ORIGINAL ARTICLE

PREDICTORS OF CLINICAL BREAST EXAMINATION AND MAMMOGRAPHY SCREENING UPTAKE AMONG WOMEN AGED 20-79 YEARS IN MALE' REGION, MALDIVES

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ABSTRACT

Breast cancer is the most prevalent form of cancer among women. Breast cancer is identified as the second-highest cancer in the Maldives and the most common cancer among females. Early detection and diagnosis of breast cancer facilitate effective treatment and cure. The main objective of the study is to identify the factors that serve as potential predictors for breast cancer screening uptake (CBE and Mammography) among women in the Male' region. The cross-sectional study was conducted among 600 women aged 20-79 years in the Male' region. Stratified random sampling was used to select the study sample. Data was collected using an interviewer-administered questionnaire. About 41.40% and 34.40% of the respondents reported ever having a CBE and a mammogram done respectively. Significant predictors for CBE uptake were age [OR=1.045, 95% CI(1.019-1.072)], ever being diagnosed for any breast disease [OR=12.405, 95% CI(4.099-37.541)], having regular medical check-up [OR=2.156, 95% CI(1.301-3.573)], knowledge on early detection of BC [OR=1.108, 95% CI(1.030-1.193)], perceptions on the susceptibility to BC [OR=1.100, 95% CI(1.022-1.184)], perceptions on the benefits of CBE [OR=1.163, 95% CI(1.036-1.306)], perceptions on barriers towards CBE [OR=0.926, 95% CI(0.866-0.991)], self-efficacy [OR=0.960, 95% CI(0.925-0.996)] and ever performed BSE [OR=2.447, 95% CI(1.423-4.209)]. Significant predictors for mammography screening uptake were having regular medical check-up [OR=2.896, 95% CI(1.289-6.503)], benefits of mammography screening [OR=1.131, 95% CI(1.003-1.277)], and ever done CBE [OR=19.135, 95% CI(7.461-49.077)]. Breast cancer screening uptake rates among Maldivian women are found to be low. Focused and well-planned multiple strategies are needed to enhance the health-promoting and preventive behaviours among Maldivian women for better management of breast cancer burden in the country.

Keywords: *Predictors, Clinical Breast Examination, Mammography Screening, Maldives*

INTRODUCTION

Breast cancer (BC), is the most prevalent form of cancer among women, impacting 2.1 million women each year, and causes the highest number of cancer-related deaths among women[1]. In 2018, it is estimated that 626,679 women died from BC, and worldwide, the BC rates are increasing in almost every region[1]. Recent studies are showing an increase in the number of newly diagnosed cases and high mortality rates resulting from BC in developing countries[2]. Additionally, in developing countries, half of the patients diagnosed with BC end up dying. This shows that the cancers have been diagnosed in the advanced stages where medical intervention is not curable but only meant to improve the quality of care[3]. There is a scarcity of published data on BC prevalence and incidence in the Maldives. BC is the most common type of cancer among females of all ages in the Maldives[4, 5].

Generally, there is a good prognosis when BC is detected early before advancing into the late stages. There has been wide advocacy for early detection and treatment of BC as a strategy to mitigate BC-related morbidity and mortality rates in developing countries[6]. Early detection and diagnosis of BC facilitate effective treatment and cure. Early diagnosis creates opportunities for rapid recovery and minimizes BC mortality. Evidence indicates that early detection increases the possibility of survival by 88% to 93% and leads to a 5-year survival rate when the disease is in its early stages[7].

BC screening practices such as clinical breast examination (CBE) and mammography are incorporated in the early detection of the disease. The methods aim at the detection of BC such that effective treatment is offered before the severity of the disease is reached[1, 8]. World Health Organization (WHO) and other organizations recommend mammography as the best and most effective method for breast cancer screening (BCS). Like many other developing and resource-poor countries, in Maldives, CBE is offered and promoted as a modality for BCS. Currently, in Maldives, the early detection of BC is more of a facility-based opportunistic approach.

Research shows that various factors influence the participation of women in BCS services. Among them are socio-demographic and economic factors[9-12], knowledge of BC and BCS[11, 13, 14], psychosocial and cultural factors[9, 10, 13-22]. At

present, very little is known about BCS uptake and the factors associated with BCS among Maldivian women. The main aim of this study is to identify factors that may serve as potential predictors for BCS uptake (CBE and Mammography) among women in the Male' region. Identifying the influencing factors or predictors can assist the healthcare planners and policymakers as well as other relevant stakeholders in the country to adopt the best measures for managing the disease and promoting early detection of BC.

METHODOLOGY

Design

A cross-sectional study was conducted among 600 women aged between 20-79 years in the Male' Region of the Maldives, from December 2019 to February 2020. Stratified random sampling was used to select the study sample. The inclusion criteria were: 1. female Maldivian citizens aged between 20-79 years, 2. understand spoken and written Dhivehi language, 3. mentally fit, and 4. consent to participate in the study. The exclusion criteria were: 1. women who have been diagnosed with BC or any other cancer, and 2. women who were sick and not able to participate at the time of data collection. Ethical approval was obtained for the study from the Health Research Committee, Ministry of Health, Maldives and ethics committee of Management and Science University, Malaysia.

