resistance (Cunha, Garcia, Silva, & Pinho, 2017). Despite the vulnerability experienced daily on the streets, deep social bonds are formed.

However, inhabiting the streets requires adaptation to the rules of this space, submitting to violence and territorial disputes. After knowing and adapting to the norms of the streets, people join the groups, starting to share experiences, bonds, and relationships of care and respect, something that did not exist in previous relationships. It breaks with the standard of the house as a place of protection, privacy and intimacy, resigning the public space (Andrade, Costa, & Marquetti, 2014).

When using public space as a home, they are subjected to danger, publicity and, paradoxically, anonymity due to social invisibility (Souza, 2018). The condition of need that permeates life on the streets, as well as the adaptations made to the local culture, start to constitute the identity of these people, making them homeless (Andrade, Costa, & Marquetti, 2014).

The effects of living on the streets on female and male bodies, whether due to biological differences or social constructions, present marked differences. Understanding gender identities on the street goes through the understanding of the influence of characteristics typical of living on the streets, such as: fluidity of bonds, different forms of violence, and the need to meet basic demands. Even though gender identity and sexual orientation have motivated people to go to the streets, a reconstruction of them is perceived in the new context, in a continuous and constant process of transformation and reiteration (Butler, 2003).

Cis women living on the streets refer to menstrual periods as an obstacle: when they are unable to access sanitary pads and spaces for hygiene, they get bloody days or clean themselves in inappropriate places.

“At the end of the year the POP closed [...] you know, you know, when blood comes out... in those days I had to get some clothes and I went back there in the sea to take a shower... the luck is that it is summer.” (Interlocutor 20)

The way public space and living on the streets are thought imposes specific conditions on them, due to physiological conditions and the need to seek alternatives to meet basic needs for hygiene and health (Giorgetti, 2014). Besides, the location, time, and day of operation of public devices often compromise access (Pinheiro & Possas, 2018).

They are also the target of greed on the streets. The permanence in the public space causes many women, heterosexuals and lesbians, to be harassed and to suffer sexual violence by homeless men and police. In this sense, some women seek protection through a fixed relationship with homeless men who hold power in the “areas”. However, others, especially lesbians, have characteristics of violent masculinities and associate with other Hp, forming groups to protect themselves.

“Here they respect me, you know! I don't even want to know, I push and do everything I can, if I need to take a stick and hit the guy on the head!” (Interlocutor 23)

“I always have a boyfriend, you know!? They take care of me and I also know how to take care.” (Interlocutor 20)

Rosa & Brêtas (2015), also found this impossibility for women to deny sexual relations on the streets. Nevertheless, they point out that the search for someone for protection is linked to friendships. The idea of protection in the masculine figure or performativity is imperative, corroborating the structured idea of male domination (Bourdieu, 1998).

In a study on masculinities among homeless people, Pinheiro and Possas (2018) identified that single women experienced the fear of violence and rape more intensely than those with a fixed relationship, who used masculine dispositions for protection, which the author calls displaced masculinities. The idea of coherence between sex, gender, and desire is questioned (Butler, 2003). One starts to think about performativities mediated by a complex social process, which in this case is related to protection and survival (Butler, 2003; Pinheiro & Possas, 2018).

Those who identify themselves as *gay* are harassed “in the dead of night” by their street companions, mainly under the influence of drugs since this harassment comes from heterosexual men living on the streets who live together on a day-to-day basis.

“There is always someone wanting, they drink, smoke and come... They are needy, some even cry.” (Interlocutor 21)

“There's a lot here, man... we need to fuck... some really abuse women and the guys who are more like women...” (Interlocutor 18).

It is noticed that despite the spatial difficulties, the Hp maintains sexual relations, with fixed partners or not, for pleasure. The studies on HP highlight sexual relations between men without identification as homosexuals, in addition to presenting *gay* characters and homosexual couples (Varanda & Adorno, 2004; Langa, 2012; Costa, 2007). The shame of revealing these practices, secondary to heterocentric and sexist perceptions, stands out (Souza, 2018).

The street context is related to drug use. Consumption can be a reason for going to the streets or adapting to them. It was noticed in the present study that the use of drugs is carried out to stay awake, due to the insecurity of sleeping on the streets; to sleep, due to excessive consumption, and to forget about problems; and as a way to socialize.

“When I started sleeping on the street, I was very afraid, my father had raped me... I was afraid of everyone... Sometimes I used drugs to stay awake... I also used it to sleep... I used it until I blacked out and only woke up the other day.” (Interlocutor 22)

“I got to the street only drinking cachaça... life here is hard, there is always someone doing their stuff and on drugs and then you are there and use it... I've used everything and it's hard to stop.” (Interlocutor 30)

Unlike what was found in this article, Varanda and Adorno (2004) point out that drug use was identified as a way to censor the discomfort of poor hygiene. Packer, Higa, Varga, and Campos (2015), corroborating the perceptions found, suggest that entering drug consumption is part of adapting to the streets.

It was also found that drugs are used as bargaining chips and mediators for sexual relations.

“They know that I have sex with other men... Then when they want it really bad, they come to offer me a rock for

a blowjob... they want to fuck my ass... I will not lie to you, sometimes I will go but I prefer women.” (Interlocutor 12)

“Some women always come here in my tent, they already know that I have some change and rock.” (Interlocutor 11)

In these relationships, usually under the influence of drugs, sexual practice is not only between men and women, as found in a study with crack users in the capital of Santa Catarina and a city in the west of the state (Zeferino, Fermo, Fialho, & Bastos, 2017).

It is noted in the literature reports of female prostitution of the HP, something little registered in this work, despite the constant contact with what they call “exchanges” (Rosa & Brêtas, 2015). What is little debated, as they are cases “that are not openly commented on”, according to Varanda and Adorno (2004), is male prostitution. On the streets of Florianópolis, it is a service usually provided to non-homeless people.

“I’m a man... I like women... on the street I started to be given a line by the guys. They pass by car and feel great and offer some money. When I go to hotels, I bathe before and after... sometimes it’s in the car or in some squares. There are some that do almost fixed service.” (Interlocutor 12)

“Are you seeing these guys sitting there on the bench? During the day they pretend they don’t even see me and at night they want to. I’ve already fucked all their asses.” (Interlocutor 7)

The practice of prostitution with non-homeless people points to a marked contradiction. At the same time, they have extremely close relationships during sexual intercourse, there is an invisibility behavior in other scenarios. Among non-homeless men, prostitution is justified by the financial return. However, it does not present this paradoxical relationship of visibility and invisibility (Prado-Júnior, Amaral, & Barbosa, 2018).

This perception of invisibility is present not only in this situation. For example, although there are groups that come together to take food, clothes and offer opportunities to leave the street, this ends in these moments. In other dimensions, there is no relationship, only in the role of helping the one who needs (Cunha, Garcia, Silva, & Pinho, 2017). Goffman (2011) considers this phenomenon of naturalization of people’s place in the social context as civil inattention. In other words, this population’s invisibility is not about their inexistence but about their existence in a defined and naturalized place.

The sexual practice among homeless heterosexual men is justified by the need for sex and the lack of women, unrelated to gender identity and expression or sexual orientation. *Gay* men are requested, however, there is also sex among the self-identified as heterosexual.

“As I am faggot when people get crazy and want to, there are a lot of people who lean on me to have some affection... I don’t like it very much... there are some who are aggressive... And sometimes there are some who say they are macho, going to some corner and hiding in the tents.” (Interlocutor 21)

Thus, when thinking about identities and expressions of gender and sexual orientation, one should consider the fluidity, uncertainty, and non-linearity between them. In this sense, it becomes coherent to dialogue with identities based on performativities that are defined and defined, are adjusted and readjusted according to the reiterations, possibilities, and intentionalities of those who perform (Butler, 2003).

Despite these homosexual relationships on the streets and the coexistence between different identities, strong discrimination against *gays* is perceived in the studies (Keuroghlian, Shtasel, & Bassuk, 2014; Langa, 2012). It is noteworthy that even in a scenario of constant social exclusion, gender phobias present outside the streets reproduce, mainly against lesbian women, *gay* men and those who have sex with other men (Garcia, 2013). Thus, there are people who suffer double stigmatization: because they live on the street and because they are lesbians or *gays*.

Even in this scenario, the narratives point to a possibility of expressing different gender identities, with fewer strings than those previously on the streets.

“Here I can be who I am... I use my drugs, whenever I want, I have a flirt [...]” (Interlocutor 23)

“I’m fine, I want to leave here, but never to go home... but here I know I have to take care of myself and I do it like this, but it’s better than before...” (Interlocutor 22)

“Being a fag on the street is not easy, but I prefer it than when I was at home... Here you do not have to report to anyone...” (Interlocutor 21)

As previously pointed out, the street conforms not only as an imposed situation but also as a space of resistance to violence suffered (Foucault, 1979). Despite the social exclusion experienced on the streets, it is noted that leaving

home and staying on the streets allows for building less violent relationships and foreseeing a way out of the streets (Packer, Higa, Varga, Campos, & Turato, 2015).

In this sense, supportive relationships among homeless people stand out, forming bonds that allow them to face and survive everyday situations. From these bonds, they share living spaces, seek income sources, and share food, drinks, and drugs (Andrade, Costa, & Marquetti, 2014).

It was noticed during the research that the relationships created between them and with the street space are fundamental for maintenance on the street. It is noticed that in addition to the use of drugs, the street causes a feeling of freedom due to physical conformation, without walls, something that causes conflicts when returning to a home.

3.3 Health Services

Regarding Primary Health Care (PHC) and Clinics on the Street (CR), it is clear that this population does not have access to services. Besides ignorance of rights and past negative experiences, one of the main obstacles is self-concept. This means that many do not seek health services.

“I didn't even know that there was such a clinic for the homeless... at the health center I don't even go here, there are people who go and get kicked out! I'm ashamed, sometimes I get a bad smell and people know I'm homeless ...” (Interlocutor 23)

“I went there a few times and they kept me waiting... I still came back a few times, but one day they didn't let me in saying that there were a lot of people there and I never went back.” (Interlocutor 22)

The material developed by the Ministry of Health to assist the homeless population (Ministério da Saúde, 2014) already pointed to the need to open the assistance network, especially the PHC to monitor this group. However, despite some positive experiences with the CR, there is a need for progress in implementing the service and raising the awareness of professionals to adequate and contextualized care (Hino et al., 2018). However, the health needs of the homeless are notable, from basic care such as making and changing dressings, to cases of tuberculosis, HIV/AIDS, malnutrition, etc (Ministério da Saúde, 2014; Hino, Santos, & Rosa, 2018).

The lack of adequate care in PHC, makes homeless people aggravate due to resolvable problems. Access to health services is due to urgency and emergency, only in severe cases or when they have a serious accident (Ministério da Saúde, 2014).

“When I'm sick I try to get by, I get a drug from an acquaintance... except that sometimes, only when I'm really bad, I almost die, I go to the emergency room.” (Interlocutor 13)

“I go to the hospital, care has already been denied because I was undocumented and I have no address... It depends on who's there, you know...” (Interlocutor 21)

The expression of non-heterosexual gender was placed as an obstacle in the form of assistance in health and social assistance services. Prejudiced attitudes of professionals working in the services and other homeless people who share the space promote taking these people away (Langa, 2012).

“They must think that I have AIDS just by being on the street... They're already afraid of even getting close to you. Look there is a fagot, a guard at the health center told her friends. And another one who was with her said like this: it's a homeless fag get out of here!” (Interlocutor 21)

“I went to the POP and a guy sat next to me... he looked at me a little down! I already asked him what he wanted you, know, just like that... And he was laughing all the time and said: “Look, the dyke is going mad, she's going to beat me...” (Interlocutor 23)

When thinking about the street situation for LGBT people and analyzing gender relations, we deal with stories of glaring vulnerabilities, with health and social assistance services having little influence on modifying this process. There is great suffering of these people when dealing with stigmatization discourses, based on prejudice for the current condition. This is a challenge for the Brazilian health system and your specialized services and policies for homeless and LGBT people (Sena & Souto, 2017; Hino, Santos, & Rosa, 2018).

4. Conclusions and Recommendations

It is noted that gender relations are closely related to the process of disaffiliation, breaking family bonds, leaving home, and going to the streets. However, the effects of heteronormative patterns permeate life on the streets with effects on situations of violence, use of the body, and relationship with services of LGBT people.

The male domination present in the street context is perceived, and from it hierarchical and violent social relations

are established against heterosexual women and LGBT people. Heterosexual men, despite perpetrating violence, also suffer when establishing their domination position.

In general, a street culture was perceived, immersed in a scenario of social, economic fragility, and crossed by gender relations. Despite the plurality, both in trajectories and objectives, it is clear that the population shares a current situation of adversity and builds new meanings for the street and their existences.

The health care of this population poses challenges to the Unified Health System (SUS), especially PHC, with the implementation of the CR and bringing these people closer to the services. It is clear that this population's precarious health conditions and the complexity of social relations on the streets require the articulation of public policies in the different sectors. Additionally, the need to approach the street population based on their needs is highlighted, considering the socio-economic context, gender relations, and needs arising from living on the streets.

In this sense, there is a need to review the focus of strategies for assisting HP, still focused on social hygiene, coercive actions, and "anti Hp" strategies to remove the population from the central regions. In addition, social assistance strategies should be rethought and contextualized from life on the streets.

Further studies are recommended to deepen the relationship between gender, Hp and access to public policies; the relationship between gender discrimination and going to the streets and staying there; and access to health services for Hp, with an emphasis on LGBT.

Competing Interests Statement

The authors declare that there are no competing or potential conflicts of interest.

