

## Inflatable Colon: A Tool to Raise Awareness of the Importance Of colorectal Cancer Screening

<sup>1</sup>Ale J. Hejase, <sup>2</sup>Hana Nemer, <sup>1</sup>Hussin Jose Hejase\*, <sup>3</sup>Gladys Honein-  
AbouHaidar

<sup>1</sup>Al Maaref University, Faculty of Business Administration, Beirut, Lebanon

<sup>2</sup>Founder & CEO, SAID NGO, Colorectal Cancer Awareness Association, Beirut, Lebanon

<sup>3</sup>Hariri School of Nursing, American University of Beirut, Beirut, Lebanon

\* Corresponding author: Hussin Jose Hejase,

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**Abstract:** The percentage of people with Colorectal Cancer (CRC) is on the increase, concurrently with an increase in the campaigns towards raising awareness of preventive medicine. Though the number of victims is still high, but with the continuous worldwide efforts to disseminate awareness, this number is expected to decline. This paper aims to assess the knowledge of a sample of Lebanese citizens of CRC, after going on a tour through a giant inflatable, walk-through colon model equipped with physical depictions of healthy tissue, polyps and CRC. A sample of 629 participants completed a simple structured questionnaire directed to assess their knowledge of colon cancer and the behavioral intentions of obtaining CRC screening, both before and after going on the Inflatable Colon (IC) tour. Research findings show, upon comparing results before and after the tour, that the use of an inflatable colon has increased knowledge of colorectal cancer and its corresponding screening practice by 49.6%. These findings are used to encourage and support concerned non-governmental organizations to adopt new awareness campaigns which have proven successful, and to provide evidence based on facts to government officials in the Ministry of Health to support national awareness campaigns and preventive efforts to mitigate CRC.

**Keywords:** Colorectal cancer, inflatable colon, awareness, preventive medicine, Lebanon

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Date of Submission: 28-07-2018

Date of acceptance: 10-08-2018

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### I. Introduction

The last decade witnessed a worldwide progress in the research related to awareness and early treatment of colorectal cancer (CRC), which according to the National Cancer Institute (2018a, 2018b), is a disease in which malignant (cancer) cells form in the tissues of the colon or the rectum; however, the utilization of this screening remains lower than that for breast and cervical cancers (American Cancer Society, 2017, p. 21). The National Colorectal Cancer Roundtable (NCCRT), established in the USA in 1997, launched in 2014 the “80% by 2018” initiative that aspires to attain an 80% CRC screening rate of adults, aged 50 and above, by 2018 (American Cancer Society, 2017, p. 20).

CRC emanates over a time span of 10-15 years, from adenomas benign polyps (a pre-malignant form) to cancerous malignant tumors. The aforementioned is due to the fact that the adenomas are in direct contact with the fecal stream in which many carcinogens are present; these immortalized cells are in constant exposure to this non-sterile environment, and over a period of time, may lead the cells to become malignant (Cubbage, 2004, p. 6).

In 2016, the American Cancer Society, estimated that in the year 2017, 50,250 deaths will be caused by CRC (American Cancer Society, 2017, p. 3). Moreover, a more frightening figure estimation, based on mathematical modeling, that a 124 percent rise in the incidence of rectal cancer is expected by the year 2030 (Deen, Silva, Deen, & Chandrasinghe, 2016). In addition, the profile of colorectal cancer in most of the Eastern Mediterranean Region (EMR) indicates that CRC is the second most common cancer after breast cancer among females, and is the first most common among males (Kulhánová et al., 2017). Consequently, there is no doubt that such statistics procure collective global concern and the need for immediate action. As for Lebanon, the epidemiology of gastrointestinal cancers indicate that in the period 2000-2005, CRC formed 52% of these cancers (Abou Rached, Khater, Aftimos, Khairallah, & Mokarbel, 2007); this percentage increased to 55% during the period 2006-2010, and then dropped slightly to 54.5% during the years 2011-2015 (Abou Rached et al., 2016).

His paper aims to assess the knowledge of colon cancer and the behavioral intentions of obtaining CRC screening of a sample of Lebanese citizens who were exposed to a new tool of spreading awareness of the importance of colorectal cancer screening.