Instrument

Data was collected using a validated and reliable interviewer-administered back-translated structured questionnaire. The questionnaire consisted of five sections:

1. Information on socio-demographic characteristics and family health history.
2. BC and BCS information and its sources.
3. Respondents' knowledge on BC and early detection of BC was determined by a standard structured questionnaire developed by Parsa et al., (2008). This section focused on participants' knowledge of signs and symptoms of BC, risk factors of BC, and early detection of BC. Cronbach's alpha reliability coefficient was 0.78 for the knowledge questions[23]. Responses related to knowledge questions were measured using the nominal scale of "true", "false" and "I don't know". Respondents were given one point for a correct answer and zero for an incorrect answer or do not know.
4. Respondents' beliefs towards BC and BCS was assessed using a reliable and validated tool adopted from Champion's revised health belief model scales (CHBMS)[24]. This consisted of self-reported measures-namely susceptibility to BC, the seriousness of BC, Confidence, health motivation, benefits of CBE, barriers to CBE, benefits of Mammogram, and barriers to Mammogram. All the items have 5 response choices which were measured using a Likert scale ranging from "strongly disagree" (1 point) to "Strongly agree" (5 points). All subscales except the subscale barriers were positively associated with screening. Construct validity and reliability of the CHBMS were tested and found to be acceptable (Cronbach's alpha reliability coefficients ranged from 0.774 to 0.939 for the subscales)[24].
5. BCS uptake. Questions on the uptake of CBE and mammography were filled by women who were eligible for the particular screening method. CBE uptake questions were filled by women aged 30 years and above and Mammography related uptake questions were filled by women aged 40 years and above. The respondents' screening uptake was assessed for frequency, timing, number of times performed, the reasons for the uptake, the reasons for the unwillingness to the uptake, and intention for future uptake.

The questionnaire was pretested among 60 women for clarity of content, the flow in the questions, and the language used as well as the estimated time to complete the questionnaire. The reliability of the questionnaire was checked based on Cronbach's alpha values. The Cronbach's alpha values for the knowledge questions and CHBMS for the current study ranged from 0.748-0.828 and 0.656-0.955 respectively.

Statistical Analysis

The data were analysed using IBM Statistical Package for Social Sciences (SPSS) version 25. Both descriptive and inferential analysis were carried out in the study. Descriptive statistical analysis was carried out for respondents' socio-demographic characteristics, family health history, BC and BCS information, sources of BC and BCS information, knowledge on BC and BCS, beliefs on BC and BCS, and prevalence of BCS uptake. To determine the factors associated with BCS uptake independent t-test and Chi-square tests were performed. Logistic regression analysis was used to examine which variables significantly predicted CBE and mammography uptake separately. For all tests, the level of significance was set at 0.05.

RESULTS

Sociodemographic Characteristics, Family Health History and BC and BCS Information of the Respondents

The mean age of the respondents was 39.43 (SD=12.62) years and ranged between 20-76 years. 23.30% of the respondents were between the age ranges 20-29, while 33.50% and 43.20% were between 30-39 and >40 years respectively. The majority (75.50%) of the women were married, about 33.60% had achieved an education level of

A' levels and above, while 66.40% had secondary school level of education and below. 32.50% of the respondents were employed while 67.50% were unemployed. The mean monthly income was Maldivian Rufiyaa 11,213.05 (SD= 9663.53), while the mean household monthly income was 30,064.80 (SD= 19,491.62) (1 US $= 15.42 Maldivian Rufiyaa). Only 11.30% of the study respondents were covered with private health insurance (insurance other than Aasandha).

About 7.70% of the respondents indicated ever being diagnosed for a disease or condition(s) related to breast and a small number of respondents (6.80%), indicated that they had a family history of BC. The majority of the respondents (82.70%) had heard about BC, while 45.20% and 43.20% of the respondents had heard about CBE and mammography screening respectively. Internet and television with 46.20% and 44.00% respectively, were the major sources of BC information. Other sources of information were social media (33.20%), doctors and nurses (21.90%), friends (18.30%), relatives (14.70%), magazines and newspapers (11.50%), seminar/workshops (11.30%), radio (11.10%), healthcare professionals (8.90%), pamphlet/brochures/posters (7.50%), organizations and groups (6.60%), journal/scientific publications (2.60%), and other BC patients (2.60%).

BC screening Uptake

About 41.40% of the respondents reported ever having a CBE done with 13.00% having it done once a year. Additionally, about 32.80% of the women had a CBE done less than a year ago. The majority of the women (79.20%) preferred female doctors/health professionals performing the CBE. Only 34.40% of the respondents reported that they ever had a mammogram done, with 27% of them having it done less than a year ago.

Of those women who never had a CBE and Mammogram done, the reasons indicated for not having CBE done were: there was no need for it (84.60%), lack of knowledge on CBE (11.80%), not knowing the procedure of it (8.50%), being too busy (6.60%), forgetting about it (3.70%), feeling embarrassed to get it done (2.90%), not knowing where and how to get it done (1.50%) and taking too much of their time to get it done (0.40%). The reasons indicated for not having a Mammogram done were: there was no need for it (80.00%), doctors/healthcare professionals never referred them for it (15.30%), lack of knowledge on the mammography screening (12.90%), being too busy (8.20%), not knowing the procedure of the examination (2.90%), not knowing where and how to get it done(2.40%), the examination being too embarrassing (1.80%), being afraid for it to be positive (1.20%), the examination being painful (0.60%), being afraid of radiation exposure (0.60%), and forgetting to schedule it (0.60%).

Factors Associated with CBE and Mammography Screening Uptake

Sociodemographic Characteristics, Family Health History and BC and BCS Information with Screening Uptake

As shown in table 1 and 2, statistically significant associations were found between CBE uptake and age (p-value=0.016), monthly income (p-value=0.002), monthly household income (p-value=0.008), ever diagnosed for any breast disease/condition(s) (p-value<0.001), regular medical check-up (p-value<0.001), ever heard about BCS (p-value<0.001), ever heard about CBE (p-value<0.001), ever heard about breast self-examination (BSE) (p-value<0.001), ever heard about mammography screening (p-value<0.001), ever done a BSE (p-value<0.001) and ever had a Mammogram done (p-value<0.001). No significant associations were found between marital status, educational level, employment status, insurance status, family history of BC and ever heard about BC with CBE uptake.