References

- Andrade, L. P., Costa, S. L., & Marquetti, F. C. (2014). A rua tem um ímã, acho que é a liberdade: potência, sofrimento e estratégias de vida entre moradores de rua na cidade de Santos, no litoral do Estado de São Paulo. *Saúde Soc*, 23(4), 1248-1261. <https://doi.org/10.1590/S0104-12902014000400011>
- Berlant, L., & Warner, M. (2002). Sexo em Público. In: Jiménez, R. M. M. (Ed.), *Sexualidades transgressoras* (pp. 229-257). Barcelona, CT: Içaria Editora.
- Bourdieu, P. (1998). *A dominação masculina*. Rio de Janeiro, RJ: Bestbolso.
- Butler, J. (2003). *Problemas de gênero: feminismo e subversão da identidade*. Rio de Janeiro, RJ: Civilização brasileira.
- Campos, D. A. & Moretti-Pires, R. O. (2018). Trajetórias sociais de gays e lésbicas moradores de rua de Florianópolis (SC), 2016. *Revista Estudos Feministas [online]*, 26(2), e45995. <https://doi.org/10.1590/1806-9584-2018v26n245995>.
- Connell, R. W., & Messerschmidt J. W. (2013). Masculinidade hegemônica: repensando o conceito. *Revista Estudos Feministas [online]*, 21(1), 241-282. <https://doi.org/10.1590/S0104-026X2013000100014>
- Costa, D. L. R. (2007). *A rua em movimento: experiências urbanas e jogos sociais em torno da população de rua*. Universidade de São Paulo, São Paulo, Brasil; 2007. Retrieved from <https://www.teses.usp.br/teses/disponiveis/8/8134/tde-20122007-140625/pt-br.php>
- Cunha, J. G. D., Garcia, A., Silva, T. H. D., & Pinho, R. C. D. (2017). Novos arranjos: lançando um olhar sobre os relacionamentos interpessoais de pessoas em situação de rua. *Gerai: Revista Interinstitucional de Psicologia*, 10(1), 95-108
- FIPE - Fundação Instituto de Pesquisa Econômicas. (2015). *Prefeitura Municipal de São Paulo. Pesquisa Censitária da População em Situação de Rua da Cidade de São Paulo*. São Paulo, SP: FIPE.
- Foucault, M. (1979). *Microfísica do poder*. Rio de Janeiro, RJ: Editora Graal.
- Garcia, M. R. V. (2013). Diversidade sexual, situação de rua, vivências nômades e contextos de vulnerabilidade ao HIV/Aids. *Temas de Psicologia*, 21(3), 1005-1019. <http://dx.doi.org/10.9788/TP2013.3-EE17PT>
- Garcia, M. R. V., de Mendonça-Magro, V. M., & Leite, K. C. (2015). Discriminação e Violência Homofóbica Segundo os Participantes da 6ª Parada Do Orgulho LGBT De Sorocaba-SP: subsídios para (re)pensar as práticas educativas. *Cadernos de Pesquisa*, 22(3), 42-58. <http://dx.doi.org/10.18764/2178-2229.v22.n3.p.42-58>
- Geertz, C. (1989). *A interpretação das culturas*. Rio de Janeiro, RJ: Guanabara Koogan.
- Gergen, K. J., & Gergen, M. (2010). *Construcionismo social: um convite ao diálogo*. Rio de Janeiro, RJ: Editora

- do Instituto NOOS.
- Giddens, A. (2012). *A transformação da intimidade: Sexualidade, Amor e Erotismo nas Sociedades Modernas*. São Paulo, SP: Editora UNESP.
- Giorgetti, C. (2014). *Moradores de rua: uma questão social?* São Paulo, SP: Fapesp.
- Goffman, E. (2011). *Ritual de interação: ensaios sobre o comportamento face a face*. Petrópolis, RJ: Vozes.
- Gonçalves, C. D. J. M. (2018). Casamento, Gênero e Violência Doméstica e Familiar Contra a Mulher no Brasil. Um Olhar Retrospectivo. *Revista Jurídica Luso-Brasileira*, 4, 315-318.
- Hino, P., Santos, J. O., & Rosa, A. S. (2018). People living on the street from the health point of view. *Revista Brasileira de Enfermagem*, 71(1), 684-692. <https://doi.org/10.1590/0034-7167-2017-0547>
- ICOM - Instituto Comunitário Grande Florianópolis. (2017). *Diagnóstico Social Participativo da População em Situação de Rua na Grande Florianópolis*. Florianópolis, SC: ICOM.
- Keuroghlian, A. S., Shtasel, D., & Bassuk, E. L. (2014). Out on the street: a public health and policy agenda for lesbian, gay, bisexual, and transgender youth who are homeless. *American Journal of Orthopsychiatry*, 84(1), 66-72. <https://doi.org/10.1037/h0098852>
- Langa, E. N. B. (2012). *Pessoas que habitam as ruas em Fortaleza nos circuitos da vulnerabilidade e exclusão: identidades em construção nas trajetórias e percursos*. Universidade Federal do Ceará, Ceará, Brasil. Retrieved from shorturl.at/fuDY1
- Mallet, S., Rosenthal, D., Keys, D., & Averill, R. (2009). *Moving out, moving on: young people's pathways in and through homelessness*. London: Routledge.
- MDS - Ministério de Desenvolvimento Social. (2008). *Pesquisa Nacional sobre a População em Situação de Rua*. Brasília, DF: MDS.
- Ministério da Saúde. (2014). *Saúde da população em situação de rua: um direito humano*. Brasília, DF: Ministério da Saúde.
- Natalino, M. A. C. (2016). *Estimativa da População em Situação de Rua no Brasil*. Rio de Janeiro, RJ: Ipea.
- ONU - Organização das Nações Unidas. (2015). *Informe de la Relatora Especial sobre una vivienda adecuada como elemento integrante del derecho a humano*. Genebra: Conselho de Direitos Humanos.
- Packer, M. P., Higa, R., Varga, C. R. R., Campos, C. J. G., & Turato, E. R. (2015). "Virei um mendigo": vivências de ex-moradores de rua acolhidos em uma instituição confessional brasileira. *Revista de Enfermagem da UFSM*, 5(1), 69-80. <https://doi.org/10.5902/2179769212964>
- Pinheiro, Z. D. A. C., & Possas, L. M. V. (2018). Centro pop: quando uma política pública incomoda. *Revista do Instituto de Políticas Públicas de Marília*, 4(1), 35-54. <https://doi.org/10.33027/2447-780X.2018.v4.n1.04.p35>
- Prado-Júnior, V. I., do Amaral, F. B., & Barbosa, Y. M. (2018). Epistemologia do território: a prostituição masculina em Goiânia. *Revista Brasileira de Gestão Urbana*, 10(2). <https://doi.org/10.1590/2175-3369.010.002.AO14>
- Rocha, D. E. H. (2012). *Rumo à vida nas ruas: trajetórias sociais de moradores de rua em Guaratuba/PR*. Universidade Federal do Paraná, Paraná, Brasil. Retrieved from <https://acervodigital.ufpr.br/handle/1884/39468>
- Rojas-Soriano, R. (2004). *Manual de pesquisa social*. Petrópolis, RJ: Editora Vozes.
- Rosa, A. D. S., & Brêtas, A. C. P. (2015). A violência na vida de mulheres em situação de rua na cidade de São Paulo, Brasil. *Interface-Comunicação, Saúde, Educação*, 19, 275-285. <https://doi.org/10.1590/1807-57622014.0221>
- Schmitz, R. M., & Tyler, K. A. (2018). The complexity of family reactions to identity among homeless and college lesbian, gay, bisexual, transgender, and queer young adults. *Archives of Sexual Behavior*, 47(4), 1195-1207. <https://doi.org/10.1007/s10508-017-1014-5>
- Sena, A. G. N., & Souto, K. M. B. (2017). Avanços e desafios na implementação da Política Nacional de Saúde Integral LGBT. *Tempus Actas de Saúde Coletiva*, 11(1), 09-28. <https://doi.org/10.18569/tempus.v11i1.1923>
- Silva, L. V., & Barbosa, B. R. S. N. (2016). Sobrevivência no armário: dores do silêncio LGBT em uma sociedade de religiosidade heteronormativa. *Estudos de religião*, 30(3), 129-154.

<http://dx.doi.org/10.15603/2176-1078/er.v30n3p129-154>

- Souza, F. K. G. (2018). A margem da invisibilidade: uma pesquisa sobre a compreensão do morador de rua da orla de Macapá de sua inclusão social. *Pey Këyo*, 3(1), 34-56.
- Spink, M. J. P. (2014). *A produção de informação na pesquisa social: A produção de informação na pesquisa social*. Rio de Janeiro, RJ: Centro Edelstein de Pesquisas Sociais.
- Stablein, T. (2017). Estimating the Status and Needs of Homeless LGBT Adolescents: Advocacy, Identity, and the Dialectics of Support. In: P. N. Claster, S. Blair (Eds). *Gender, Sex, and Sexuality Among Contemporary Youth* (pp. 23-41). Bingley: Emerald Publishing Limited.
- Varanda, W., & Adorno, R. D. C. F. (2004). Descartáveis urbanos: discutindo a complexidade da população de rua e o desafio para políticas de saúde. *Saúde e Sociedade*, 13, 56-69. <https://doi.org/10.1590/S0104-12902004000100007>
- Warner, M. (1993). *Fear of a queer planet: Queer politics and social theory*. Minnesota: University of Minnesota Press.
- Zeferino, M. T., Fermo, V. C., Fialho, M. B., & Bastos, F. I. (2017). Semelhanças e contrastes nos padrões de uso de crack em Santa Catarina, Brasil: capital vs Meio Oeste. *Ciência & Saúde Coletiva*, 22, 97-106. <https://doi.org/10.1590/1413-81232017221.18342016>

Copyrights

Copyright for this article is retained by the author(s), with first publication rights granted to the journal.

This is an open-access article distributed under the terms and conditions of the Creative Commons Attribution license (<http://creativecommons.org/licenses/by/4.0/>).

Smartphone Medical Apps Use by Health Professionals: Is Gender a Confounding Factor?

Elena J. Tetenova¹, Aleksei V. Nadezhdin^{1,2}, Alexey J. Kolgashkin¹, Mikhail V. Fedorov¹, Inessa A. Bedina¹, Egor A. Koshkin³, Sergei V. Zolotukhin¹, Alexandr I. Klyachin¹, Valery V. Shipitsin¹, Yelena I. Sokoltchik¹, Evgeniya A. Koshkina¹, Sergei G. Koporov¹ & Evgeny A. Bryun^{1,2}

¹ Moscow Research and Practical Centre for Narcology, 37/1 Lyublinskaya Ulitsa, Moscow, Russia

² Russian Medical Academy of Continuous Professional Education, 2/1 Barrikadnaya Ulitsa, Moscow, Russia

³ I.M. Sechenov First Moscow State Medical University, 8 Trubetskaya Ulitsa, Moscow, Russia

Correspondence: Alexey J. Kolgashkin, Moscow Research and Practical Centre for Narcology, 37/1 Lyublinskaya Ulitsa, Moscow 109390, Russia. E-mail: ajkol@narcologos.ru

Received: December 28, 2021 Accepted: February 9, 2022 Online Published: February 17, 2022

doi:10.5539/gjhs.v14n3p87

URL: <https://doi.org/10.5539/gjhs.v14n3p87>

Abstract

The main aim of the study was to establish, whether the gender of a health professional affects the use of smartphone medical apps. We studied the basic patterns of smartphone use in doctors with the largest addiction clinic in Moscow, engaged in in-patient treatment, to access possible gender-determined “digital divide”, evaluate the current use of medical applications, and eventual intentions to use a decision-support app. We performed a cross-sectional study of a non-probability sample of medical doctors using a non-standardized anonymous self-questionnaire, covering 3 domains: socio-demographic and professional characteristics; present use of a mobile device; attitudes to the use of mobile medical apps. The study covered 212 of the 328 staff members, 56% men and 44% women. The largest age group was 41–50 years old (32.1%), followed by 51–60 (25%), 31–40 (23.6%), over 61 (10.8%) and 20-30 (8.5%). 77.8% of respondents use mobile Internet in the office to search for professionally relevant information. 86.5% would like to use mobile applications that help in their professional activities. We failed to confirm the hypothesis about possible gender-related features in the use of mobile devices in doctors. The dedicated mobile system for supporting clinical decision-making in addiction hospitals may be in-demand. The level of doctors’ use of mobile devices and mobile applications shows the absence of gender barriers to the utilization of such systems. In the future, we recommend studying other socio-demographic and occupational predictors affecting the use of professional mobile applications by health professionals of various specialties and the acceptability of the gaming approach in the field.

Keywords: digital divide, smartphone, mobile application, gender

1. Background

The introduction of modern digital technologies in healthcare is currently considered one of the most important tools to improve the quality and accessibility of medical care. Great attention is paid to this by WHO (WHA 71.7 26 May 2018) (WHO, 2019). Today we have two principal elements to facilitate the process – these are clinical decision support systems (CDSS) and smartphones.

O’Sullivan defined the concept of CDSS as: “a system that provides the clinician or patient with computer-generated clinical data or patient-related information that has been rationally selected and presented at the right time to improve patient care.” CDSS appeared over 50 years ago, but are still used in medical practice only on a limited scale. This is due to the need to process large volumes of high-quality data, digitize this data, as well as harmonize the principles of information processing by the system and existing practices of a particular medical institution (O’Sullivan et al., 2014).

In a systematic review, Khariat indicates that the introduction of CDSS in clinical practice is hampered by the fact that these systems were often developed without taking into account the opinions of practitioners and did not reflect the decision-making process (Khariat et al., 2018).

In 2003, the chapter “The Digital Divide and What to Do About It” by E. Hargittai was published in the New Economy Handbook. There the digital divide was defined as the inequality in access and use of the digital

environment, which is less used by women, ethnic minorities, people with low incomes and education, residents of rural areas, and older age groups (Hargittai, 2003). Hong noted that, despite the sharp increase in the availability of Internet technologies and related mobile devices in the last decade, the digital divide problem has not only not disappeared, but has acquired a new form – digital inequality. The question was no longer whether the user has access to the Internet, but whether he knows how to use it (Hong et al., 2017).

To the best of our knowledge, the number of studies on the digital divide and the digital inequality among health professionals, including doctors, is insignificant. Usually, one studies the very fact of the availability of smartphones and Internet access in remote and rural areas of underdeveloped countries (Shiferaw & Mehari, 2019; Yagos et al., 2017). At the same time, we met several works on the readiness of health professionals to work in the digital environment. In 2017, Albrecht conducted a comparative study of the use of mobile devices and related applications by doctors and ambulatory patients, depending on their socio-demographic parameters, such as age, education, gender, professional experience, concluding that the advantages of digital technologies are underused, both by doctors and patients (Albrecht et al., 2017).

The gender issues in the professional style of health professionals have been the subject of several studies. For example, Tsugawa found that older patients who were treated by female doctors were less likely to be re-hospitalized and die than patients of male doctors (Tsugawa et al., 2017). The frequency of re-hospitalization depending on the gender of the doctor was also considered (Skolka et al., 2020). It was noted that women doctors are distinguished by a more patient-oriented approach: they communicate more with patients and devote more time to them (Roter et al., 2002).

At the same time, there is a certain lack of knowledge concerning the influence of gender on patterns of attitude to and use of e- and mHealth technologies among health professionals.

In the article, we focused on a rather narrow aspect – the study of gender differences in the use of a smartphone both as a means of communication and a possible platform for CDSS by doctors working in the largest addiction clinic in Moscow

1.1 Aims and Objectives of the Study

The aim is to study the gender differences in the main patterns of smartphone use as a means of communication and access to the media, including in the professional activities among doctors providing in-patient care in an addiction clinic.

The objectives of the study were to answer the following research questions:

Is the gender-related phenomenon of the “digital divide” / “digital inequality” present or absent in health professionals?

Is there a gender difference in the use of medical smartphone applications by doctors and what are their attitudes to such use in the future?

Are there any gender differences in doctors’ preferences for the integral components of such applications?

2. Materials and Methods

3.1 Study Design

A cross-sectional study of a non-probability sample of doctors from the Moscow Scientific and Practical Center for Narcology (Center), working in three departments of the Center providing in-patient addiction treatment, was carried out. The study was approved by the local ethics committee of the Center (Protocol No. 3/18 of November 26, 18) and was conducted in March-April 2019.

3.2 Inclusion in the Study

Medical doctors of various specialties working in a hospital were invited to participate. Participation was voluntary. Remuneration of respondents was not provided, the fact of filling out the questionnaire was considered as consent to participate.

3.3 Research Tool

The non-standardized anonymous self-reporting questionnaire was developed by the authors. When developing it we used the provisions, expressed in (Jones et al., 2013; Rea L.M. & Parker R.A., 2014). In our view, it reflects the situation in which medical doctors find themselves in the digital environment. It consisted of 20 items covering 3 domains: individual socio-demographic and professional characteristics (4 items), current use of a mobile device (13 items), attitude to the use of mobile medical applications (3 items) (Appendix 1). Some of the questions

provided for a dichotomous, and some - multiple answers with the possibility to select all the proposed options, two items provided fields for free answers. The questionnaires were distributed during weekly clinical conferences in the respective inpatient departments. The doctors were provided with brief oral information on the study itself and the questionnaire. The completed questionnaires were collected by a member of the research team and assigned registration numbers, in which the number of the inpatient department and the serial number of the questionnaire were encoded. The data of the questionnaires were entered into a specially developed database, implementing the “double-entry” method with the subsequent correction of the detected errors. The basic principles of organizing information and technical support for the study were presented in our article (Nadezhdin A.V., 2018).