## II. Literature Review

The duration needed for the transformation of the benign cells to cancerous cells allows the early detection, correction and prevention of this malignancy, especially if patients resort to screening; hence, the importance of such a procedure. All research indicates that CRC screening reduces morbidity and mortality. This fact is due to the possibility of an early detection of the malignancy; this will lead the patient to undergo colonoscopy and the removal of a precancerous lesion, which is significantly much more cost-effective than to attempt treating an advanced CRC with major surgery and expensive chemotherapy (Sieg & Friedrich, 2009; Briant, Wang, Holte, Ramos, Marchello, & Thompson, 2015; and Aljumah & Aljebree, 2017). Globally, according to the American Cancer Society (2017), "CRC screening has increased among adults 50 years of age and older from 34% in 2000 to 63% in 2015" (p. 19). Another study reported that from 1987 to 2010, the percentage of adults aged 50 or above who underwent screening rose from 34.8% to 66.1% (Yang, Gross, Soulos, & Yu, 2014). Furthermore, the reported CRC mortality rates which had reached 30,000 citizens annually in countries like Germany (Sieg & Kilian, 2009) have, in general, declined in many developed and newly economically developed countries; however, this rate continues to increase in some low-resource countries of South America and Eastern Europe (Center, Jemal, Smith, & Ward, 2009).

Raising awareness of the importance of undergoing CRC screening is the main obstacle to an increase in the percentage of adults who are motivated to undergo these procedures. As a matter of fact, awareness affects peoples' views of cancer, attitudes towards colorectal cancer screening modalities, and motivation for screening (Honein-AbouHaidar et al., 2016). A recent study in Lebanon reveals that the percentage of respondents that have never heard of CRC exceeds 59%; likewise, the study underlines the lack of knowledge of CRC screening, where the percentage of respondents that have heard of it, though claimed that they are familiar with CRC, does not exceed 57.17% (Nemer, Hejase, Hejase, Othman, Chawraba, & Trad, 2016, p. 10). In addition, the same study reveals poor knowledge of CRC risk factors and symptoms. Similarly, a recent study performed in the United Arab Emirates reveals that the percentage of those respondents who have poor knowledge concerning risk factors, warning signs/symptoms and screening is 81.7%, 84.7% and 94.1%, respectively (Al-Sharbatti, Muttappallymyal, Sreedharan, & Almosawy, 2017).

The low awareness rates concerning CRC in general, and the low screening rates in particular, highlight the need for novel techniques and procedures first to increase the levels of awareness and secondly to motivate adults, 50 years and above, to undergo screening as early as possible. Along the aforementioned track, several studies have proposed various approaches. In the USA, different studies have recommended the use of an inflatable walk-through colon as an innovative technology to promote colorectal cancer (CRC) screening among the underserved, such as low-income individuals, uninsured persons, immigrants, racial and ethnic minorities, and the elderly—who typically do not benefit from the health system (Silow-Carroll, Alteras, & Stepnick, 2006; Molina, Briant, Sanchez, O'Connell, & Thompson, 2017; Redwood, Provost, Asay, Ferguson, & Muller, 2013; Briant et al., 2015; Sanchez, Palacios, Cole, & O'Connell, 2014). Interestingly, the outcomes of these aforementioned studies demonstrate, in general, an increase in sample's CRC knowledge and awareness after touring the inflatable colon.

The overall objective of this study is to assess if knowledge of CRC increases after individuals go on a tour through a giant inflatable, walk-through colon model equipped with physical depictions of healthy tissue, polyps and CRC. 629 participated in the study done in Lebanon; these participants underwent pre- and post-tests to measure their familiarity with CRC and CRC screening, past screening behavior, and likelihood to be screened, before and after walking through the inflatable colon.