As for mammogram uptake, the variables educational level (p-value=0.041), monthly income (p-value=0.002), monthly household income (p-value=0.003), insurance status (p-value=0.006), ever diagnosed for any breast disease/condition(s) (p-value<0.001), regular medical check-up (p-value<0.001), ever heard about BCS (p-value<0.001), ever heard about mammography screening (p-value<0.001), ever heard about BSE (p-value<0.001), ever heard about CBE (p-value<0.001), ever performed BSE (p-value<0.001) and ever had a CBE done (p-value<0.001) are found to be statistically significant and associated to influence the mammogram uptake. Conversely, the variables, age, marital status, employment status, family history of BC, and ever heard about BC, however, depicted no significant association with mammography uptake.

Table 1: Association Between Socio-Demographic, Family Health History, and BC and BCS Information Variables with CBE and Mammography Screening Uptake

Characteristics	Statistics					
	CBE Uptake			Mammogram Uptake		
	CBE done (n=192)	CBE not done (n=272)		Mammogram done (n=89)	Mammogram not done (n=170)	
	n (%)	n (%)	p-value	n (%)	n (%)	p-value
Marital status						
Married	155 (40.60)	227 (59.40)	0.448	68 (34.50)	129 (65.50)	0.925
Not married	37 (45.10)	45 (54.90)		21 (33.90)	41 (66.10)	
Educational level						
Lower level	137 (39.40)	211 (60.60)	0.128	70 (31.80)	150 (68.20)	**0.041***
Higher level	55 (47.40)	61 (52.60)		19 (48.70)	20 (51.30)	
Employment status						
Employed	49 (39.80)	74 (60.20)	0.685	16 (35.60)	29 (64.40)	0.853
Unemployed	143 (41.90)	198 (58.10)		73 (34.10)	141 (65.90)	
Insurance status (Private)						
Yes	25 (48.10)	27 (51.90)	0.298	11 (64.70)	6 (35.30)	**0.006***
No	167 (40.50)	245 (59.50)		78 (32.20)	164 (67.80)	
Ever diagnosed for any breast disease						
Yes	35 (85.40)	6 (14.60)	**<0.001***	17 (65.40)	9 (34.60)	**<0.001***
No	157 (37.10)	266 (62.90)		72 (30.90)	161 (69.10)	
Family history of BC						
Yes	12 (41.40)	17 (58.60)	1.000	7 (43.80)	9 (56.30)	0.414
No	180 (41.40)	255 (58.60)		82 (33.70)	161 (66.30)	
Regular medical check-up						
Yes	107 (56.90)	81 (43.10)	**<0.001***	64 (50.00)	64 (50.00)	**<0.001***
No	85 (30.80)	191 (69.20)		25 (19.10)	106 (80.90)	
Ever heard about BC						
Yes	164 (42.80)	219 (57.20)	0.171	72 (36.00)	128 (64.00)	0.307
No	28 (34.60)	53 (65.40)		17 (28.80)	42 (71.20)	
Ever heard about BCS						
Yes	129 (51.00)	124 (49.00)	**<0.001***	64 (50.40)	63 (49.60)	**<0.001***
No	63 (29.90)	148 (70.10)		25 (18.90)	107 (81.10)	
Ever heard about CBE						
Yes	121 (58.20)	87 (41.80)	**<0.001***	58 (53.20)	51 (46.80)	**<0.001***
No	71 (27.70)	185 (72.30)		31 (20.70)	119 (79.30)	
Ever heard about BSE						
Yes	151 (51.70)	141 (48.30)	**<0.001***	67 (46.20)	78 (53.80)	**<0.001***
No	41 (23.80)	131 (76.20)		22 (19.30)	92 (80.70)	
Ever heard about Mammogram						
Yes	121 (60.20)	80 (39.80)	**<0.001***	64 (56.10)	50 (43.90)	**<0.001***
No	71 (27.00)	192 (73.00)		25 (17.20)	120 (82.80)	
Ever had a BSE						
Yes	127 (54.00)	108 (46.00)	**<0.001***	51 (47.20)	57 (52.80)	**<0.001***
No	65 (28.40)	164 (71.60)		38 (25.20)	113 (74.80)	
Ever had a Mammogram						
Yes	81 (91.00)	8 (9.00)	**<0.001***	-	-	**-**
No	41 (24.10)	129 (75.90)		-	-	
Ever had a CBE						
Yes	-	-	**-**	81 (66.40)	41 (33.60)	**<0.001***
No	-	-		8 (5.80)	129 (94.20)	

Bold: Significance at level p-value<0.05*

Table 2: Association Between Socio-Demographic, Family Health History, and BC and BCS Information Variables with CBE and Mammography Screening Uptake

Characteristics	Statistics				
	Mean	Std.Dev	Mean Difference	t	p-value
CBE					
Age					
CBE done (n=192)	45.19	10.61	-2.494	-2.412	**0.016***
CBE not done (n=272)	42.70	11.21			
Monthly income					
CBE done (n=100)	14522.10	13267.95	-4643.700	-3.108	**0.002***
CBE not done (n=125)	9878.40	7678.35			
Monthly household income					
CBE done (n=192)	32714.17	22572.06	-5137.843	-2.674	**0.008***
CBE not done (n=272)	27576.32	16804.91			
Mammogram					
Age					
Mammogram done (n=89)	52.33	8.59	-1.661	-1.394	0.165
Mammogram not done (n=170)	50.66	9.36			
Monthly income					
Mammogram done (n=45)	17864.44	15737.03	-8235.054	-3.225	**0.002***
Mammogram not done (n=82)	9629.39	9135.45			
Monthly household income					
Mammogram done (n=89)	36207.87	24969.85	-9059.748	-3.038	**0.003***
Mammogram not done (n=170)	27148.12	17915.06			

Bold: Significance at level p-value<0.05*

Knowledge and Beliefs on BC and BCS with Screening Uptake

The comparison between CBE and Mammography screening uptake (those who had a CBE and Mammography done versus those who had not done CBE and Mammography) with knowledge on BC and BCS and CHBMS are shown in table 3. As for CBE uptake, the findings demonstrate significant p-values for knowledge on symptoms of BC (p-value=0.002), risk factors of BC (p-value<0.001), early detection of BC (p-value<0.001), benefits of CBE (p-value<0.001), barriers to CBE (p-value<0.001), self-efficacy (p-value=0.008) and health motivation (p-value<0.001) indicating that there is a significant mean difference among the two groups. For both the susceptibility to BC (p-value=0.319) and the severity of BC (p-value=0.706), no significant difference was discovered amongst the two groups.