3.4 Statistical analysis

The data were analyzed using IBM SPSS 25.0 (Armonk, NY). We considered p-value of < 0.05 significant. Confidence intervals (95%) for proportions were calculated using the Wilson method applying Statclass software add-on (Predictive Solutions, Russia, Moscow) for IBM SPSS. To identify differences between categorical variables, the Pearson χ^2 test was used, and in the case of 2x2 tables with Yates correction for continuity. To determine the strength of association between two nominal or nominal and an ordinal variable we used Cramer's V. The interpretation of the values was carried out according to the recommendations of Rea & Parker (.00 and under .10 - negligible association, .10 and under .20 - weak association, .20 and under .40 - moderate association, .40 and under .60 - relatively strong association, .60 and under .80 - strong association, .80 and under 1.00 - very strong association) (Rea L.M. & Parker R.A., 2014).

Multivariate questions were considered as a set of univariate variables, indicating answer options. In other words, each answer option was presented as a dichotomous variable.

The sample size for the study was calculated using GPower 3.1.9.7 package with effect size = 0,3; $\alpha = 0.05$; power = 0.95; df = 2, giving total sample size of 172.

4. Results

The characteristics of the respondents are presented in Table 1. 212 of the 328 staff members of the Center who met the inclusion criteria participated in the study, 24.1% of participants represented the Center; 46.7% Clinical Branch No. 1; 29.2% - Clinical Branch No. 2. The gender division among respondents was 56% men and 44% women. The largest age group was 41–50 years old (32.1%), followed by 51–60 (25%), 31–40 (23.6%), over 61 (10.8%) and 20–30 (8.5%) years. According to the specialties, participants were distributed as follows: 77.4% addiction doctors, 14.6% doctors of other specialties, 5.7% anesthetists-resuscitators, 1.4% psychotherapists, 0.9% psychiatrists. 81.1% of the sample worked as resident doctors and 18.9% as department heads. Of the doctors interviewed, only 1 denied use of mobile communications, which amounted to 0.5% of the sample (for this reason, this case was excluded from further analysis). Of the doctors surveyed, 67% own mobile phones with the Android operating system, 21% use iOS, 12% use devices with other operating systems. To the question “Do you use mobile Internet” 89.6% gave an affirmative answer. The overwhelming majority of survey participants (70.9%) reported that they use one SIM card, 26.7% - two, 2.4% - three.

Table 2 presents the gender distribution of answers to the multivariate question “Do you use a mobile phone for ...”. It shows that differences were detected only in 2 cases. Affirmatively answered the question “Do you use the phone to listen to music” 35.0% of men and only 16.3% of women (the strength of association is moderate). Men also used their phones more often to watch video content 30.8% versus 15.2% (the strength of association is weak).

Table 3 presents the gender distribution of answers to the multivariate question “For you, a mobile phone is ...”. Here two differences are evident: women more often consider a smartphone as a means of everyday communication: 93.5% versus 82.9% for men (the strength of association is weak), and men more often use the gadget as a means of entertainment 21.4% against 9.8% for women (the strength of association is weak).

Table 4 presents data on the distribution of respondents' answers to several questions from our questionnaire, testing the hypothesis of possible gender differences in the use of mobile devices among doctors. There were no statistically significant differences between men and women in the answers to the vast majority of questions presented in the table, including items that were significant for the present study, such as the use of the Internet during office hours to search for professionally valid information; availability on a smartphone medical applications; intention to use similar applications in the future. It was also found that men spend much more time on the use of entertainment content. Answers to the question “How much time do you spend daily using multimedia features?” showed that 68.8% of men and 90.7% of women used those functions less than 1 hour daily. If we look at ranges of 1–2 hours and more than 2 hours, the performances of men were significantly higher: 22.9%

and 5.8% and 8.3% and 3.5%, respectively (the strength of association is moderate).

Table 1. Descriptive characteristics of the study sample

Variable	Total N (% within category)	95% CI	
		Lower limit	Upper limit
Inpatient department of the Center			
Head Office	51 (24,1)	0,188	0,3049
Clinical Branch № 1	99 (46,7)	0,401	0,5341
Clinical Branch № 2	62 (29,2)	0,2354	0,357
Gender			
Male	117 (56)	0,4896	0,6277
Female	92 (44)	0,3746	0,508
Age			
20-30	18 (8,5)	0,0544	0,1302
31-40	50 (23,6)	0,1837	0,2973
41-50	68 (32,1)	0,2616	0,3863
51-60	53 (25,0)	0,1965	0,3124
≥61	23 (10,8)	0,0734	0,1575
Doctors (by profession)			
Addiction Doctors	164 (77,4)	0,7127	0,8248
Psychotherapists	3 (1,4)	0,0048	0,0408
Psychiatrists	2 (0,9)	0,0026	0,0337
Resuscitation Anesthetists	12 (5,7)	0,0327	0,0963
Other professions	31 (14,6)	0,1049	0,2
Doctors (by appointments)			
Department Head	40 (18,9)	0,1417	0,2467
Resident Physician	172 (81,1)	0,7533	0,8583
Use of mobile communications			
Use	211 (99,5)	0,9738	0,9992
Do not use	1 (0,5)	0,0008	0,0262
Mobile phone operating system			
Android	140 (67,0)	0,6036	0,7301
iOS	44 (21,0)	0,1607	0,2707
Other	25 (12,0)	0,0823	0,1706

Table 2. Gender distribution of answers to the multivariate question “Do you use your mobile phone for ...” *

Variable	Men N (% within category)	Women N (% within category)	χ^2 ; df; p-value**	Cramer's p-value	V;
Communication with colleagues			0,532; 1; 0,466	0,071; 0,304	
Yes	112 (95,7)	85 (92,4)			
No	5 (4,3)	7 (7,6)			
Communication with clients			0,041; 1; 0,839	0,025; 0,723	
Yes	37 (31,6)	27 (29,3)			
No	80 (68,4)	65 (70,7)			
Communication with relatives and friends			<0,000; 1; 1 (0,733)***	0,024; 0,728	
Yes	113 (96,6)	88 (95,7)			
No	4 (3,4)	4 (4,3)			
Search for information on the Web			0,534; 1; 0,465	0,062; 0,369	
Yes	88 (75,2)	74 (80,4)			
No	29 (24,8)	18 (19,6)			
Social Media Communication			<0,000; 1; 1	0,005; 0,941	
Yes	40 (34,2)	31 (33,7)			
No	77 (65,8)	61 (66,3)			
Listening to music			8,289; 1; 0,004****	0,210; 0,002	
Yes	41 (35,0)	15 (16,3)			
No	76 (65,0)	77 (83,7)			
Playing games			1,776; 1; 0,183	0,110; 0,111	
Yes	12 (10,3)	4 (4,3)			
No	105 (89,7)	88 (95,7)			
Watching videos			6,016; 1; 0,014****	0,181; 0,009	
Yes	36 (30,8)	14 (15,2)			
No	81 (69,9)	78 (84,8)			
Reading texts			<0,000; 1; 1	<0,000; 0,996	
Yes	56 (47,9)	44 (47,8)			
No	61 (52,1)	48 (52,2)			
Taking photos			<0,000; 1; 1	0,003; 0,960	
Yes	67 (57,3)	53 (57,6)			
No	50 (42,7)	39 (42,4)			
Video recording			1,430; 1; 0,232	0,092; 0,181	
Yes	54 (46,2)	34 (37,0)			
No	63 (53,8)	58 (63,0)			
Respondent's option			<0,000; 1; 1 (1)***	0,018; 0,793	
Yes	6 (5,1)	4 (4,3)			
No	111 (94,9)	88 (95,7)			

* Each answer option is presented as a separate dichotomous variable

** For 2x2 tables, the Yates continuity correction was applied.

*** If 1 or more cells have expected count less than 5, we applied Fisher's Exact Test. Data presented as p-level.

****p-level less than 0,05.

Table 3. Gender distribution of respondents' answers to the multivariate question "For you, a mobile phone is ..."

Variable	Men N (% within category)	Women N (% within category)	χ^2 ; df; p-value*	Cramer's V; p-value
Business communication tool			0,095; 1; 0,758*	0,033; 0,638
Yes	87 (74,4)	71 (77,2)		
No	30 (25,6)	21 (22,8)		
Personal communication tool			4,359; 1; 0,037*	0,159; 0,022
Yes	97 (82,9)	86 (93,5)		
No	20 (17,1)	6 (6,5)		
Emergency communication tool			2,174; 1; 0,140*	0,112; 0,106
Yes	66 (56,4)	62 (67,4)		
No	51 (43,6)	30 (32,6)		
Status symbol			0,296; 1; 0,586 (0,505)**	0,087; 0,208
Yes	2 (1,7)	0 (0)		
No	115 (98,3)	92 (100)		
Entertainment tool			4,260; 1; 0,039	0,156; 0,024
Yes	25 (21,4)	9 (9,8)		
No	92 (78,6)	83 (90,2)		

* For 2x2 tables, the Yates continuity correction was applied.

** If 1 or more cells have expected count less than 5 we applied Fisher's Exact Test. Data presented as p-level.

*** Each answer option is presented as a separate dichotomous variable.

Table 4. Gender distribution of respondents' answers

Variable	Men N (% within category)	Women N (% within category)	χ^2 ; df; p-value*	Cramer's V; p-value
Do you use mobile Internet?			0,003; 1; 0,955*	0,020; 0,776
Yes	104 (88,9)	82 (90,1)		
No	13 (11,1)	9 (9,9)		
Do you use mobile communications at work?			0,001; 1; 0,975*	0,020; 0,774
Yes	108 (92,3)	83 (91,2)		
No	9 (7,7)	8 (8,8)		
Do you use mobile Internet during business hours?			0,226; 1; 0,635*	0,044; 0,524
Yes	84 (73,0)	70 (76,9)		
No	31 (27,0)	21 (23,1)		
How many SIM cards do you use?			0,336; 1; 0,562*	0,051; 0,463
1 card	80 (69,0)	67 (73,6)		
More than 1 card	36 (31,0)	24 (26,4)		

How long have you been using your mobile phone?			1,396; 2; 0,498	0,083; 0,498
1-10 years	21 (18,3)	17 (19,8)		
11-20 years	66 (57,4)	54 (62,8)		
> 20 years	28 (24,3)	15 (17,4)		
How much time do you spend daily talking on a cell phone?			0,398; 0,819**	2; 0,044; 0,819
< 1 hour	79 (68,1)	60 (66,7)		
1-2 hours	33 (24,8)	28 (31,1)		
> 2 hours	4 (3,4)	2 (2,2)		
How much time do you spend daily using multimedia features (music, movies, games)?			13,872; 2; 0,001	0,267; 0,001
< 1 hour	75 (68,8)	78 (90,7)		
1-2 hours	25 (22,9)	5 (5,8)		
> 2 hours	9 (8,3)	3 (3,5)		
How much time do you spend daily on mobile Internet, including social networking?			1,772; 2; 0,412	0,095; 0,412
< 1 hour	75 (68,2)	58 (65,9)		
1-2 hours	23 (20,9)	24 (27,3)		
> 2 hours	12 (10,9)	6 (6,8)		
Do you use the mobile Internet during business hours to search for professionally valid information?			0,640; 1; 0,424*	0,068; 0,332
Yes	86 (75,4)	73 (81,1)		
No	28 (24,6)	17 (18,9)		
Do you have installed medical mobile applications?			0,007; 1; 0,934*	0,016; 0,823
Yes	55 (48,2)	42 (56,7)		
No	59 (51,8)	48 (53,3)		
Would you like to use a mobile application that facilitates your professional performance?			0,719; 1; 0,397*	0,073; 0,293
Yes	101 (88,6)	76 (83,5)		
No	13 (11,4)	15 (16,5)		

* For 2x2 tables, the Yates continuity correction was applied.

** Proportion of cells with expected count less than 5 exceeds 20%.

*** p-level less than 0,05.

Answering a multiple answer question “What elements need to be included in the mobile application?” most respondents selected the options “clinical recommendations” (83.9%) and “pharmaceuticals” (83.9%). The next most popular options were ICD-10 (74.0%) and “clinical assessment scales” (58.3%). 41.1% of respondents would like to include information on the approved criteria for the quality of care, and 10.9% added their version to the answers (Figure 1). The gender distribution of answers to this question is presented in Table 5. Statistically significant differences with a weak association between the variables were established only in the “clinical scale” variant. 59% of men consider their presence in a medical mobile application to be necessary, compared to 43.5% of women.

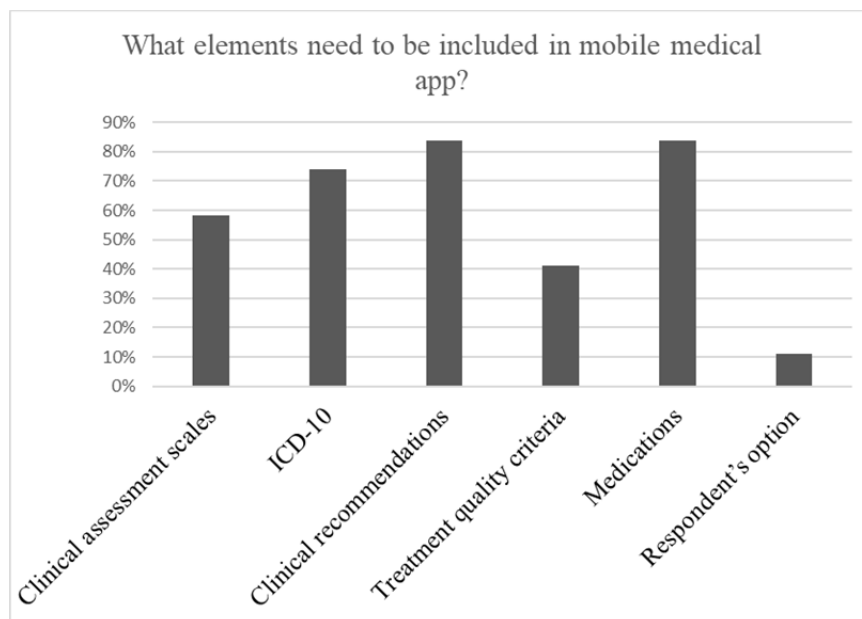


Figure 1. Answers to the question “What elements need to be included in the mobile application?”

Table 5. Gender distribution of respondents’ answers to the multivariate question “What elements need to be included in the medical mobile application?” *

Variable	Men N (% within category)	Women N (% within category)	χ^2 ; df; p-value**	Cramer’s V; p-value
Clinical assessment scales			4,355; 1; 0,037***	0,154; 0,026
Yes	69 (59,0)	40 (43,5)		
No	48 (41,0)	52 (56,5)		
ICD-10			2,308; 1; 0,129	0,115; 0,095
Yes	84 (71,8)	56 (60,9)		
No	33 (28,2)	36 (39,1)		
Clinical recommendations			0,442; 1; 0,506	0,057; 0,408
Yes	91 (77,8)	67 (72,8)		
No	26 (22,2)	25 (27,2)		
Treatment quality criteria			0,427; 1; 0,513	0,055; 0,425
Yes	47 (40,2)	32 (34,8)		
No	70 (59,8)	60 (65,2)		
Medications			0,662; 1; 0,416	0,068; 0,329
Yes	92 (78,6)	67 (72,8)		
No	25 (21,4)	25 (27,2)		
Respondent’s option			<0,000; 1; 1	0,008; 0,910
Yes	12 (10,3)	9 (9,8)		
No	105 (89,7)	83 (90,2)		

* Each answer option is presented as a separate dichotomous variable.