The use of inflatable colons (IC) has been widely adopted by different organizations as a stimulating means to raise awareness of colon cancer and its screening procedures. In New York, in the middle of Union Square, a giant inflatable colon was displayed to send a message to all New Yorkers that screening for CRC is important and effective before the symptoms develop (Thomas, 2017). Likewise, a giant 30-foot-long tunnel colon was displayed at the University of Alabama at Birmingham (UAB) to encourage screening and consequently early detection. UAB has established an annual event called "Colon on the Green" to raise awareness of colorectal cancer screenings through raffles, photo booths, music and the giant inflatable colon (UAB Comprehensive Cancer Center, 2018). Additionally, the Huntsman Cancer Institute (HCI) located in Salt Lake City, at the University of Utah, continues to use an oversized visual-aid giant colon as an important learning tool to illustrate the beginning and advanced stages of colon cancer. In fact, HCI is partnering with the National Cancer Institute (NCI) to implement a nationwide colorectal cancer outreach and education initiative to increase colorectal cancer screening rates (Huntsman Cancer Institute at the University of Utah, 2017). Furthermore, "Nolan the Colon", a giant interactive walk-through inflatable replica of a human colon, 20-feet long and 12-feet high, was used in Phoenix, Arizona to illustrate the progress of colorectal cancer and demonstrate to patients and survivors state-of-the-art advances in colorectal cancer treatment and medication

(azfamily.com, 2015). Such a tunnel was also used in rural counties within Washington State and on the campus of New Mexico State University in Las Cruces, NM (Kocarnik, 2017).

A recent study performed in Lebanon among a group of 1140 respondents selected from universities, public places and hospitals reveal that the percentage of those who have never heard of CRC exceeds 59%; and of those who have heard of CRC more than 57%, but are unfamiliar with the basic knowledge related to CRC screening (Nemer et al., 2016). Such discouraging results have motivated the researchers to disseminate knowledge and to educate people about colorectal cancer. Here it is worth mentioning that the frequency of colorectal cancer is high in Lebanon, ranking among the top four types of cancer, with more than 650 new cases per year for a population of less than 5 million (Abu Rached, Abi Kheir, & Khairallah, 2016). Thus, the idea of adopting a walk-through inflatable colon to promote CRC awareness was put into effect, and tours to different regions of Lebanon were realized. During these events, an assessment survey was administered to assess the knowledge of colon cancer and the behavioral intentions of obtaining CRC screening, both under a pre- and post-research design. Though such an approach hasn't been introduced in Lebanon, yet, as afore-stated it has been widely utilized in the western world and the research outcomes are well known in the CRC literature (Redwood, Provost, Asay, Ferguson, & Muller, 2013; Sanchez, Palacios, Cole, & O'Connell, 2014; and Briant et al., 2015).

### III. Materials and Methods

#### Inflatable Colon

The used inflatable colon (IC), demonstrated in Figure 1, belongs to the SAID nongovernmental organization whose main goal is to spread awareness of CRC in Lebanon. It is constructed from seven interconnected arches. The total tunnel length from entry to exit is approximately 5.25 meters, with a height, from floor to middle topmost point, equals to approximately 2.5 meters. Additionally, the width of the interior path is around 3.5 meters. This inflatable colon was assembled in Lebanon at a cost of USD 4000.

Inside the IC tunnel, a visitor can inspect and identify normal tissue, polyps, cancerous tissues and the advanced malignant tumors. The IC includes display signs to explain how a normal tissue progresses to become a fatal tumor. Additionally, these signs highlight the importance of screening, which contributes to early detection and consequently prevention of CRC.



**Figure 1. The SAID NGO Educational Inflatable Colon.**

#### Procedure and Participants

The IC tours took place in a wide gamut of Lebanese territories (See Figure 2) that extended from the South (Shebaa, Tyr, Majdel Selm, Iblel-Saqi, Bkassine) to the North (Akkar, Tripoli) crossing Mount Lebanon (Shoueit, Ainab, Baaklin, Chemlan, Btater, Meshkity, Kfarnabrakh, Khreibeh) to the Bekaa valley (Cascada Mall) to Beirut and its suburbs (ESCWA, Choueifat) and Keserwan (Zouk Mousbeh). As for the dates of these activities (See Figure 3); they started on July 21, 2017, and from there on an average of approximately 2 (actual, 2.25) a month (the highest number of events occurred in August and October with 4 events in each month, while in the months of November, December and February, only one event took place during each month) to reach a total of 19 events by February 16, 2018. As for the number of participants, the total was 629 participants, with a minimum of 11 participants on January 28, 2018 and the maximum 77 participants on February 16, 2018.

#### Instruments

Every participant was asked to fill out a simple questionnaire prior to going on the informative IC tour. The questionnaire was directed to assess the participant’s knowledge of colon cancer and the behavioral intentions of obtaining CRC screening. The SAID NGO members were available to help read the questions for those who needed assistance. On exiting the IC, the same knowledge and behavioral questions were administered so that a pre- and post-IC visit record was available for each participant.