In terms of mammography screening, significant difference between those who had a mammogram done and those who had not done a mammogram, was indicated for knowledge on symptoms of BC (p-value=0.010), risk factors of BC (p-value=0.001), early detection of BC (p-value<0.001), benefits of Mammogram (p-value<0.001), the barriers to Mammogram (p-value=0.020), the self-efficacy (p-value=0.023) and the health motivation (p-value=0.006). No significant difference was found between the two groups, for the susceptibility to BC (p-value=0.869) and the severity of BC (p-value=0.217).

Predictors for CBE and Mammography Screening Uptake

Table 4 describes the logistic regression model for the predictors of CBE and Mammography screening uptake. All variables that were found associated with the CBE and Mammography screening uptake, as well as CHBMS were included in the analysis. Findings show that there is a statistically significant association linking the age of the respondents with the CBE uptake, suggesting that as the age of the respondents increases, it results in a rise in the likelihood for CBE uptake (OR=1.045, 95% CI:1.019-1.072). Furthermore, those women who were ever diagnosed with any breast disease/condition(s) are twelve times more likely (OR=12.405, 95% CI:4.099-37.541) and those who go for regular medical check-ups are two times more likely to have a CBE done (OR=2.156, 95% CI:1.301-3.573). Moreover, women who perform regular BSE (OR=2.447, 95% CI:1.423-4.209) and women who have better knowledge on early detection of BC are more likely to have a CBE done (OR=1.108, 95% CI:1.030-1.193). In the case of the beliefs on BC and BCS variables, those women who believe that they are susceptible to the disease (OR=1.100 95% CI:1.022-1.184) and those who perceive that having a CBE done will be beneficial for them in early detection of BC are more likely to have a CBE done (OR=1.163, 95% CI:1.036-1.306). In addition, those who perceive greater barriers to CBE (OR=0.926, 95% CI:0.866-0.991) and those who perceive greater self-efficacy to BSE, are less likely to have a CBE done (OR=0.960, 95% CI:0.925-0.996) than those women who lack the beliefs.

Table 3: Knowledge on BC and BCS and CHBMS Between Those Who Had Done CBE and Mammography Screening and Those Who Had Not Done CBE and Mammography Screening

Variables	CBE done (n=192)	CBE not done (n=272)		Mammogram done (n=89)	Mammogram not done (n=170)	
	Mean±(SD)	Mean±(SD)	p-value	Mean±(SD)	Mean±(SD)	p-value
Knowledge						
Symptoms of BC	4.83 ± 2.20	4.16 ± 2.39	**0.002***	4.79 ± 2.25	3.98 ± 2.45	**0.010***
Risk factors of BC	6.72 ± 2.44	5.66 ± 2.91	**<0.001***	6.79 ± 2.33	5.56 ± 3.26	**0.001***
Early detection of	13.03 ± 3.10	10.60 ± 4.70	**<0.001***	13.21 ± 3.12	10.32 ± 5.04	**<0.001***
BC	24.59 ± 5.56	20.42 ± 8.53	<0.001	24.79 ± 5.45	19.87 ± 9.34	<0.001
Total knowledge						
CHBMS	12.90 ± 3.32	12.59 ± 3.25	0.319	12.57 ± 3.23	12.65 ± 3.53	0.869
Susceptibility to BC	23.59 ± 4.20	23.44 ± 4.35	0.706	23.64 ± 4.37	24.32 ± 4.14	0.217
Severity of BC	16.27 ± 2.23	15.10 ± 2.28	**<0.001***	24.09 ± 3.14	22.09 ± 3.79	**<0.001***
Benefits of						
CBE/Mammogram	16.09 ± 3.81	17.47 ± 3.79	**<0.001***	14.52 ± 2.76	15.35 ± 2.69	**0.020***
Barriers towards						
CBE/Mammogram	36.74 ± 7.32	34.89 ± 7.43	**0.008***	36.80 ± 7.49	34.56 ± 7.49	**0.023***
Self-efficacy	26.39 ± 3.25	25.20 ± 3.19	**<0.001***	27.01 ± 3.07	25.81 ± 3.40	**0.006***
Health motivation	209.25 ±	204.92 ±	0.006	211.22 ±	209.17 ±	0.347
Total beliefs	14.93	17.79		14.21	20.55	

Bold: Significance at level p-value<0.05*

Table 4: Logistic Regression Analysis for Predicting Likelihood of CBE and Mammography Screening Uptake