** For 2x2 tables, the Yates continuity correction was applied.

*** p-level less than 0,05.

5. Discussion

Results of the study show that Russian doctors working in inpatient departments of addiction clinics quite actively use basic mobile communication technologies. Almost 90% of the sample studied used mobile Internet, and 30% used more than one SIM card. 94.8% of respondents use mobile phones as a means of communicating with colleagues, 30% use them as a means of communicating with patients, 83% described their device as a means of business communication, and 91.5% reported that they use mobile communications at work. Mobile Internet is used to search for professionally valid information by 77.8% of respondents. Almost half have installed medical mobile applications. At the same time, more than 85% want to have an application that helps them with their specialization. This level of mastering mobile technologies, as we think, provides for the readiness of Russian doctors working in inpatient departments of addiction clinics to use not only specialized mobile applications but also CDSS.

Prospects for using CDSS on mobile devices have been shown long ago. Divall noted that even PDA computers will allow transferring the clinical decision support system from a desktop computer directly to the clinical setting (Divall et al., 2013). Around the same time, a systematic review by Mickan stated that handheld computers are effectively used by healthcare professionals for easy and timely access to information, they allow for accurate and complete medical documentation, provide immediate access to CDSS and patient management systems based on the principles of evidence-based medicine and also contribute to the implementation of effective work practices (Mickan et al., 2014). A large-scale study by Carvalho also notes a generally positive attitude of anesthesiologists to the use of mobile medical applications (Carvalho et al., 2020).

The hypothesis about possible gender features in the use of mobile devices among doctors remained to a large extent unconfirmed. At the same time, the proportion of women who are looking for professionally valid information using their mobile phones (81.1%) is greater than among men (75.4%). Also, the proportion of women who have installed medical mobile applications exceeds that of men: 56.7% versus 48.2%. On the other hand, 88.6% of men and 83.5% of women would like to use a mobile application that facilitates their professional performance. However, these differences were not statistically significant. The only exception was the use of multimedia, which was indicated by us in the “Results” section.

In answering the multivariate question “Do you use a mobile phone for ...”, gender differences were identified in items that were not directly related to the professional activities of the respondents. Men more often than women use their smartphones to listen to music and watch video content (35.0% versus 16.3% and 30.8% versus 15.2%).

When answering the multivariate question “A mobile phone is for you ...”, twice as many men consider it as a means of entertainment: 21.4% versus 9.8%. At the same time, women are more likely to perceive the phone as a means of everyday communication: 93.5% versus 82.0%. Even though we did not find statistically significant differences in answers to the question “Do you use a mobile phone for games?” (10.3% of men answered affirmatively against 4.3% of women), we may assume that men more often perceive a smartphone as a means of entertainment and leisure.

This naturally correlates with the tendency of men to use the multimedia function on their smartphones that we have identified. The question arises: can this feature be used for greater adherence to mobile professional solutions, and, as a result, CDSS? This can be accomplished, for example, by implementing the well-established principles for the gamification of different healthcare activities, previously applied mainly to patients. Considering that these principles, according to (Abdul Rahim & Thomas, 2017; Marques et al., 2017; Nadezhdin S.A., 2016; Sardi et al., 2017), began to be applied in the field of e-Health only in 2014, the process is at an early stage of its development and, undoubtedly, requires further research.

When answering the multivariate question “What elements need to be included in a mobile medical application ...” we did not find gender differences in the most common options: the need to include information on pharmaceuticals, providing access to clinical recommendations, ICD-10. (Note that, according to Tsugawa (Tsugawa et al., 2017), male doctors pay less attention to guidelines, which is not confirmed by our results). Statistically significant differences were demonstrated in the response option on the inclusion of clinical assessment scales in the application – this was more often suggested by men. It is difficult for us to interpret this difference – we can assume that female doctors are either better at using scales or male doctors want to formalize to greater extent information on the patient’s condition. We would also like to note that a very small percentage of respondents gave their options in the “Respondent’s option” field, which may indicate that practicing doctors are not well aware of what professionally valid information they can get from modern mobile applications.

4.1 Limitations of the Study

The main limitation of this study was the relatively small sample size since the work was carried out in one, albeit a large, specialized medical institution with a specific set of medical specialties. In this regard, its results should be interpolated with care to health professionals in general. It cannot be ruled out that there are possible recall biases and inaccuracies associated with the desire to give a socially acceptable answer (social desirability bias) in any observational study, which may also to some extent affect the result (Althubaiti, 2016).

The issues raised in this article are too complex and multifaceted to be considered in one publication. The authors are aware that a few problems have remained only outlined or mentioned and hope to cover them in more detail in their future works.

5. Conclusions

Thus, we found no noticeable differences in the use of the smartphone for household and professional purposes between male and female doctors. Similar results, although exploring the use of mobile applications, were demonstrated in (Albrecht et al., 2017). The existing gender features that we have established are not global, categorically do not show the existence of the gender “digital divide” phenomenon and, rather, point to the possibility of using different methods to strengthen the commitment of various doctors to work with medical mobile applications.

It seems important to fill the knowledge gap associated with the insufficient study of other socio-demographic and occupational predictors affecting the use of professional mobile applications by health professionals of various specialties.

We would also recommend investigating whether the use of gamification can help doctors to utilize mobile applications in their routine professional activities, and how this approach can be adapted to different health professional groups.

Competing Interests Statement

The authors declare that there are no competing or potential conflicts of interest.

References

- Abdul Rahim, M. I., & Thomas, R. H. (2017). Gamification of Medication Adherence in Epilepsy. *Seizure*, 52, 11-14. <https://doi.org/10.1016/j.seizure.2017.09.008>
- Albrecht, U.-V., Afshar, K., Illiger, K., Becker, S., Hartz, T., Breil, B., Wichelhaus, D., & von Jan, U. (2017). Expectancy, usage and acceptance by general practitioners and patients: exploratory results from a study in the German outpatient sector. *Digital Health*, 3, 1-22. <https://doi.org/10.1177/2055207617695135>
- Althubaiti, A. (2016). Information bias in health research: Definition, pitfalls, and adjustment methods. *Journal of Multidisciplinary Healthcare*, 9, 211-217. <https://doi.org/10.2147/JMDH.S104807>
- Carvalho, H., Verdonck, M., Forget, P., & Poelaert, J. (2020). Acceptance of mHealth among health professionals: A case study on anesthesia practitioners. *BMC Anesthesiology*, 20(1). <https://doi.org/10.1186/s12871-020-00958-3>
- Divall, P., Camosso-Stefinovic, J., & Baker, R. (2013). The use of personal digital assistants in clinical decision making by health care professionals: A systematic review. *Health Informatics Journal*, 19(1), 16-28. <https://doi.org/10.1177/1460458212446761>
- Hargittai, E. (2003). The Digital Divide and What To Do About It. In Jones D.C. (Ed.), *New Economy Handbook* (New Economy Handbook, pp. 822-841). Academic Press. <http://www.eszter.com/papers/c04-digitaldivide.html>
- Hong, Y. A., Zhou, Z., Fang, Y., & Shi, L. (2017). The digital divide and health disparities in China: Evidence from a national survey and policy implications. *Journal of Medical Internet Research*, 19(9). <https://doi.org/10.2196/jmir.7786>
- Jones, T. L., Baxter, M., & Khanduja, V. (2013). A quick guide to survey research. *Annals of the Royal College of Surgeons of England*, 95(1), 5-7. <https://doi.org/10.1308/003588413X13511609956372>
- Khairat, S., Marc, D., Crosby, W., & al Sanousi, A. (2018). Reasons for physicians not adopting clinical decision support systems: Critical analysis. *JMIR Medical Informatics*, 20(4). <https://doi.org/10.2196/medinform.8912>
- Marques, R., Gregório, J., Pinheiro, F., Póvoa, P., Mira Da Silva, M., & Lapão, L. V. (2017). How can information

- systems provide support to nurses' hand hygiene performance? Using gamification and indoor location to improve hand hygiene awareness and reduce hospital infections. *BMC Medical Informatics and Decision Making*, 17:15. <https://doi.org/10.1186/s12911-017-0410-z>
- Mickan, S., Atherton, H., Roberts, N. W., Heneghan, C., & Tilson, J. K. (2014). Use of handheld computers in clinical practice: A systematic review. *BMC Medical Informatics and Decision Making*, 14(1). <https://doi.org/10.1186/1472-6947-14-56>
- Nadezhdin A.V. (2018). Sistema informacionno-tekhnicheskoy podderzhki klinicheskogo nauchnogo issledovaniya. [IT-Support System for Clinical Research]. *Narkologia*, 17(8), 33-39. <https://doi.org/10.25557/1682-8313.2018.08.33-39>
- Nadezhdin S.A. (2016). Metody global'nogo informacionnogo kontrolya kak sposob optimizacii sistemy medicinskogo strahovaniya [Global Information Surveillance Methods as a Way to Optimize Health Insurance System]. *Narkologia*, 15(3), 78-83.
- O'Sullivan, D., Fraccaro, P., Carson, E., & Weller, P. (2014). Decision time for clinical decision support systems. *Clinical Medicine*, 14(4), 338-341.
- Rea L. M., & Parker R. A. (2014). *Designing and Conducting Survey Research A Comprehensive Guide*. John Wiley & Sons.
- Roter, D. L., Hall, J. A., & Aoki, Y. (2002). Physician Gender Effects in Medical Communication A Meta-analytic Review. *JAMA*, 177(2), 756-764. <http://jama.jamanetwork.com/>
- Sardi, L., Idri, A., & Fernández-Alemán, J. L. (2017). A systematic review of gamification in e-Health. *Journal of Biomedical Informatics*, 71, 31-48. <https://doi.org/10.1016/j.jbi.2017.05.011>
- Shiferaw, K. B., & Mehari, E. A. (2019). Internet use and eHealth literacy among health-care professionals in a resource-limited setting: A cross-sectional survey. *Advances in Medical Education and Practice*, 10, 563-570. <https://doi.org/10.2147/AMEP.S205414>
- Skolka, M., Lehman, E., Khalid, M., & Hennrikus, E. (2020). Physician characteristics correlate with hospital readmission rates. *Medicine*, 99(10), e19363. <https://doi.org/10.1097/MD.00000000000019363>
- Tsugawa, Y., Jena, A. B., Figueroa, J. F., Orav, E. J., Blumenthal, D. M., & Jha, A. K. (2017). Comparison of hospital mortality and readmission rates for Medicare patients treated by male vs female physicians. *JAMA Internal Medicine*, 177(2), 206-213. <https://doi.org/10.1001/jamainternmed.2016.7875>
- WHA 71.7 26 May 2018. (n.d.). *Digital health*.
- WHO. (2019). *Recommendations on digital interventions for health system strengthening*.
- Yagos, W. O., Tabo Olok, G., & Ovuga, E. (2017). Use of information and communication technology and retention of health workers in rural post-war conflict Northern Uganda: Findings from a qualitative study. *BMC Medical Informatics and Decision Making*, 17(1). <https://doi.org/10.1186/s12911-016-0403-3>

Appendix 1. Non-Standardized anonymous self-questionnaire

Dear colleague! We ask you to participate in an anonymous survey and answer the questionnaire. This survey will help us to get acquainted with the target audience and find out the demands for the development of a mobile application ("assistant" of an addiction doctor)

Thank you in advance for your cooperation.

Your gender	Male
	Female
Your age	20-30
	31-40
	41-50
	51-60
	Over 60
You are a department head	Yes
	No
You are	Addiction doctor
	Psychotherapist
	Psychiatrist
	Doctor of another speciality
	Resuscitation Anesthetist
Do you use cell phone?	Yes
	No
Do you use mobile Internet?	Yes
	No
Your mobile phone operating system is	Android
	iOS
	Other
Do you use mobile communications at work?	Yes
	No
How many SIM cards do you use?	1
	More than 1
How long have you been using your mobile phone?	1-10 years
	11-20 years
	> 20 years
Do you use your mobile phone for... (Multivariate question)	Communication with colleagues
	Communication with clients
	Communication with relatives and friends
	Search for information on the Web
	Social Media Communication
	Listening to music
	Playing games

	Watching videos
	Reading texts
	Taking photos
	Video recording
	Respondent's option
For you, a mobile phone is ... (Multivariate question)	Business communication tool
	Personal communication tool
	Emergency communication tool
	Status symbol
	Entertainment tool
How much time do you spend daily talking on a cell phone?	< 1 hour
	1-2 hours
	> 2 hours
How much time do you spend daily using multimedia features (music, movies, games)?	< 1 hour
	1-2 hours
	> 2 hours
How much time do you spend daily on mobile Internet, including social networking?	< 1 hour
	1-2 hours
	> 2 hours
Do you use the mobile Internet during business hours?	Yes
	No
Do you use the mobile Internet during business hours to search for professionally valid information?	Yes
	No
Do you have installed medical mobile applications?	Yes
	No
Would you like to use a mobile application that facilitates your professional performance?	Yes
	No
What elements need to be included in the medical mobile application? (Multivariate question)	Clinical assessment scales
	ICD-10
	Clinical recommendations
	Treatment quality criteria
	Medications
	Respondent's option

Copyrights

Copyright for this article is retained by the author(s), with first publication rights granted to the journal.

This is an open-access article distributed under the terms and conditions of the Creative Commons Attribution license (<http://creativecommons.org/licenses/by/4.0/>).

Prevalence and Characteristics of Oral Squamous Cell Carcinoma in Fiji: A Retrospective Study

Mehwish Dean¹, Ratu Osea Gavid², Masoud Mohammadnezhad³ & Richard D. Nair³

¹ Tavua Hospital, Tavua, Fiji

² School of Dentistry and Oral Health, Fiji National University, Suva, Fiji

³ School of Public Health and Primary Care, Fiji National University, Suva, Fiji

Correspondence: Masoud Mohammadnezhad, Associate Professor in Public Health (Health Promotions) School of Public Health and Primary Care, Fiji National University, Suva, Fiji. Tel: +679-97-26-127. E-mail: masoud.m@fnu.ac.fj

Received: January 23, 2022 Accepted: February 21, 2022 Online Published: February 22, 2022

doi:10.5539/gjhs.v14n3p100

URL: <https://doi.org/10.5539/gjhs.v14n3p100>

Abstract

Background: Oral squamous cell carcinoma (OSCC) is malignant epithelial neoplasm that affects the oral cavity. Despite the large number of studies on OSCC in the literature, details on the demographic profile of these lesions in different populations are limited, especially amongst the Fijian population, thus this study aimed to determine the prevalence and characteristics of OSCC cases diagnosed from 2011 to 2015 at the Colonial War Memorial Hospital (CWMH), Suva, Fiji Islands.

Materials and Methods: A retrospective quantitative study was carried out at the CWMH Histology department looking at OSCC cases diagnosed from 2011–2015. All confirmed cases were included in the study and excluded cases were suspected cases that were pending diagnosis and children. An extraction sheet was used for data collection which was designed to meet the requirements of study finding. This data was entered in SPSS software and then analyzed using the simple analytical tool as bar graphs and tables.

Results: There were 74 OSCC cases diagnosed in the study period. The occurrence of OSCC cases over the 5-year period was fluctuant with the year 2013 recording the highest number of cases (24 cases, 32%). During the reported period, more men suffered (53 cases, 72%) from this condition with the tongue (40%) being the commonest oral cancer site followed by the lip and vermillion border (28%). Individuals in the 40 to 60 years' age group (35 cases, 47.3%) were mostly affected with the I-taukei population (38 cases, 51.4%) recording the highest occurrence of OSCC. The results show that, the common occurrence is the tongue (40.5%) while the least presentation sight is Buccal mucosa/buccal sulcus area (8.1%).