The main core of the questionnaire consisted of six questions that comply with the major guidelines adopted by other similar studies (Sanchez, Palacios, Cole, & O’Connell, 2014; Redwood, Provost, Asay, Ferguson, & Muller, 2013; and Briant et al., 2015). Of these six main questions, the first four are knowledge questions and the last two are intention questions.

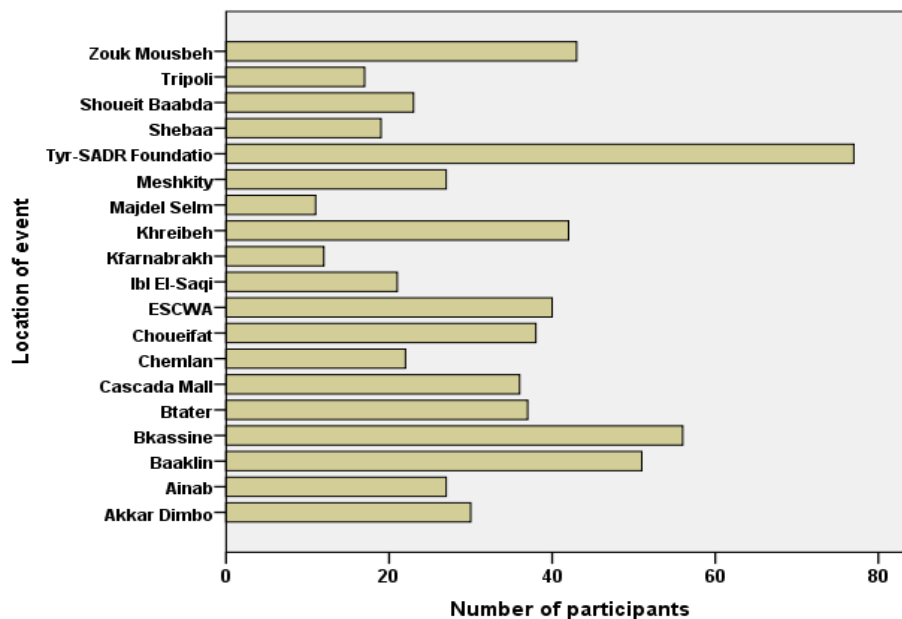


Figure 2. Bar graph showing the number of participants in each of the 19 locations.

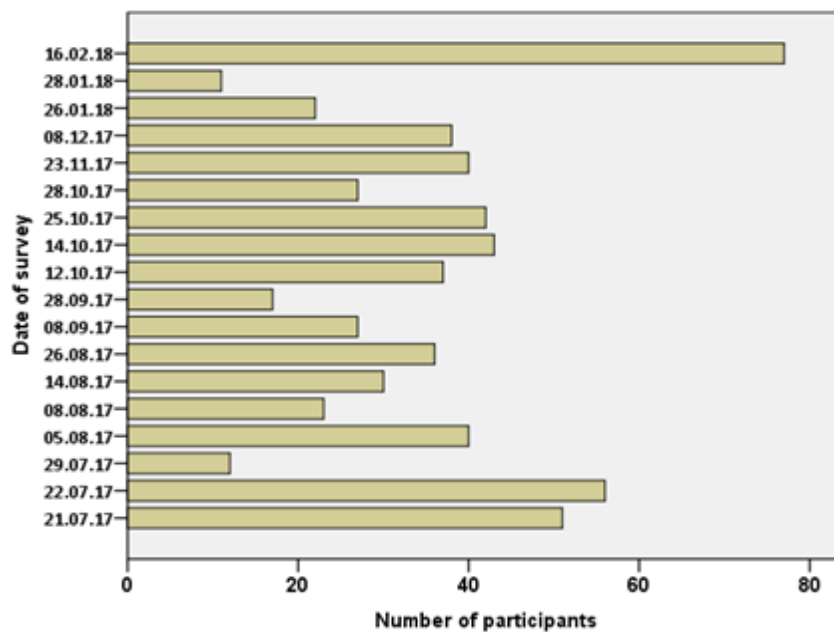


Figure 3. Bar graph showing the number of participants on each specific date of the IC tour.