Variables	CBE Uptake			Mammogram Uptake		
	p-value	OR	95% CI	p-value	OR	95% CI
Socio-demographic, health history, and BC and BCS information						
Age	**0.001***	1.045	1.019-1.072	-	-	-
Educational Level	-	-	-	0.668	0.799	0.287-2.225
Monthly household income	0.165	1.000	1.000-1.000	0.119	1.000	1.000-1.000
Regular medical check-up	**0.003***	2.156	1.301-3.573	**0.010***	2.896	1.289-6.503
Insurance Status	-	-	-	0.359	1.956	0.466-8.209
Ever diagnosed for any breast disease	**<0.001***	12.405	4.099- 37.541	0.482	1.515	0.475-4.826
Ever heard about BCS	0.239	0.665	0.337- 1.312	0.089	2.513	0.869-7.265
Ever heard about CBE	0.154	1.615	0.835- 3.122	0.694	0.794	0.253-2.495
Ever heard about BSE	0.065	1.892	0.962- 3.722	0.365	0.599	0.197-1.815
Ever heard about mammography	0.058	1.738	0.981- 3.081	0.576	1.326	0.493-3.565
Knowledge						
Symptoms of BC						
Risk factors of BC	0.550	0.963	0.851- 1.090	0.970	0.996	0.819-1.212
Early detection of BC	0.506	1.036	0.993- 1.152	0.951	1.005	0.847-1.193
CHBMS	**0.006***	1.108	1.030- 1.193	0.609	1.032	0.916-1.162
Susceptibility to BC						
Severity of BC	**0.011***	1.100	1.022- 1.184	0.477	1.041	0.932-1.163
Benefits of CBE	0.766	0.991	0.935- 1.051	0.882	0.993	0.901-1.094
Benefits of Mammogram	**0.010***	1.163	1.036- 1.306	-	-	-
Barriers to CBE	-	-	-	**0.045***	1.131	1.003-1.277
Barriers to Mammogram	**0.026***	0.926	0.866- 0.991	-	-	-
Self-efficacy	-	-	-	0.457	0.947	0.820-1.094
Health motivation	**0.030***	0.960	0.925- 0.996	0.559	0.983	0.927-1.042
Ever performed BSE	0.977	0.999	0.923- 1.080	0.786	0.982	0.864-1.117
Ever had CBE	**0.001***	2.447	1.423- 4.209	0.254	1.626	0.706-3.744
	-	-	-	**<0.001***	19.135	7.461-49.077

Bold: Significance at level p-value<0.05, CBE=N=464, Chi-square for Omnibus test is 172.390, with significance level of <0.001, df= 18, Nagelkerke R^2=0.310, Cox & Snell R^2=0.418. The Chi-square value for the Hosmer-Lemeshow Goodness of Fit test is 3.312, with a significance level of 0.913. Mammogram=N=259, Chi-square for Omnibus test is 144.151, with significance level of <0.001, df= 20, Nagelkerke R^2=0.590, Cox & Snell R^2=0.427. The Chi-square value for the Hosmer-Lemeshow Goodness of Fit test is 5.598, with a significance level of 0.692.*

Regarding the predictors for mammography screening uptake, the findings show that those women who go for regular medical check-ups (OR=2.896, 95% CI:1.289-6.503), those who perceive that having a mammogram done will be beneficial for them in early detection of breast cancer (OR=1.131, 95% CI:1.003-1.277) and those who had a CBE done are more likely to have a mammogram done (OR=19.135, 95% CI:7.461-49.077) compared to those who do not have such beliefs and practices.

DISCUSSION

Early detection of BC is vital in reducing morbidity and mortality and promoting women's overall quality of life[25]. In the current study, 41.40% of women ever had a CBE done, with 32.80% having it done less than a year ago. Similarly, about 34.40% of the women ever had a mammogram done, with 27.00% of them having it done less than a year ago. When compared with studies done in other countries, the CBE uptake rates in the current study were higher than studies done among Sri Lankan women (33.3%)[26], Turkish women (18%)[27], and among rural Indian women (8%)[28] and lower than in studies done among women in Malaysia 53.3%[29], 53.5%[30] and female academicians in Turkey (48.5%)[31]. With regard to the mammography uptake, a similar rate (33.5%) were found in a study conducted among female academicians in Turkey[31], and lower rates than the current study were found in studies done among Jordanian women (17.2%)[32], Saudi teachers (12.8%)[33], Malaysian women (14.1%)[29], Sri Lankan women (3.6%)[26] and among Turkish women (10.3%)[27]. The observed variations in the CBE and Mammogram uptake in different studies could be explained by the different study populations, different socio-economic and demographic characteristics, women's awareness and exposure to information on BC and BCS, as well as the availability, accessibility, and affordability of the screening services.

The current study determined statistically significant associations between the variables: age, monthly income, monthly household income, ever diagnosed for any breast disease, regular medical check-up, ever heard about BCS, ever heard about CBE, ever heard about BSE, ever heard about mammography screening, ever performed BSE, and ever had a Mammogram with CBE uptake. Parallel to our findings, studies found age[9, 34, 35], family income[9, 29, 35, 36], regular visit with physician[35], previous breast condition[9, 35], and performing BSE[35] to be associated with CBE uptake. On the other hand, previous studies have also found that educational level[9, 36], health insurance[36], and distance to the hospital[29] to be associated with CBE uptake.

The variables: monthly income, monthly household income, educational level, insurance status, ever diagnosed for any breast disease, regular medical check-up, ever heard about BCS, ever heard about BSE, ever heard about CBE, ever heard about mammography screening, ever performed BSE and ever had a CBE done are found to be statistically significant and associated to influence the mammogram uptake in this study. In line with our findings, previous studies also found the variables: regular medical check-up[28, 37], educational level[9, 32, 34, 36], income[9, 38], insurance status[38], previous history of breast disease[9, 35, 39], performing BSE[35], and ever had a CBE done[35, 40] to be associated with mammogram uptake. In contrast to our findings, studies found age[28, 34, 37, 40], family history of BC[28, 37], perceived health status[35], and distance to the health facility[38] to be associated with the Mammogram uptake.

The present study established that those women who have better levels of knowledge on BC and BCS were more adherent to CBE and mammography screening uptake. These findings are consistent with those of earlier studies which found that a significant relationship existed between knowledge on BC and screening uptake[25, 28, 37, 39, 41-48]. This shows that knowledge plays a major role as a facilitator in adopting health-promoting behaviours.