Conclusion: The study concluded that more men suffer from oral squamous cell carcinoma compared to woman and the ethnicity that was most affected was I-taukei population. More detailed record keeping and reporting of oral cancer is needed to help evaluate progress in controlling oral cancer in the Fiji Islands. This availability of geographic data would further assist the Ministry of Health of Fiji in data collection and planning of preventative activities

Keywords: epidemiological Characteristics, Fiji, oral squamous cell carcinoma, prevalence

1. Introduction

Every year, non-communicable diseases (NCDs) account for more than 36 million premature deaths (Hawley and McGarvey, 2015). Oral squamous cell carcinoma (OSCC) is the sixth most common cancer worldwide (Kempen et al., 2015). OSCC is one of the widespread multifactorial etiological epithelial malignancies associated with high mortality and morbidity. OSCC may typically occur completely new or from the commonly referred to pre-existing oral lesions as potentially malignant oral disorders (Feller & Lemmer, 2012). Clinically, the lesion appears as an indolent ulcer with homogenous white patch in the early stages and is asymptomatic. Sometimes, there may be some discomfort and irritation (Rana et al., 2015; Gaitan-Cepeda, Peniche-Becerra, & Quezada-Rivera, 2011).

In the advanced stage of the disease, patients present with a number of clinical presentations including ulceration

or growth in the oral cavity, loosening of teeth, pain, malodour (halitosis), excessive salivation, bleeding, difficulty in speaking and swallowing, referred pain to the ear, swelling and ulceration of the face and neck swelling. The symptoms vary depending on the site of involvement (Muthu, Vaishnavi, & Sivadas, 2018). The exact aetiology of OSCC is unknown however it has been strongly associated with tobacco use and alcohol consumption, human papilloma virus and some other risk factors (Bugshan & Farooq, 2020; Mehrotra & Yadav, 2006).

Leukoplakia is a homogenous white patch like lesion often advances to oral cancer is one of the major types of potentially malignant condition according to (Sridharan, Ramani, Patankar, & Vijayaraghavan, 2019). Various parts of India, leukoplakia has a recorded incidence of 1.3–2.1 per 1000 individuals. Despite advancements in diagnosis and treatment over the decades, the disorder remains a concern for medical professionals with a 5-year survival rate of about 45% (Sridharan, Ramani, Patankar, & Vijayaraghavan, 2019). The incidence of OSCC has been increasing in most countries around the world predominantly in South and Southeast Asia, West and East European, Caribbean and in the Pacific (Siakholak et al., 2016; Purwanto et al., 2019; Selvamani, Yamunadevi, Basandi, & Madhushankari, 2015).

Prevalence of OSCC is increasing in Pacific Island Countries (PICs) such as Papua New Guinea and other Melanesian countries (Siakholak et al., 2016). It is important to report the occurrence of OSCC in Fiji that experiences different NCDs. In relevance to the population data of Fiji Gavidi et al., (2014); concluded that according to the annual age standardized ratio (ASR) for OSCC there were 13 per 1,000,000 persons compared to New Zealand population. This study was also a retrospective study based on Fiji's OSCC prevalence in comparison to New Zealand whereby same methodology was used to extract data of Fiji between years 2000 and 2010 as the present study which reflects OSCC cases between 2011 and 2015. Despite the large number of studies on OSCC in the literature, details on the demographic profile of these lesions in different populations are limited, especially amongst the Fijian population. Therefore, this study aimed to determine prevalence and characteristics and of OSCC over a period of 5 years from 2011 to 2015 in Fiji.

2.0 Materials and Methods

2.1 Study Design and Setting

This quantitative retrospective study was conducted at Colonial War Memorial Hospital (CWMH) and data was collected from 2011 to 2015. CWMH is the major referral hospital in Fiji comprising of 22 wards in total. All oral pathological cases are referred to for the confirmation of diagnosis, according to the pathologist of CWMH over a phone conversation, approximately 2 cancer cases are diagnosed weekly and 1 to 2 oral cancer per month. In this regard, the data collected in this study can be approximated as a representative of the national data evincing an increase in the prevalence of occurrence of OSCC among all multiracial groups in Fiji. For exact values of cases per week diagnosis, this was not available on patient information system as well; as it is only updated from year 2013 onwards and most records in this study are missing from the server itself, however they are keeping the manual registers which was used to access all missing data. The ward number was informed by the sister-in charge via phone call.

2.2 Study Population and Sample

In this study the age distribution was chosen at 10 year interval to highlight the occurrence of OSCC in younger individuals which are often misdiagnosed thus inappropriately treated, if data is available for younger populations there would be more vigilance in screening and easier tracking of the patients five-year survival period and cancer stages depending upon the TNM (Tumor, Node, Metastasis) stage of cancer. The exclusion criteria include all those records which are not confirmed diagnosis of OSCC and are suspected lesions only.

The age distribution used in this study is at a 5 year interval which proves the hypothesis yet again proven by Gavidi et al., (2014) that OSCC occurrence in both genders in Fiji was very similar for most age groups and very infrequent from the 1st to 4th decade of life; the age ratio increased in individuals from age 45 and over. Another reason for choosing age distribution at a 5 year interval was to highlight the occurrence of OSCC in younger individuals which are often misdiagnosed thus inappropriately treated, if data is available for younger populations there would be more vigilance in screening and easier tracking of the patients five-year survival period and cancer stages depending upon the TNM (Tumor, Node, Metastasis) stage of cancer.

2.3 Data Collection

All data was collected from the cancer registry and histopathology registers. All confirmed OSCC records between 2011–2015 was included in the study. The independent variables such as ethnic groups (I-taukei; Fijian of Indian decent; Fijians of other decent), gender (male and female) affected, age and location of lesion were included in the data.

2.4 Data Analysis

Data was entered on Microsoft excel spread sheet and then imported to Statistical Package for Social Sciences (SPSS) version 24 to perform a descriptive statistical analysis to generate the graphs and tables. This method was seen as plausible in a case study whereby the same procedure was applied to a large quantity of data (Nair et al. 2021). Each recorded registry was assigned a code to de-identify patient information which was kept in sealed envelopes. Patients' information such as the location of cancer, age range diagnosed, ethnicity, gender and year of diagnosis was then entered into the excel spreadsheet.

2.5 Ethical Approval

Ethical approval was obtained from the Fiji National University- College of Medicine, Nursing & Health Sciences Research & Ethics Committee (CHREC), the Fiji National Health Research & Ethics Committee (FNHREC) the Medical superintendent of CWMH and the head of Department of Histopathology at CWMH.

3. Results

Seventy-four cases of OSCC diagnosed at CWMH during the study period of 2011 to 2015. The results reveal that around two thirds of OSCC cases were male population (72%) and one third was female population (28%). It was also shown that OSCC was mostly diagnosed in individuals of age group 40–60 (35, 47.3%), that followed by the age group 60 and over (31, 41.9%). Also it was found that distribution of the cancer was almost fair amongst I-taukei (51.4%) and Indo Fijian (44.6%). the two larger ethnic populations of Fiji.

Table 1. Demographic features of patients with OSCC (n=74)

Variables	Year's n (%)					Total
	2011	2012	2013	2014	2015	
Gender						
Male	10(83)	8(67)	19(79)	4(40)	12(75)	53(72)
Female	2(17)	4(33)	5(21)	6(60)	4(25)	21(28)
Total per year	12 (100)	12(100)	24(100)	10(100)	16(100)	74(100)
Age						
20-29	0 (0)	2(16.66)	1(4.16)	0(0)	0(0)	3(4.05)
30-39	0(0)	0(0)	2(8.33)	3(30)	0(0)	5(6.75)
40-49	6(50)	4(33.3)	5(20.8)	1(10)	1(6.25)	17(22.9)
50-59	1(8.33)	3(25)	7(29.16)	3(30)	4(25)	18(24.3)
60-69	4(33.3)	2(16.66)	6(25)	0(0)	3(18.75)	15(20.27)
70-79	1(8.33)	1(8.33)	2(8.33)	3(30)	7(43.75)	14(18.91)
80-89	0(0)	0(0)	1(4.16)	0(0)	1(6.25)	2(2.70)
Ethnicity						
I-taukei	7(58.3)	7(41.7)	12(50.0)	4(40.0)	8(50.0)	38(51.4)
Indo Fijian	5(41.7)	4(33.3)	12(50.0)	6(60.0)	6(37.5)	33(44.6)
Fijians of other decent	0(0)	1(8.3)	0(0)	0(0)	2(12.5)	3(4.1)

Figure 1 shows the total number of cases diagnosed each year along the study period. The results show that, the confirmed cases of OSCC were same for years 2011 and 2012 (each 12 cases, 16.2% of total cases). There was a significant increase of diagnosed cases in 2013, cases was twice as much being 24 cases (32.4% of total cases) then fluctuated between 2014 (13.5%) and 2015, 10 cases (13.5%) and 16 cases (21.6%); respectively.

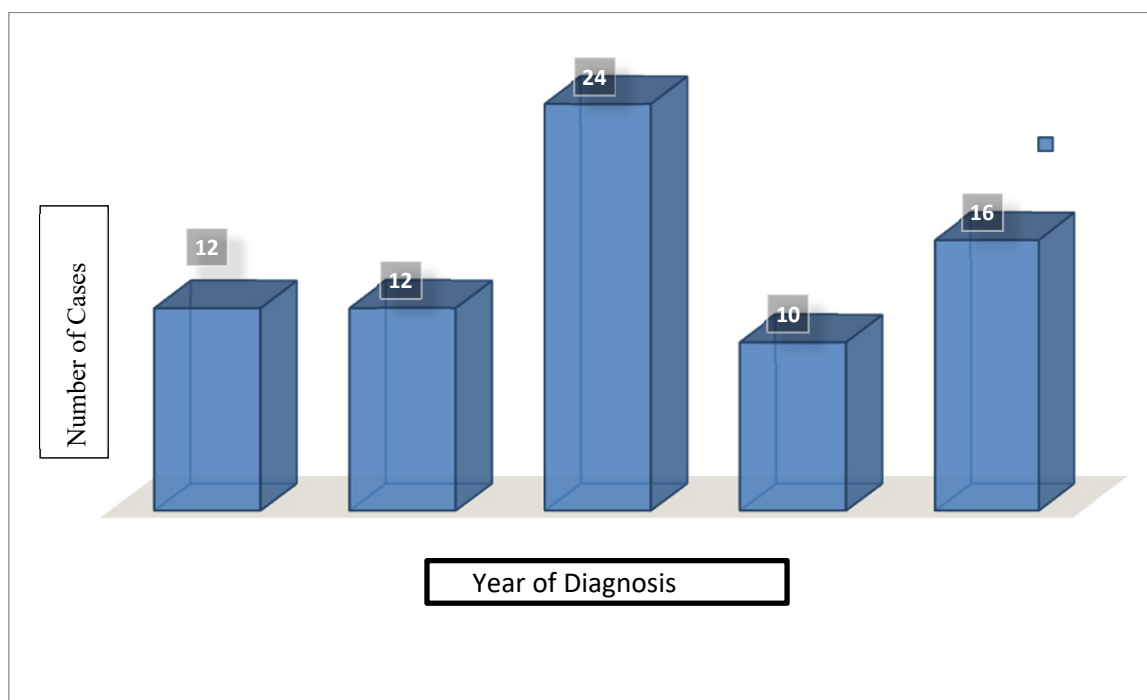


Figure 1. Frequency of OSCC cases diagnosed from 2011-2015

Table 2 shows the clinical characteristic of OSCC specifically its location of occurrence over the study period. The results show that, the common occurrence is the tongue (40.5%) and lips and vermilion border of the lips (28.4%). It is also noted that very least presentation sight is Buccal mucosa/buccal sulcus area (8.1%), Floor of mouth/ventral tongue (10.8%), and the soft palate and tonsillar area (12.2%).

Table 2. Clinical characteristics of OSCC

Variables	Year n (%)					Total
	2011	2012	2013	2014	2015	
Cancer Location						
Tongue	7(58.3)	3(25)	12(50)	5(50)	3(18.8)	30(40.5)
Lips and vermilion boarder	1(8.3)	6(50)	5(28.8)	4(40)	5(31.3)	21(28.4)
Buccal mucosa/buccal sulcus	3(25)	0(0)	0(0)	0(0)	3(18.8)	6(8.1)
Floor of mouth/ventral tongue	1(8.3)	2(16)	2(8.3)	0(0)	6(18.8)	8(10.8)
Soft palate e/tonsil area	0(0)	1(8.3)	5(20.8)	1(10)	2(12.5)	9(12.2)

4. Discussion

There were 74 cases of OSCC diagnosed in CWMH during the 2011–2015 time period compared with 124 cases for the whole of Fiji Islands in the 2000–2010 time period (Gavidi et al., 2014). This suggests that there has been an increase in the average annual number of OSCC cases in Fiji since the 2000-2010 time period. There was a reduction in concurrence between 2014 and 2015 that could be correlated to early detection and diagnosis by the oral surgery team which was more strongly formed in 2013. However, during the study period the cases included were confirmed diagnosed cases only; pending diagnosis cases were excluded

The finds of this study revealed that males had more OSCC than females. This is an interesting finding since the previous study reported by Gavidi et al., (2014) showed equal distribution between both genders. Over the study period, it was noticed that oral squamous cell carcinoma was not dependent on gender or ethnicity. All ethnic groups in the study namely Itaukei and Fijian of Indian descent and Fijians of other origins were affected inclusive of both males and females. Lumukana and King, (2003) reported that amongst Solomon Island men, OSCC was

attributed to have a high prevalence with a male to female ratio of 1:3 hence showing a male predilection of the disease.

In this study, individuals in the age group of 40–60 years were mostly affected with the itaukei (natives) population recording the highest occurrences (51.4%), followed by Fijian of Indian descent (44.6%) and the minority population of Fijians from others descent having the lowest occurrence (4.1%). This suggests that ethnicity does not play a major role in the occurrence of the disease but the occurrence can be narrowed down to the practises by these ethnic groups in later studies. This is another interesting occurrence as middle aged individuals are reported to have the highest occurrence of the disease. OSCC occurrence in both genders in Fiji was very similar for most age groups and very infrequent from the 1st to 4th decade of life; the age ratio increased in individuals from age 45 and over.

Additionally, late stage of disease at diagnosis occurred for 100% for cancer of the base of the tongue, 90% for cancer of the gingiva and floor of the mouth, while early stages of disease occurred for 100% of cancer of the lip. This could be related to the cell structure of these locations intra-orally that makes it more prone to be affected as compared to other locations with highly keratinised cells; however more advanced screening such as TNM staging and risk factor identification of individual case presentation is required to reach a precise conclusion. In a study by Albuquerque et al., (2011) it was instituted that the lateral borders of the tongue were the most repeated carcinoma locations in both groups (drinking and smoking persons as well as nondrinking and non-smoking subjects). According to them, lateral border showed 59.7% and 40.3% in user and nonusers, respectively. In similar study by Falaki et al., (2011) 158 cases of OSCC was analysed and again it was found that the most mutual site of involvement was the tongue (66%) and lateral border of the tongue. These studies and their results are similar to present study results as we also concluded tongue 40.5% to be the most common site affected

Cancers of the oral cavity have been reported to have a high mortality rate and despite the current advancement in treatment options, the situation has not improved. Five-year survival rates ranging from 30% to 80% have been reported from several parts of the world. Survival rates are lower in low and middle income countries in comparison to high income countries (Sargeran et al., 2008). A retrospective study carried out in the Spanish city of Cordoba from 1989 to 2005 reported that, of the 89 OSCC cases the 5- year survival rates were lowest (35–40%) amongst those 61 to 70 years of age (Bolesina et al., 2007). The most frequent cancer location was in the tongue (26%), followed by gum (23%) and floor of the mouth (11%). The highest mortality rate occurred for cancer of the base of the tongue, the gum and the floor of the mouth having the rates of; 100%, 88% and 85%, respectively (Bolesina et al., 2007).