This study applied the health belief model (HBM) to determine the beliefs/perceptions on BC and BCS. When the difference between the average belief scores of women according to those who had a CBE and Mammogram done and those who had not done a CBE and Mammogram were examined, a significant difference was seen for the sub-dimensions benefits of CBE, barriers to CBE, benefits of mammogram, barriers to mammogram, self-efficacy and health motivation. In line with our finding, Parsa et al., (2010) found a significant association between the benefits of CBE and CBE uptake. However, the researchers also found perceived susceptibility to being associated with CBE uptake[35]. Additionally, other studies found statistically significant associations for the subdimensions: benefits of mammogram[27, 49], barriers to mammogram, self-efficacy[28, 49], and health motivation[49]. However, different from our findings, previous studies observed statistically significant associations between susceptibility to BC[27, 28, 50], and the severity of BC[28] with Mammogram uptake.

As HBM suggests, health beliefs play an important role in the person's attention and interest in protective health behaviours. The findings of the present study as well as other studies have established a relationship between women's beliefs/perceptions with the screening uptake. It indicates that those women who held perceptions that they are susceptible to BC, perceive that the disease has severe consequences, perceive that screening is beneficial to them in the early detection of BC, perceive fewer barriers to screening, have confidence in performing the preventive behaviour, and are health motivated

are more likely to adopt to the screening behaviours[39, 46, 51, 52].

The present study had shown that CBE uptake is improved with the increase in women's health promotion and prevention-seeking behaviours. In addition, with the increase of women's knowledge on BC, increase in the perception that they too are susceptible to the illness, increase in perception of the benefits of CBE in early detection of the disease, increase in their confidence to perform BSE and are adherent to BSE uptake increased the level of CBE uptake. Moreover, when women perceived fewer barriers to having a CBE done, their level of CBE uptake increased. Similar to the current study findings, age[34], regular physician visits, higher perceived susceptibility to BC, perceived greater benefits of CBE[35], self-efficacy[31, 36], perceived barriers to CBE[36], good knowledge of BC[30] was found to be predictors for CBE uptake in previous studies. On contrary to this study, Dahlui et al., (2012) found social support and being married as predictors for CBE uptake[30].

As for mammography screening uptake, when women perceive that having a mammogram done would be beneficial in early detection of BC, their compliance to the behaviour increased. In the same way, the uptake is increased with women being more health-conscious and seek regular medical advice. Moreover, having previous experience of positive preventive behaviour is also found to be an enabling factor for the increased level of mammogram uptake. Correspondingly, studies done in other countries also determined having attended CBE[30, 35, 40], regular medical check-ups[37], and perceived benefits of mammography screening[53] as significant predictors for mammogram uptake. However, previous studies also determined age[34, 36, 40], income[36], knowledge on mammography screening[37], perceptions on susceptibility to BC[31, 35], and perceptions on barriers to Mammography screening[22, 36, 53] as significant predictors to mammogram uptake.

Like other studies, this study too has limitations. As this is a cross-sectional study, cause-and-effect relationships between the variables cannot be established, and it can only determine the associations between the variables. The study was limited only to the population in the Male' region. Hence, the findings may not be generalized to the entire population of the Maldives. In addition, the data on screening uptake was based on self-reported responses with no objective measure (such as review of medical records) to verify the information. Therefore, there are possibilities of overestimation or underestimation of screening uptake, recall-bias, and social desirability bias.

CONCLUSIONS

The study provides valuable insight on the BCS uptake among Maldivian women. The findings indicate that the BCS uptake (CBE and Mammography screening) levels among Maldivian women are low. Additionally, the findings have established relationships between screening uptake with women's health-related beliefs/perceptions, sociodemographic factors as well as their knowledge level on BC thereby determining the significant predictors for the screening uptake. Considering the results of this study, multiple strategies are required for Maldivian women to comply with regular BCS. Much effort focus and emphasis should be placed by healthcare planners, managers, healthcare providers, and other relevant authorities to address the identified gaps and barriers and to create awareness on BC and the importance of early detection of the disease. Increasing women's awareness and knowledge, improving beliefs and attitudes, and increasing screening behaviours are crucial to BC prevention.

Acknowledgements
The authors would like to thank all women who participated and all those who kindly assisted and supported in conducting the research study.

Competing interests
The authors declare that they have no competing interests.

Funding
This study was self-funded.

Authors' contributions
All authors read and approved the final manuscript.

REFERENCES

1. WHO. Breast Cancer 2019. Available from: https://www.who.int/cancer/prevention/diagnosis-screening/breast-cancer/en/.

2. Masso-Calderon AM, Meneses-Echavez JF, Correa-Bautista JE, Tovar-Cifuentes A, Alba-Ramirez PA, Charry-Angel CE. Effects of an Educational Intervention on Breast Self-Examination, Breast Cancer Prevention-Related Knowledge, and Healthy Lifestyles in Scholars from a Low-Income Area in Bogota, Colombia. J Cancer Educ. 2016.

3. Kisuya J, Wachira J, Busakhala N, Naanyu V, Chite AF, Omenge O, et al. Impact of an educational intervention on breast cancer knowledge in western Kenya. Health education research. 2015;30(5):786-96.

4. WHO. Cancer Country Profiles. 2014.

5. Globocan. Maldives Cancer Statistics- fact sheet 2018.

6. Todd A, Stuifbergen A. Breast Cancer Screening Barriers and Disability. Rehabilitation nursing : the official journal of the Association of Rehabilitation Nurses. 2012;37(2):74-9.

7. Subramanian P, Oranye NO, Masri AM, Taib NA, Ahmad N. Breast cancer knowledge and screening behaviour among women with a positive family history: a cross sectional study. Asian Pacific journal of cancer prevention : APJCP. 2013;14(11):6783-90.

8. El Saghir NS, Adebamowo CA, Anderson BO, Carlson RW, Bird PA, Corbex M, et al. Breast cancer management in low resource countries (LRCs): consensus statement from the Breast Health Global Initiative. Breast (Edinburgh, Scotland). 2011;20 Suppl 2:S3-11.

9. Abdel-Aziz SB, Amin TT, Al-Gadeeb MB, Alhassar AI, Al-Ramadan A, Al-Helal M, et al. Perceived barriers to breast cancer screening among Saudi women at primary care setting. Journal of preventive medicine and hygiene. 2018;59(1):E20-e9.

10. Mamdouh HM, El-Mansy H, Kharboush IF, Ismail HM, Tawfik MM, El-Baky MA, et al. Barriers to breast cancer screening among a sample of Egyptian females. Journal of Family & Community Medicine. 2014;21(2):119-24.

11. Patel K, Kanu M, Liu J, Bond B, Brown E, Williams E, et al. Factors influencing breast cancer screening in low-income African Americans in Tennessee. J Community Health. 2014;39(5):943-50.

12. Boxwala FI, Bridgemohan A, Griffith DM, Soliman AS. Factors associated with breast cancer screening in Asian Indian women in metro-Detroit. Journal of immigrant and minority health. 2010;12(4):534-43.

13. Donnelly TT, Khater AH, Al-Bader SB, Al Kuwari MG, Malik M, Al-Meer N, et al. Factors that influence awareness of breast cancer screening among Arab women in Qatar: results from a cross sectional survey. Asian Pacific journal of cancer prevention : APJCP. 2014;15(23):10157-64.

14. Parsa P, Kandiah M, Abdul Rahman H, Zulkefli NM. Barriers for breast cancer screening among Asian women: a mini literature review. Asian Pacific journal of cancer prevention : APJCP. 2006;7(4):509-14.

15. Alexandraki I, Mooradian AD. Barriers related to mammography use for breast cancer screening among minority women. Journal of the National Medical Association. 2010;102(3):206-18.

16. Donnelly TT, Khater AH, Al-Bader SB, Al Kuwari MG, Al-Meer N, Malik M, et al. Arab women's breast cancer screening practices: a literature review. Asian Pacific journal of cancer prevention : APJCP. 2013;14(8):4519-28.

17. Wu TY, Chung S, Yeh MC, Chang SC, Hsieh HF, Ha SJ. Understanding breast cancer screening practices in Taiwan: a country with universal health care. Asian Pacific journal of cancer prevention : APJCP. 2012;13(9):4289-94.

18. Yilmaz D, Bebis H, Ortabag T. Determining the awareness of and compliance with breast cancer screening among Turkish residential women. Asian Pacific journal of cancer prevention : APJCP. 2013;14(5):3281-8.

19. Wu T-Y, Chen S-L. Breast Cancer Screening Practices and Related Health Beliefs among Taiwanese Nurses. Asia-Pacific Journal of Oncology Nursing. 2017;4(2):104-11.

20. Fayanju OM, Kraenzle S, Drake BF, Oka M, Goodman MS. Perceived barriers to mammography among underserved women in a Breast Health Center Outreach Program. American journal of surgery. 2014;208(3):425-34.

21. Kim JI, Oh KO, Li CY, Min HS, Chang ES, Song R. Breast cancer screening practice and health-promoting behavior among chinese women. Asian nursing research. 2011;5(3):157-63.

22. Fouladi N, Pourfarzi F, Mazaheri E, Asl HA, Rezaie M, Amani F, et al. Beliefs and behaviors of breast cancer screening in women referring to health care centers in northwest Iran according to the champion health belief model scale. Asian Pacific journal of cancer prevention : APJCP. 2013;14(11):6857-62.

23. Parsa P, Kandiah M, Mohd Zulkefli NA, Rahman HA. Knowledge and behavior regarding breast cancer screening among female teachers in Selangor, Malaysia. Asian Pacific journal of cancer prevention : APJCP. 2008;9(2):221-7.

24. Parsa P, Kandiah M, Mohd Nasir MT, Hejar AR, Nor Afiah MZ. Reliability and validity of Champion's Health Belief Model Scale for breast cancer screening among Malaysian women. Singapore medical journal. 2008;49(11):897-903.

25. Guilford K, McKinley E, Turner L. Breast Cancer Knowledge, Beliefs, and Screening Behaviors of College Women: Application of the Health Belief Model. American Journal of Health Education. 2017;48(4):256-63.

26. Nilaweera RI, Perera S, Paranagama N, Anushyanthan AS. Knowledge and practices on breast and cervical cancer screening methods among female health care workers: a Sri Lankan experience. Asian Pacific journal of cancer prevention : APJCP. 2012;13(4):1193-6.

27. Ertem G, Dönmez YC, Dolgun E. Determination of the Health Belief and Attitude of Women Regarding Breast Cancer and Breast Self-Exam. J Breast Health. 2017;13(2):62-6.

28. Veena KS, Kollipaka R, Rekha R. The Knowledge and attitude of breast self examination and mammography among rural women. International Journal of Reproduction, Contraception, Obstetrics and Gynecology. 2015;4(5):1511-6.

29. Nik Farid ND, Abdul Aziz N, Al-Sadat N, Jamaludin M, Dahlui M. Clinical Breast Examination As the Recommended Breast Cancer Screening Modality in a Rural Community in Malaysia; What Are the Factors That Could Enhance Its Uptake? PloS one. 2014;9(9):e106469.

30. Dahlui M, Gan DE, Taib NA, Pritam R, Lim J. Predictors of breast cancer screening uptake: a pre intervention community survey in Malaysia. Asian Pacific journal of cancer prevention : APJCP. 2012;13(7):3443-9.