The observed 5-year survival rate in OSCC stage I was 75% whereas only 23% of the patients survived with Stage IV disease. In the study by Gavidi et al., (2014) that compared the incidence of OSCC in New Zealand and Fiji, 1916 cases of OSCC occurred in NZ in the 11-year study period and 124 in Fiji, 89% and 93% of all oral malignancies respectively. The annual age standardized incidence rate for New Zealand and Fiji was 4.2 and 1.3 per 100,000 individuals, respectively.

Nagler (2006) suggested that oral carcinogenesis of tobacco may be due, at the molecular level, to an interaction between the redox-active metals in saliva and the low reactive free radicals in cigarette smoke. The result may be that saliva loses its antioxidant capacity and instead becomes a potent pro-oxidant milieu. In addition, dehydrogenase oxidizes ethanol to acetaldehyde, which is cytotoxic and results in the production of free radicals and DNA hydroxylated bases that includes alcohol dehydrogenase type 3 genotypes which appear to predispose to OSCC.

Alcohol consumption was the most prevalent risk factor for oral cancer found in New Zealand, followed by tobacco (Gavidi et al., 2014). Given the high prevalence of these two risk factors and their synergistic effect, it becomes essential for doctors and dentists to encourage smoking cessation in smokers and to recommend judicious alcohol intake amongst heavy drinkers. Other factors include betel nut chewing together with smoking, impaired immune function, poor nutrition status and human papilloma virus infections. Chronic irritation from dentures were proved to be a modifying factor rather than an initiator of oral squamous cell carcinoma.

5. Limitations

The major limitations of the study were unavailability of detailed data and record keeping for individual case. Also no proper system of records was followed and the patient information system was only updated from 2013 and were missing a significant amount of data.

Manual counting of patients by over going the registers may have been subjected to human errors of overlooking any case. It was noted that many results were discussed over the phone call to practitioners and the exact diagnosis

was not documented in the register thus these cases had to be excluded from total number of cases found. Suspected cases were also excluded as no record of follow ups were available to give exact diagnosis.

Another major limitation was time, the registers were only given for maximum of 2 hours three times a week and it was difficult to compile all data in sheets within the time frame, delayed response from the medical superintendent for release of registers added more to the gist of difficulties.

6. Conclusion

The study concluded that more men suffer from oral squamous cell carcinoma compared to woman and the ethnicity that was most affected was I-taukei population. More detailed record keeping and reporting of oral cancer is needed to help evaluate progress in controlling oral cancer in the Fiji Islands. Factors such as tumour size, location, bone involvement, skin involvement, lymphovascular and perineural invasion, invasive front grading, DNA-ploidy status and histopathology should be recorded when cancers are diagnosed to assess whether there is favourable trend towards earlier diagnosis and the prevention of oral cancer. The demographic, geographic and ethnic variations in the incidence plays important role especially for zone nurses to identify the hot spots for cases. In this study, the most affected ethnic group is the i-taukei population and the most common site affected is tongue second by lips and vermilion border.

7. Recommendations

The prognostic determination factors such as; presence or absence of metastasis, number and site of positive nodes, size of metastatic deposit, laterality of positive nodes, extra-capsular spread and post-operative nodal stage should be taken into consideration. This would assist in holistic management of such cases.

This availability of geographic data would further assist the Ministry of Health of Fiji in data collection and planning of preventative activities. More community awareness and primary screening outreach programs should be provided to the population of Fiji especially individuals in the fourth to fifth decade of their life.

Competing Interests Statement

The authors declare that there are no competing or potential conflicts of interest.

References

- Albuquerque, R., López-López, J., Mari-Roig, A., Jané-Salas, E., Roselló-Llabrés, X., & Santos, J. (2011). Oral tongue squamous cell carcinoma (OTSCC): alcohol and tobacco consumption versus non-consumption. A study in a Portuguese population. *Brazilian Dental Journal*, 22(6), 517-521. <https://doi.org/10.1590/S0103-64402011000600013>
- Boring, C., Squires, T., Tong, T., & Montgomery, S. (1994). Cancer statistics, 1994. *CA: A Cancer Journal for Clinicians*, 44(1), 7-26. <https://doi.org/10.3322/canjclin.44.1.7>
- Bugshan, A., & Farooq, I. (2020). Oral squamous cell carcinoma: metastasis, potentially associated malignant disorders, etiology and recent advancements in diagnosis. *F1000research*, 9, 229. <https://doi.org/10.12688/f1000research.22941.1>
- Cancers of the Oral Mucosa: Background, Pathophysiology, Etiology. (2022). Retrieved 23 January 2022, from <http://emedicine.medscape.com/article/1075729-overview>.
- Falaki, F., Dalirsani, Z., Pakfetrat, A., Falaki, A., Saghravanian, N., Nosratzahi, T., & Pazouki, M. (2011). Clinical and histopathological analysis of oral Squamous cell carcinoma of young patients in Mashhad, Iran: A retrospective study and review of literature. *Medicina Oral Patología Oral Y Cirugía Bucal*, e473-e477. <https://doi.org/10.4317/medoral.16.e473>
- Feller, L., & Lemmer, J. (2012). Oral Squamous Cell Carcinoma: Epidemiology, Clinical Presentation and Treatment. *Journal of Cancer Therapy*, 3(04), 263-268. <https://doi.org/10.4236/jct.2012.34037>
- Fiji Bureau of Statistics. (2012). *2007 Fiji Census of Population and Housing - Analytical Report*. Suva: Fiji Bureau of Statistics.
- Fiji population (2017) live - Country meters 2017. Retrieved 23 January 2018, from <https://countrymeters.info/en/Fiji>
- Gaitan-Cepeda, L., Peniche-Becerra, A., & Quezada-Rivera, D. (2011). Trends in frequency and prevalence of oral cancer and oral squamous cell carcinoma in Mexicans. A 20 years' retrospective study. *Medicina Oral Patología Oral Y Cirugía Bucal*, e1-5e. <https://doi.org/10.4317/medoral.16.e1>

- Gavidi, R., Cox, B., King, T., & Rich, A. (2014). Epidemiological differences in oral squamous cell carcinoma in New Zealand and Fiji. *Pathology*, *46*, S9. <https://doi.org/10.1097/01.PAT.0000443429.70369.cb>
- Glance, F. (2017). *Fiji Bureau of Statistics - Fiji Bureau of Statistics*. Retrieved 23 January 2022, from: <http://www.statsfiji.gov.fj/>
- Hawley, N., & McGarvey, S. (2015). Obesity and Diabetes in Pacific Islanders: the Current Burden and the Need for Urgent Action. *Current Diabetes Reports*, *15*(5). <https://doi.org/10.1007/s11892-015-0594-5>
- Kempen, P., Noorlag, R., Braunius, W., Moelans, C., Rifi, W., & Savola, S. et al. (2015). Clinical relevance of copy number profiling in oral and oropharyngeal squamous cell carcinoma. *Cancer Medicine*, *4*(10), 1525-1535. <https://doi.org/10.1002/cam4.499>
- Lumukana R, King T (2003). Smoking and chewing habits of oral cancer patients in the Solomon Islands. *Pacific Health Dialogue*, *10*, 41-44. PMID: 16276941
- Mehrotra, R., & Yadav, S. (2006). Oral squamous cell carcinoma: Etiology, pathogenesis and prognostic value of genomic alterations. *Indian Journal of Cancer*, *43*(2), 60. <https://doi.org/10.4103/0019-509X.25886>
- Meo, L., Phillips, D., & Brough, R. (1996). Smoking in Viti Levu, Fiji. *Pacific Health Dialogue*, *3*, 41-42
- Muthu, K., Vaishnavi, V., & Sivasdas, G. (2018). Warning Signs and Symptoms of Oral Cancer and its Differential Diagnosis. *Journal of Young Pharmacists*, *10*(2), 138-143. <https://doi.org/10.5530/jyp.2018.10.32>
- Nagler, R., & Dayan, D. (2006). The Dual Role of Saliva in Oral Carcinogenesis. *Oncology*, *71*(1-2), 10-17. <https://doi.org/10.1159/000100445>
- Nair, R., Odrovakavula, L., Mohammadnezhad, M., Raman Reddy, K., Gohil, D., & Sami, S. (2021). Data Cleaning Needs and Issues: A Case Study of the National Reproductive Health Assessment (RHA) Data from Solomon Islands. *Global Journal of Health Science*, *13*(3), 23. <https://doi.org/10.5539/gjhs.v13n3p23>
- Neville, B., & Day, T. (2002). Oral Cancer and Precancerous Lesions. *CA: A Cancer Journal for Clinicians*, *52*(4), 195-215. <https://doi.org/10.3322/canjclin.52.4.195>
- Nicolás Bolesina, Fabián L. Femopase, Silvia A. López de Blanc, Rosana A. Morelatto and María Alicia Olmos (2012). *Oral Squamous Cell Carcinoma Clinical Aspects, Oral Cancer*. Dr. Kalu U. E. Ogbureke (Ed.). <https://doi.org/10.5772/32968>
- Markopoulos, A. (2012). Current Aspects on Oral Squamous Cell Carcinoma. *The Open Dentistry Journal*, *6*(1), 126-130. <https://doi.org/10.2174/1874210601206010126>
- Parkin, D. (2006). The evolution of the population-based cancer registry. *Nature Reviews Cancer*, *6*(8), 603-612. <https://doi.org/10.1038/nrc1948>
- Purwanto, D., Soedarsono, N., Reuwpassa, J., Adisasmita, A., Ramli, M., & Djuwita, R. (2019). The prevalence of oral high-risk HPV infection in Indonesian oral squamous cell carcinoma patients. *Oral Diseases*, *26*(1), 72-80. <https://doi.org/10.1111/odi.13221>
- Rana, M., Kanatas, A., Herzberg, P., Khoschdel, M., Kokemueller, H., Gellrich, N., & Rana, M. (2015). Prospective study of the influence of psychological and medical factors on quality of life and severity of symptoms among patients with oral squamous cell carcinoma. *British Journal of Oral and Maxillofacial Surgery*, *53*(4), 364-370. <https://doi.org/10.1016/j.bjoms.2015.01.019>
- Sargeran, K., Murtomaa, H., Safavi, S., Vehkalahti, M., & Teronen, O. (2008). Survival after diagnosis of cancer of the oral cavity. *British Journal of Oral and Maxillofacial Surgery*, *46*(3), 187-191. <https://doi.org/10.1016/j.bjoms.2007.11.004>
- Screening.iarc.fr. (2018). *A digital manual for the early diagnosis of oral neoplasia*. Retrieved 22nd January, 2022, from https://screening.iarc.fr/atlasoral_list.php?cat=B2&lang=1
- Selvamani, M., Yamunadevi, A., Basandi, P., & Madhushankari, G. (2015). Prevalence of oral squamous cell carcinoma of tongue in and around Davangere, Karnataka, India: A retrospective study over 13 years. *Journal of Pharmacy and Bioallied Sciences*, *7*(6), 491. <https://doi.org/10.4103/0975-7406.163511>
- Siakholak, F., Ghoncheh, M., Pakzad, R., Gandomani, H., Ghorat, F., & Salehiniya, H. (2016). Epidemiology, incidence and mortality of oral cavity and lips cancer and their relationship with the human development index in the world. *Biomedical Research and Therapy*, *3*(10), 872-888. <https://doi.org/10.15419/bmrat.v3i10.129>

- Silverman, S. Jr, Dillon, W. & Fischbein, N. (1998). Diagnosis. In Silverman S. Jr ed. *Oral Cancer* (4th ed., pp. 41-66). Hamilton, Ontario, Canada: BC Decker Inc.
- Sridharan, G., Ramani, P., Patankar, S., & Vijayaraghavan, R. (2019). Evaluation of salivary metabolomics in oral leukoplakia and oral squamous cell carcinoma. *Journal of Oral Pathology & Medicine*, 48(4), 299-306. <https://doi.org/10.1111/jop.12835>
- Surveillance, Epidemiology, and End Results Program. (2022). Retrieved 23 January 2022, from <https://seer.cancer.gov/>
- Warnakulasuriya, K., Robinson, D., & Evans, H. (2003). Multiple primary tumours following head and neck cancer in southern England during 1961-98. *Journal of Oral Pathology & Medicine*, 32(8), 443-449. <https://doi.org/10.1034/j.1600-0714.2003.00179.x>

Copyrights

Copyright for this article is retained by the author(s), with first publication rights granted to the journal.

This is an open-access article distributed under the terms and conditions of the Creative Commons Attribution license (<http://creativecommons.org/licenses/by/4.0/>).

An Observational Study on Barbers' Practices and Associated Health Hazard in Fiji

Dip Chand¹, Masoud Mohammadnezhad¹ & Sabiha Khan¹

¹ School of Public Health and Primary Care, Fiji National University, Suva, Fiji

Correspondence: Associate Professor Dr Masoud Mohammadnezhad, School of Public Health and Primary Care, Fiji National University. Tel: +679-97-26-127. E-mail: masraqo@hotmail.com

Received: January 20, 2022 Accepted: February 28, 2022 Online Published: March 1, 2022

doi:10.5539/gjhs.v14n3p108

URL: <https://doi.org/10.5539/gjhs.v14n3p108>

Abstract

Background: The barbers' work is associated to many infectious diseases which lead to major cause of morbidity and mortality in human's population globally. This study aimed to determine barbers' practices and health hazards associated with their profession in Fiji.

Materials and Methods: A cross sectional quantitative study was conducted to collect data from 50 observational sessions among barbers in Suva, Fiji in 2020. A sample of 25 barbers were randomly selected to participate in this study. A checklist was used to record and collect data. Out of the 25 barbershops observed none of them carried out any form of sterilization.

Results: Only 4 (16%) did some form of disinfection with home bleach and savalon randomly while 84% did not have any form of decontamination in place. The results further illustrate that 22 (88%) of the disinfection were not potent while 3 (12%) were unknown. Similarly, 22 (88%) had inappropriate methods of disinfection and 3 (12%) were questionable. None of the barbershops observed had supply of hot water and only 15 (60%) had sufficient privy and hand washing facilities. Furthermore, only 6 (24%) used PPEs compared to 19 (76%) were in non-compliance.

Conclusion: This finding calls for immediate attention of authorities to enforce relevant laws and create awareness and training to improve standards in barbering profession.

Keywords: barbering instruments, health hazards, decontamination, Fiji, observation, practices

1. Introduction

The current estimated burden of infectious diseases in Fiji is around 18.4% which are preventable and treatable as well (MOHMS Fiji, 2017), but continue to thrive owing to ignorance to personal and environmental hygiene including poor political commitment to public health over clinical services (Chaudhry et al., 2010). According to the World Bank (WB) and World Health Organization (WHO) report "Tracking progress towards Universal Health Coverage", millions of people globally have insufficient provision of essential health services (WHO & WB, 2015). Furthermore "The global epidemiology of infectious diseases" report states that many families in Low- and Middle Income Countries (LMICs) are propelled into utmost poverty due to excessive health care costs (WHO, 2006). Currently, at least half of the world's population do not have access to health services they need (Lopez et al., 2006). The lack of equipment's and medicine, water and electricity; shortages of doctors; prohibitive costs; obsolete infrastructure of hospitals and clinics; poorly trained nurses and midwives; they all stand in the way of providing good quality healthcare to all. This must change (Kruk et al., 2018).