31. Kirag N, Kızılkaya M. Application of the Champion Health Belief Model to determine beliefs and behaviors of Turkish women academicians regarding breast cancer screening: A cross sectional descriptive study. BMC women's health. 2019;19(1):132.

32. Al-Mousa DS, Alakhras M, Hossain SZ, Al-Sa'di AG, Al Hasan M, Al-Hayek Y, et al. Knowledge, Attitude and Practice Around Breast Cancer and Mammography Screening Among Jordanian Women. Breast Cancer (Dove Med Press). 2020;12:231-42.

33. Alshareef B, Yaseen W, Jawa W, Barnawe Y, Alshehri W, Alqethami H, et al. Breast Cancer Awareness among Female School Teachers in Saudi Arabia: A Population Based Survey. Asian Pacific journal of cancer prevention : APJCP. 2020;21(2):337-42.

34. Albeshan SM, Hossain SZ, Mackey MG, Naser Osmani SS, Brennan PC. Understanding better the knowledge, beliefs, and attitudes toward breast cancer and breast screening practices among women living in Ras Al Khaimah, United Arab Emirates (UAE). Proceedings of the 3rd International Conference on Public Health. 2017; 3(2):208-22.

35. Parsa P, Kandiah M. Predictors of adherence to clinical breast examination and mammography screening among Malaysian women. Asian Pacific journal of cancer prevention : APJCP. 2010;11(3):681-8.

36. Farzaneh E, Heydari H, Shekarchi AA, Kamran A. Breast and cervical cancer-screening uptake among females in Ardabil, northwest Iran: a community-based study. OncoTargets and therapy. 2017;10:985-92.

37. Al-Naggar RA, Bobryshev YV. Practice and barriers of mammography among Malaysian women in the general population. Asian Pacific journal of cancer prevention : APJCP. 2012;13(8):3595-600.

38. Chan PY, Latip LS. A case control study in factors that affect mammogram compliance. The Medical journal of Malaysia. 2011;66(5):456-61.

39. Abolfotouh MA, BaniMustafa AA, Mahfouz AA, Al-Assiri MH, Al-Juhani AF, Alaskar AS. Using the health belief model to predict breast self examination among Saudi women. BMC Public Health. 2015;15:1163.

40. Yusof A, Chia YC, Hasni YM. Awareness and prevalence of mammography screening and its predictors--a cross sectional study in a primary care clinic in Malaysia. Asian Pacific journal of cancer prevention : APJCP. 2014;15(19):8095-9.

41. Akhtari-Zavare M, Ghanbari-Baghestan A, Latiff LA, Matinnia N, Hoseini M. Knowledge of breast cancer and breast self-examination practice among Iranian women in Hamedan, Iran. Asian Pacific journal of cancer prevention : APJCP. 2014;15(16):6531-4.

42. Akhtari-Zavare M, Latiff LA, Juni MH, Said SM, Ismail IZ. Knowledge of Female Undergraduate Students on Breast Cancer and Breast Self-examination in Klang Valley, Malaysia. Asian Pacific journal of cancer prevention : APJCP. 2015;16(15):6231-5.

43. Atuhairwe C, Amongin D, Agaba E, Mugarura S, Taremwa IM. The effect of knowledge on uptake of breast cancer prevention modalities among women in Kyadondo County, Uganda. BMC Public Health. 2018;18(1):279.

44. Didarloo A, Nabilou B, Khalkhali HR. Psychosocial predictors of breast self-examination behavior among female

students: an application of the health belief model using logistic regression. BMC Public Health. 2017;17(1):861.

45. Getu MA, Kassaw MW, Tlaye KG, Gebrekiristos AF. Assessment of breast self-examination practice and its associated factors among female undergraduate students in Addis Ababa University, Addis Ababa, Ethiopia, 2016. Breast Cancer (Dove Med Press). 2018;11:21-8.

46. Masoudiyekta L, Dashtbozorgi B, Gheibizadeh M, Malehi AS, Moradi M. Applying the Health Belief Model in Predicting Breast Cancer Screening Behavior of Women. Jundishapur J Chronic Dis Care. 2015;4(4).

47. Mekuria M, Nigusse A, Tadele A. Breast Self-Examination Practice and Associated Factors Among Secondary School Female Teachers in Gammo Gofa Zone, Southern, Ethiopia. Breast Cancer (Dove Med Press). 2020;12:1-10.

48. Ossai E, Azuogu B, Ogaranya I, Ogenyi A, Enemor D, Nwafor M. Predictors of practice of breast self-examination: A study among female undergraduates of Ebonyi State University, Abakaliki, Nigeria. Nigerian Journal of Clinical Practice. 2019;22(3):361-9.

49. Shiryazdi SM, Kholasehzadeh G, Neamatzadeh H, Kargar S. Health Beliefs and Breast Cancer Screening Behaviors among Iranian Female Health Workers. Asian Pacific Journal of Cancer Prevention. 2014;15:9817-22.

50. Yılmaz M, Durmuş T. Health Beliefs and Breast Cancer Screening Behavior among a Group of Female Health Professionals in Turkey. The Journal of Breast Health. 2016;12(1):18-24.

51. Champion VL. Revised susceptibility, benefits, and barriers scale for mammography screening. Res Nurs Health. 1999;22(4):341-8.

52. Onoruoiza IS, Musa A, Umar BD, Kunle SY. Using health belief model as an intervention to noncompliance with hypertension information among hypertensive patient. IOSR-Journal of Humanities and Social Sciences. 2015;20(9):11-6.

53. Darvishpour A, Vajari SM, Noroozi S. Can Health Belief Model Predict Breast Cancer Screening Behaviors? Open access Macedonian journal of medical sciences. 2018;6(5):949-53.