The above situations aggravate the delivery of health care services in developing countries, where infectious diseases are the major cause of all human deaths, killing more than 11 million people annually apart from diminishing the lives of countless others (Downey, 2005; Abia et al., 2016). Furthermore, infectious diseases related to barbers' profession remains the major cause of morbidity and mortality in human beings particularly in developing and underdeveloped countries (Wazir et al., 2008). Even though many infectious diseases are preventable and treatable in developing countries, personal, environmental and food hygiene, poor water and sanitation (WASH) pollution caused by poor waste management, ignorance to Good Hygiene Practices (GHP) and poor political commitments persist (Khandiat et al., 1999).

There are several transmission modes of infectious diseases however the most common routes of transmission in

barbershops include airborne, faeco-oral, infected instruments and direct spread through person-to-person transmission (Amodio et al., 2010; James et al., 2017). Since barbers' profession involves cutting any type of hair, give shaves, and trim beard which are potential routes of transmission to several infectious diseases which increases the burden of infectious diseases in many developing and under developed countries (Almasi et al., 2016). In view of the above barbering operations in Fiji may expose a large proportion of its clients with several health hazards silently if preventive measures are continued to be ignored as demonstrated by previous studies. (Amir & Raymond, 2005; Shahid et al., 2013). Considering the grave consequences of infections especially Hepatitis, HIV and recent outbreak of COVID19, related to barbers' profession; bona fide barbering practices is imperative to control infections associated with this profession (Janjua & Nizamy, 2002).

The frequency and severity of Communicable Disease (CD) out breaks in Fiji is well documented. Despite this, there had been no previous study carried out in Fiji neither in Pacific Island Countries (PIC) in particular on barbers to gauge their practices that may be helpful to eliminate and prevent many common CDs associated with barbering profession. In addition, lack of relevant literature on many data base on the research topic and many studies cited did not avail full text therefore only abstracts were used.

Since Fiji is a small island nation, and barbering profession is considered as small and medium enterprises (SME) that provides employment opportunities to school drop outs and substantially contributes to Fiji's economic growth. In this regard barbershop standard is well stipulated in the Public Health Act and Regulations which forms the basic standards on the Hair Dresser and Chiropractor practices in the country. These standards were formulated by the Colonial British Government which is still very much practical. Despite having stringent laws in place, the enforcement of these Laws are still neglected by the relevant authorities especially in barbershops when inspections are carried out for annual licensing. However, Hair salons and beauty salons which are niche market for higher class including tourism have higher rate of compliance and standards which would be a bench mark for compliance in barbershops that serves ordinary Fijians at an affordable cost. Therefore, the purpose of the study was to observe practices and health hazards associated with barber's profession in Suva Fiji and to bench mark against regulated standards of practice as per Public Health Act and Regulations. The results of this study will help the health authorities to understand the dynamics of disease transmission and design appropriate interventions in relation to barbering profession in Fiji which serves majority of the ordinary Fijians.

2. Materials and Methods

2.1 Study Design and Settings

A cross-sectional study was conducted to observe practices and health hazards associated with barber's profession between June and November 2020 in Suva, Fiji which also serves as the national and regional hub for Fiji and the Pacific respectively. There were 48 barbershops operating at the time of this study.

2.2 Study Sample

All the barbershops operating in Suva were considered as study population. Out of 48 barbershops that were in operation during the time of study, a sample size of 25 barbers were randomly selected for this study. The inclusion criteria applied was all those barbershops that were operating at least for 6 months in Suva and were currently licensed. Beauty salons and hair salons were excluded from the study including those barbershops who were hesitant to participate were also excluded. A sample size of 25 barbers were randomly selected for this study.

2.3 Data Collection Tool

A checklist was used for the observation. Checklist was developed using relevant literatures (John J, 2011) to fulfill the aim and objective of the study. The observational checklist had 10 sections or areas for observation such as whether any decontamination was practiced, method of decontamination, name of disinfectants, Virucidal potency of the decontamination, appropriateness of the decontamination exercise, accidental cuts, GHP, conditions of the barbershops, adequate supply of hot and cold water, adequate provision of privy facilities and provision of Personal Protective Equipment's (PPEs) to bench mark against Fijis Public Health Act and Regulations on Hairdressers (Kruk et al., 2018). The observation was carried out by the principle researcher at least 2 random sessions to avoid biasness and to maintain the reliability and credibility of the observational sessions conducted.

2.4 Study Procedure

Suva City Council (SCC) provided the facility approval and records of barbershops, their locations and other relevant details. The owners of the barbershops were contacted by phone and physical visit by the principle researcher and were explained the purpose of this observational study. The barbershop owners were assured that no disturbances will be caused to the normal operations during the time of observations. Barbershops anonymity and

privacy of information was assured. A written consent was obtained once the participating barbershop agreed to participate. All barbershop owners were informed of their privilege and right to withdraw from this study at any time. The checklist prepared was used to collect the information while observing the practices. Questions that needed to be responded were asked during the observation session and forms filled accordingly.

2.5 Data Management and Analysis

Data was managed manually as per the checklist criteria. The notes taken during the observations was rechecked to ensure that quality is maintained. Data analysis was done using the checklist which was tabulated under different headers. Raw data was entered under each header and frequency and percentage was calculated manually.

2.6 Ethics Approval

Ethical approval for the study was obtained from Fiji National University (FNU) College of Health Research Committee (CHREC) and the facility approval was also obtained from SCC. For data collection all barbershop owners were informed through the information sheet the purpose of the visit and documented consents were secured from barbershop owners.

3. Results

3.1 Demographic Characters of Participants

Twenty-five barbers representing the entire traceable barbers in the study area were interviewed during the observational sessions. The age of the participants ranged between 18 and 39 years. When grouped, age group 18-29 years predominated at 18 (72%). Hundred percent of the barbers were males and Fijians of Indian descent. Major religion practiced were Hinduism among majority respondents. Sixteen (64%) were currently married and 100% had secondary level of education. All the participants earned \$150 to \$250 Fijian Dollars per week. All barbershops were in operation for more than 4 years and non-had undergone any form of training (Table 1).

Table 1. Demographic characteristics of participants (n=25)

Characteristics	Frequency	Percentage
Age		
18–29 years	18	72
30–39 years	7	28
Sex (Gender)		
Male	25	100
Race		
Fijian of Indian Decent	25	100
Religion		
Hindu	21	84
Muslim	4	16
Marital Status		
Currently married	16	64
Never married	9	36
Education Level		
Secondary	25	100
Weekly Income		
\$150-\$250	25	100
Duration of Practice		
>4 years	25	100
Training received		
No	25	100

3.2 Barbers Practices

Out of the 50 barbering sessions observed, 100% use equipment's such as electrical clippers, scissors, razors, barber blades, combs, hair brush, save brush, cape, neck duster, hand mirror, powder puff and water sprayer.

As Table 2 shows, out of the 25 barbershops observed only 4 (16%) did some form of disinfection with home bleach and savalon randomly while 84% did not have any form of decontamination in place. The results also reveal that none of the 25 barbershops observed carry out any form of sterilization of barbering equipment's while only 16% used some form of chemical decontamination and 84% had no means of decontaminating there barbering equipment's. In terms of using disinfectant, the results showed that only 4% used Methylated spirits with 10% methanol, Sodium hypochlorite (Janola-home bleach) and Savalon while majority (88%) did not use any form of chemicals or sterilization.

Table 2. Participants practices (n=25)

Factors	Frequency	Percentage
Instrument decontamination done?		
Yes	4	16
No	21	84
Method of Instrument Decontamination		
Sterilization	0	0
Disinfection	4	16
None	21	84
Name of disinfectant used		
Methylated spirits with 10% methanol	1	4
Sodium hypochlorite (Janola- Bleach)	1	4
Savalon	1	4
Others	22	88

Table 3 illustrates that twenty-two (88%) of the disinfection were not potent while 3 (12%) were unknown. Similarly, 22 (88%) had inappropriate methods of disinfection and 3 (12%) were questionable. During the observations, 2 (8%) sessions involved incidental cuts and only 14 (56%) had GHP and their barbershops in good order. None of the barbershops observed had supply of hot water and only 15 (60%) had sufficient privy and hand washing facilities. Furthermore, only 6 (24%) used PPEs compared to 19 (76%) were in non-compliance.

Table 3. Observation results (n=25)

Factors	Frequency	Percentage
Virucidal potency of the decontamination		
Potent	0	0
Not potent	22	88
Unknown	3	12
Appropriateness of the decontamination exercise		
Appropriate	0	0
Inappropriate	22	88
Questionable	3	12
Accidental cut		
Yes	2	8
No	23	92
GHP & Barbershop in Good order		
Yes	14	56
No	11	44

Adequate supply of Hot and cold water		
Yes	0	0
No	25	100
Sufficient Privy and hand washing facility		
Yes	15	60
No	10	40
PPEs used		
Yes	6	24
No	19	76

4. Discussion

This study aimed to determine barbers' practices on health hazard associated with their profession in Fiji. Out of the 25 barbershops observed, all barbers were males and 72% were between the age of 18–29 years. All Barbers had education up to secondary school level and non-had any training on barbering. The results also show that out of the 25 barbershops observed none of them carried out any form of sterilization. Only 4 (16%) did some form of disinfection with home bleach and savalon randomly while 84% did not have any form of decontamination in place. The results further illustrate that 22 (88%) of the disinfection were not potent while 3 (12%) were unknown. Similarly, 22 (88%) had inappropriate methods of disinfection and 3 (12%) were questionable. During the observations, 2 (8%) sessions involved incidental cuts and only 14 (56%) had Good Hygiene Practice (GHP) and their barbershops in good order. None of the barbershops observed had supply of hot water and only 15 (60%) had sufficient privy and hand washing facilities. Furthermore, only 6 (24%) used PPEs compared to 19 (76%) which were in non-compliance.

The results of this study revealed that none of them were practicing instrument decontamination and sterilization. Similar views have been reported in previous studies in Iran, (Almasi et al., 2016) South Africa (James et al., 2017) and Pakistan (Shahid et al., 2013). Findings reveal that barbers only clean their instruments with brush, wet cloth and oil the machines when required. The studies did not relate these findings to demographic characteristics however it is believed that most street, road side and corner barber shops do not adhere to best practices as regulated by these countries. Government policies on SMEs to promote income generating avenues in poor communities were the challengers regarding compliance issues by the authorities (James et al., 2017). Studies conducted in South Africa and Rawalpindi Pakistan reported similar findings (Amir & Raymond, 2005; Janjua & Nizamy, 2004). Perhaps decontamination is seen as synonyms with routine cleaning of barbering equipment's with wet cloths, and oiling the clippers which is understood as physically clean, regardless of the invisible microbial load on the barbering equipment's. Studies conducted in Pakistan and Ethiopia had similar findings (Janjua & Nizamy, 2004; Zuwudic et al., 2002). Though provision of hot water for decontamination of instruments is regulated by Public Health Act (PH Act) and Regulations poor awareness and enforcement compelled by political interference, barbershops compliance issues with barbershops have been eroded gradually. Obsolete laws and poor litigation capacity also contributes to non-compliances as stated in other studies (James et al., 2017; Kruk et al., 2018). These findings strongly suggest for aggressive awareness and training by the authorities to meet the minimum requirements.

Observations further revealed that no participant was found to be disinfecting or sterilizing their barbering equipment's before use on each and every client contrary to requirements of the Public Health H Act and Regulations of Fiji (PH Act, 1935).

In addition, most of the barbering practices observed posed direct risk of infection from their clients and from clients to clients through contaminated instruments which were neither sterilized nor decontaminated. This agrees with the findings reported among barbers in a study conducted in North-West Ethiopia (Beyen et al., 2012). Barbers are at direct risk of CD infection if they come into contact with an infected person or equipment's especially blood or contagious diseases of the skin including air born viral infections. The risk becomes higher if they have cuts or bruises that are not properly protected, particularly on the arms (Jokhio et al., 2010). Findings revealed that the practice on equipment non decontamination was consistent in all barbershops irrespective of the location and scale of operations. This concludes that barbers lacked knowledge in the areas such as expertise on decontamination/disinfection and sterilization of barbering instruments; lacked recognition on basic infection control and insight on infection transmission and control. A study conducted in Hyderabad Pakistan showed

similar results (Jokhio et al., 2010). However, this finding is in variance to a study conducted in Oyo State in Nigeria where findings demonstrated high sterilization rate among barbers (Salami et al., 2005). The study, probably needed further investigation whether decontamination procedures were probably administered.

Though majority of participants appeared not to observe the decontamination or sterilization process, only few who did used some form of decontamination which were inappropriately carried out. These findings are similar to studies conducted in Nigeria (Salami et al., 2005) and Bangladesh (Chanda et al., 2004). Standard disinfectants that are recommended for use in health care facilities and personal care settings do recognizes 5.25% household bleach, 70% isopropyl alcohol, and iodophors as intermediate level disinfectants which kills the microorganisms for low level disinfectants plus fungi but does not recognize water, wet cloth and oil as disinfectants (Chanda et al., 2004).

On the other hand, observations results revealed that majority of participants do not wear coats/overalls, face mask neither hand gloves while serving clients especially during this COVID19 pandemic. Furthermore, none were using any paper towels, clean and fresh face towels, neck protectors, neck cloths, and other fabrics for each and every customer as required by the Public Health Act of Fiji (Public Health Act, 1935) and the Australia Public Health (Hairdressing) Code of Practice. The finding of this study is similar to studies conducted on barber's practices in Ethiopia (Zuwudic et al., 2002) and the purpose of wearing proper PPEs for barbers and clients may be the consequence of lack of knowledge on infection transmission and prevention.

Results of observational sessions revealed that none of the barbers were practicing the basic hand hygiene practice by washing their hand with soap and clean water after serving each and every client. Hundred percent sessions observed used the same cape for each and every client. Furthermore, there was no screening conducted for clients coming with infectious diseases. Studies conducted in Karachi Pakistan (Almasi et al., 2016) and Kumasi Ghana (Mutocheluh & Kwarteng, 2015) had similar findings that barbers would attend to any clients who present to them. However, these findings are at variance to studies conducted in developed countries. (Lyons et al., 2013; Amodio et al., 2010; Moda & King, 2019)

Observations further revealed that majority of the barbers used same brushes with powder on clients to remove hair from shoulder and neck and also for cleaning instruments in the same barbering procedure with the high chances of cross contamination. This finding was also consistent to similar studies conducted in Ethiopia (Beyen et al., 2012) and Cameroon (Kana et al., 1998). Lack of knowledge and awareness on cross contamination and GHP may be the rationale leading to improper practices. Studies suggest that to improve GHP in barbershops Massive, Repetitive, Intensive and Persuasive (MRIP) awareness may be involved (Lopez et al., 2006; Ottawa Charter for Health Promotion, 1986). This finding tends to suggest that authorities need to train, inform and create awareness on all barbershops to standardize the barbering practice. These were similar sentiments expressed in studies conducted in Hyderabad Pakistan and Sokoto Nigeria. (Jokhio et al., 2010; Ibrahim et al., 2007)

In addition, lack of enforcement and monitoring by authorities may be another reason for substandard hygiene practices among barbers. Similar findings have also been revealed in studies conducted in developing countries (Almasi et al., 2016). Contrary to findings in many developed countries where activities of barbers are properly regulated and monitored by way of thorough training and licensing process (Ann, 2006). Fijian authorities have neglected barbers' activities despite having a stringent Public health laws in place. (Public Health Act, 1935)

Incidental cuts are known as skin damage which are preconditions required for infectious diseases to arise. Skin damage during barbering usually happens as an accidental cut or abrasion as a result of blade-to-skin contact or both, increases the potential of infection transmission. In many circumstances incidental cuts and skin damages occur due to blade-to- skin contact or when detachable plastic comb is not used. (TAOD & HPU, 2002)

All the sessions observed in this study involved procedures which led blade-to-skin contact with increased risk of skin abrasion and cuts. Consequently, two sessions observed actually resulted into accidental cuts on the clients whereby no action was taken to disinfect the instruments concerned and the victims of the cuts. Failure to disinfect instruments and provide first aid to clients due to minor cuts during barbering sessions seem to be regarded as insignificant as reported in several previous studies. (Amodio et al., 2010; Almasi et al., 2016; Ibrahim et al., 2007; Correa & Gisselquist, 2006) The raise in fashion especially in young Fijians for the zero-cut hairstyle may be a contributing factor for barbers not to use detachable plastic combs or clippers during barbering sessions which poses increased risk of incident cuts and abrasion (Australian Public Health (Hairdressing) Code of Practice 2000 and John 2011). Therefore, the Fijian authorities need to derive the best practices to maintain barbershops standards within the ambit of the current laws. The 1935 Public Health Act and Regulations relating to hair dressers need to be reviewed to address practices based on scientific data and research.

4.1 Limitations

As this study is a cross sectional study, the results of this study can't be generalized to all of Fiji. This study was conducted during the COVID19 pandemic; therefore, the sample size was small due to closer of few barbershops. Furthermore, more recent studies on the topic were not available on the several data base.

5. Conclusions

The finding from this study reveal that majority of barbershops did not practice decontamination and sterilization of barbering equipment's. Those that had some form of decontamination such as home bleach and spirits were inappropriate and questionable. Majority barbers did not practice GHP neither cleaned the barbering equipment's with appropriate decontamination solutions nor with hot and sterile cloth. Majority of them did not have proper PPEs and the conditions of many barbershops needed to comply with the requirements of the PH Act. This tends to suggest that authorities need to strengthen enforcement, train and create awareness on all barbershops to standardize the barbering practice. It also suggests that the training contents should place more emphasis on, and employ more appropriate techniques such as demonstration while teaching technical and practical subjects like decontamination. Laxity in monitoring and enforcement of Public Health Act is another contributing factor for noncompliance despite having a stringent Public health laws in place which needs to be reviewed to suite the current and future needs of the country.

Acknowledgements

We would like to thank all the barbershops for their participation in this study including all those who provided their valuable support in this study such as SCC, FNU CHREC and MOHMS. The authors remain grateful to the barbershop owners who voluntarily allowed to participate in this study.

Competing Interests Statement

The authors declare that there are no competing or potential conflicts of interest.

References

- Almasi, A., Dargahi, A., Mohammadi, M., Amirian, F., Shokri, A., & Tabandeh, L. (2016). Comparative study of awareness, attitude, and performance of hairdressers in west regions of Iran in terms of personal hygiene, decontamination of tools and devices, and general status of building. *Journal of Chemical and Pharmaceutical Sciences*, 9(4), 3056-3062.
- Abia, W. A., Fomboh, R., Ntungwe, E., Abia, E. A., Serika, W. A., & Ageh, M. T. (2016). Assessment of occupational health hazards awareness and common practices amongst barbers and hairdressers in Cameroon. *Journal of Public Health in Developing Countries*, 2(1), 94-101.
- Amodio, E., Di Benedetto, M. A., Gennaro, L., Maida, C. M., & Romano, N. (2010). Knowledge, attitudes and risk of HIV, HBV and HCV infections in hairdressers of Palermo city (South Italy). *European journal of public health*, 20(4), 433-437. <https://doi.org/10.1093/eurpub/ckp178>
- Khaliq, A. A., & Smego, R. A. J. (2005). Barber shaving and blood-borne disease transmission in developing countries: issues in medicine: SAMJ forum. *South African Medical Journal*, 95(2), 94-96.
- Ann, 2006 sterilization. Retrieved March 3, 2007 from <http://www.licenses.state.us/barbers> .org
- Beyen, T. K., Tulu, K. T., Abdo, A. A., & Tulu, A. S. (2012). Barbers' knowledge and practice about occupational biological hazards was low in Gondar town, North West Ethiopia. *BMC Public Health*, 12(1), 1-7. <https://doi.org/10.1186/1471-2458-12-942>
- Catalogue.nla.gov.au. 2021. Public Health (Hairdressing) Code of Practice 2000 | National Library of Australia. Retrieved 15 January, 2021, from <https://catalogue.nla.gov.au/Record/1919163>
- Chanda, S. K., & Khan, K. H. (2004). Sharing of razor-blade in salons and risks of spreading HIV in Bangladesh. In *The 3rd IAS Conference on HIV pathogenesis and Treatment*.
- Chaudhry, M. A., Rizvi, F., Ashraf, M. Z., Afzal, M., & Niazi, S. (2010). Knowledge and practices of barbers regarding hepatitis B and hepatitis C in Bahra Kahu, Islamabad-Pakistan. *Rawal Med J*, 35(1), 37-40. Retrieved May 5, 2015, from <http://www.wikipedia.org.com> Barber
- Correa, M., & Gisselquist, D. (2006). Reconnaissance assessment of risks for HIV transmission through health care and cosmetic services in India. *International journal of STD & AIDS*, 17(11), 743-748. <https://doi.org/10.1258/095646206778691068>
- Downey, C. (2005). *Can Saloons spread infections? Third Age Health Encyclopedia*. Retrieved July 5, 2007 from

- http://www.gettingon.org/isi_news.htm.
- Ibrahim, M. T., Opara, W. E., & Tanimomo, T. (2007). Knowledge of HIV/AIDS, infection prevention practices and accidental skin cuts in barbing saloons in Sokoto, Nigeria. *Nigerian Medical Practitioner*, 51(6), 123-127. <https://doi.org/10.4314/nmp.v51i6.28857>
- Muleme, J., Kankya, C., Ssempebwa, J. C., Mazeri, S., & Muwonge, A. (2017). a Framework for integrating Qualitative and Quantitative Data in Knowledge, attitude, and Practice studies: a case study of Pesticide Usage in eastern Uganda. *Frontiers in public health*, 5, 318. <https://doi.org/10.3389/fpubh.2017.00318>
- Janjua, N. Z., & Nizamy, M. A. M. (2004). Knowledge and practices of barbers about hepatitis B and C transmission in Rawalpindi and Islamabad. *Journal of Pakistan medical association*, 54(3), 116.
- Jokhio, A. H., Bhatti, T. A., & Memon, M. S. (2010). Knowledge, attitudes and practices of barbers about hepatitis B and C transmission in Hyderabad, Pakistan. *EMHJ-Eastern Mediterranean Health Journal*, 16 (10), 1079-1084, 2010. <https://doi.org/10.26719/2010.16.10.1079>
- John, J. (2011). *The knowledge, attitude, practice and perceived barriers towards screening for premalignant cervical lesions among women aged 18 years and above in Songea urban* (Ruvuma. Muhimbili University of Health and Allied Sciences).
- Kana, F., Ndongmo, C., Kembou, E., & Kaptue, L.N. (1998). Sensitization of barbers on SIT/AIDS in Bafousson, *Cameron International Conference on AIDS*.
- Khandait, D. W., Ambadekar, N. N., & Vasudeo, N. D. (1999). Knowledge and practices about HIV transmission among barbers of Nagpur City. *Indian journal of medical sciences*, 53(4), 167-171.
- Kruk, M. E., Gage, A. D., Arsenaault, C., Jordan, K., Leslie, H. H., Roder-DeWan, S., ... & Pate, M. (2018). High-quality health systems in the Sustainable Development Goals era: time for a revolution. *The Lancet global health*, 6(11), e1196-e1252. [https://doi.org/10.1016/S2214-109X\(18\)30386-3](https://doi.org/10.1016/S2214-109X(18)30386-3)
- Laws of Fiji; Public Health Act 1935.
- Lopez, A. D., Mathers, C. D., Ezzati, M. D., Jamison, T., & Murray, C. J. (2006). *Changes in individual behavior could limit the spread of infectious diseases*. London: Oxford University Press; 2006.
- Lyons, G., Roberts, H., Palmer, A., Matheson, M., & Nixon, R. (2013). Hairdressers presenting to an occupational dermatology clinic in Melbourne, Australia. *Contact Dermatitis*, 68(5), 300-306. <https://doi.org/10.1111/cod.12016>
- MOHMS, Fiji. Health Information Unit Annual report, 2017, CD section, page 16.
- Moda, H. M., & King, D. (2019). Assessment of occupational safety and hygiene perception among afro-caribbean hair salon operators in Manchester, United Kingdom. *International Journal of Environmental Research and Public Health*, 16(18), 3284. <https://doi.org/10.3390/ijerph16183284>
- Mutocheluh, M., & Kwarteng, K. (2015). Knowledge and occupational hazards of barbers in the transmission of hepatitis B and C was low in Kumasi, Ghana. *The Pan African Medical Journal*, 20. <https://doi.org/10.11604/pamj.2015.20.260.4138>
- Ottawa Charter for Health promotion. (1986). *Health Promotion International*, 1(4), 405-405. <https://doi.org/10.1093/heapro/1.4.405>
- Salami, K. K., Titiloye, M. A., Brieger, W. R., & Otusanya, S. A. (2005). Observations of barbers' activities in Oyo State Nigeria: implications for HIV/AIDS transmission. *International quarterly of community health education*, 24(4), 319-330.
- Shahid, A., Nasim, S., & Memon, A. A. (2013). Insight and educational intervention concerning hepatitis among roadside barbers and their clients in Karachi, Pakistan. *The Journal of Infection in Developing Countries*, 7(02), 125-129. <https://doi.org/10.3855/jidc.2290>
- The World Bank. *Tracking Progress Towards Universal Health Coverage. 2015*. Retrieved from <https://www.worldbank.org/en/events/2015/06/12/trackinguhc>
- TAOD & HPU, 2002, *Hairdressing policy*, The Department of Alcohol and other drugs and HIV Health Promotion. Retrieved June 2007 from http://www.nsweel.on/docs/des_HAIRDRESSING.doc
- World Health Organization [WHO]. (2006). *The global epidemiology of infectious diseases*. Retrieved from <http://www.who.int/publications/2004/9241592303.pdf>

Wazir, M. S., Mehmood, S., Ahmed, A., & Jadoon, H. R. (2008). Awareness among barbers about health hazards associated with their profession. *J Ayub Med Coll Abbottabad*, 20(2), 35-8.

Zewudie, T., Legesse, W., & Kurkura, G. (2002). Knowledge, attitudes and Practices among barbers in South-western Ethiopia. *Afr Newslett on Occup Health and Safety*, 12(3), 69-71.

Copyrights

Copyright for this article is retained by the author(s), with first publication rights granted to the journal.

This is an open-access article distributed under the terms and conditions of the Creative Commons Attribution license (<http://creativecommons.org/licenses/by/4.0/>).

Reviewer Acknowledgements for Global Journal of Health Science, Vol. 14, No. 3

Global Journal of Health Science wishes to acknowledge the following individuals for their assistance with peer review of manuscripts for this issue. Their help and contributions in maintaining the quality of the journal are greatly appreciated.

Global Journal of Health Science is recruiting reviewers for the journal. If you are interested in becoming a reviewer, we welcome you to join us. Please contact us for the application form at: gjhs@ccsenet.org.

Reviewers for Volume 14, Number 3

Ama Pokuaa Fenny, University of Ghana, Ghana
Ayesha Johnson, University of South Florida, United States of America
Farahnaz Amini, UCSI University, Malaysia
Gavric Zivana, University Banja Luka, Bosnia and Herzegovina
Georgann Valerie Weissman, Capella University, United States of America
Karthek R Balapala, University Tunku Abdul Rahman, Malaysia
Krzysztof Goniewicz, Medical University of Warsaw, Poland
Loray Daws, British Columbia Masterson Institute, Canada
Marcel Wullschleger, University of Bern, Switzerland
Meng Zhao, Texas A&M University at Corpus Christi, United States of America
Pedram Iranmanesh, Dentist, Independent Researcher, Iran
Pi-Ming Yeh, Missouri Western State University, United States of America
Samir Othman, Hawler Medical University, Iraq
Soontareeporn Meepring, Naresuan University, Thailand
Tawheda El-saidy, Menoufia University, Egypt
Thandiwe Marethabile Letsie, University of the Free State, South Africa
Thanusin Saleeon, Mae Fah Lung University, Thailand

Call for Manuscripts

Global Journal of Health Science is a peer-reviewed journal, published by Canadian Center of Science and Education. The journal publishes research papers in the fields of public health, community health, environmental health, behavioral health, health policy, health service, health education, health economics, medical ethics, health protection, and equity in health. The journal is published in both printed and online versions, and the online version is free to access and download.

We are seeking submissions for forthcoming issues. All manuscripts should be written in English. Manuscripts from 3000–8000 words in length are preferred. All manuscripts should be prepared in MS-Word format, and submitted online, or sent to: gjhs@ccsenet.org

Paper Selection and Publishing Process

- a) Upon receipt of a submission, the editor sends an e-mail of confirmation to the submission's author within one to three working days. If you fail to receive this confirmation, your submission e-mail may have been missed.
- b) Peer review. We use a double-blind system for peer review; both reviewers' and authors' identities remain anonymous. The paper will be reviewed by at least two experts: one editorial staff member and at least one external reviewer. The review process may take two to three weeks.
- c) Notification of the result of review by e-mail.
- d) If the submission is accepted, the authors revise paper and pay the Article Processing Charge.
- e) A PDF version of the journal is available for download on the journal's website, free of charge.

Requirements and Copyrights

Submission of an article implies that the work described has not been published previously (except in the form of an abstract or as part of a published lecture or academic thesis), that it is not under consideration for publication elsewhere, that its publication is approved by all authors and tacitly or explicitly by the authorities responsible where the work was carried out, and that, if accepted, the article will not be published elsewhere in the same form, in English or in any other language, without the written consent of the publisher. The editors reserve the right to edit or otherwise alter all contributions, but authors will receive proofs for approval before publication.

Copyrights for articles are retained by the authors, with first publication rights granted to the journal. The journal/publisher is not responsible for subsequent uses of the work. It is the author's responsibility to bring an infringement action if so desired by the author.

More Information

E-mail: gjhs@ccsenet.org

Website: <http://gjhs.ccsenet.org>

The journal is peer-reviewed
The journal is open-access to the full text
The journal is included in:

CNKI Scholar	PKP Open Archives Harvester
DBH	SHERPA/RoMEO
Google Scholar	Standard Periodical Directory
JournalTOCs	Ulrich's
JournalSeek	Universe Digital Library
LOCKSS	WorldCat
Open J-Gate	

Global Journal of Health Science

Monthly

Publisher	Canadian Center of Science and Education
Address	1595 Sixteenth Ave, Suite 301, Richmond Hill, Ontario, L4B 3N9, Canada
Telephone	1-416-642-2606
Fax	1-416-642-2608
E-mail	gjhs@ccsenet.org
Website	gjhs.ccsenet.org