#### IV. Results

##### Demographics of Participants

A total of 629 participants completed the inflatable colon tour and were subject to the pre-tour and post-tour questions. The demographic variables that have been collected include: gender, age, marital status and educational background. All of the following descriptive statistics and inferential tests were performed using IBM's SPSS - Statistical Product and Service Solutions (Hejase & Hejase, 2013, p. 58). Results show that 64.9% of the participants are females, and 34.7% of the participants belong to the age group of 50 to 64 years, with those belonging to the two lower categories being 29.3% for the 35 to 49 years group, and 27.8% for the young group below 35 years. Only 7.9% of the participants are older than 65 years old. Moreover, 59% of the participants are married; 29.1% of them are single; 6% is widowed; and, 5.7% is divorced. Finally, results disclose that, in general, the participants belong to an educated group, where 32.6% of them have a bachelor degree and 24.2% have completed graduate studies. On the other hand, 28.3% has secondary schooling, 11.3% has primary or less schooling, 3.7% has other types of schooling, including vocational schooling.

**Analysis of Results**

Tables 1 through 7 depict the frequencies and percentages related to the six main questions presented before entering the inflatable colon and after leaving it. Again, the reader should recall that among the six main survey questions, the first four are knowledge questions and the last two are intention questions.

The first knowledge question asked is: "At what age should a person have his/her first screening for colorectal cancer?" (Age 35, 40, 50, or 65). Table 5 shows that only 25.8% of the participants are aware that screening for CRC should take place at the age of 50. This percentage did increase to 75.4% after the interaction with the inflatable colon. Moreover, applying the Related-Samples Wilcoxon Signed Ranks Test to the pre-entrance and post-exit responses to the first question reveal a statistically significant difference in the answers by rejecting the null hypothesis (p=0.000) that the median of differences between the pre-entrance and post-exit answers equals to zero. It is worth here to mention that the Wilcoxon Signed Ranks Test is the nonparametric test equivalent to the dependent t-test. It does not assume normality in the data. It is used to investigate if any change in scores gathered from pre-entering to post-exiting the inflatable colon filled-out questionnaires has occurred (Laerd Statistics, 2013).

**Table 1. At what age should a person have their first screening for colorectal cancer?**

Age	Pre-Entrance to Inflatable Colon		Post-Exit from Inflatable Colon	
	Frequency	Percent	Frequency	Percent
35 Years	184	29.3	51	8.1
40 Years	227	36.1	98	15.6
50 Years	162	25.8	474	75.4
65 Years	8	1.3	1	0.2
No idea	27	4.3	4	0.6
Don't know	21	3.3	1	0.2
Total	629	100.0	629	100.0

Table 2 provides interesting data on the comparison of participants' opinions about ages, before (pre-entrance) and after (post-exit). Table 2 reveals that 301 participants state a lower age score for "their first screening for colorectal " than after their touring of the inflatable colon. Likewise, 75 participants declare a higher screening age score before entering the IC than after the tour; 253 participants underwent no change in their answers pertaining to age.

**Table 2. The ranks table for: "At what age should a person have his/her first screening for colorectal cancer?"**

	N	Mean Rank	Sum of Ranks	
Before entering IC: At what age should a person have his/her first screening for colorectal cancer?	Negative Ranks (Before<After)	301	174.59	52552.00
After exiting IC: At what age should a person have his/her first screening for colorectal cancer?	Positive Ranks (Before>After)	75	244.32	18324.00
	Ties (Before=After)	253		
	Total	629		

The second knowledge question asked: "Removing a polyp from your colon can prevent cancer" (Yes, No, or Don't know). Table 3 displays how the percentage of an affirmative answer increased from 49.6% to 90.6%, following the walk through the inflatable colon. Likewise, the Related-Samples Wilcoxon Signed Ranks Test of the pre-entrance and post-exit responses to the second question show a significant improvement

( $p=0.000$ ), thus rejecting that the median of differences between the pre-entrance and post exit answers equals to zero. Because the  $p$ -value is almost zero, the null hypothesis cannot be rejected. There is sufficient evidence at the 0.001 level of significance to conclude that the median answer for “*Removing a polyp from your colon can prevent cancer*” differs significantly from before entering to that after exiting the inflatable colon.

**Table 3. Removing a polyp from your colon can prevent cancer**

		Pre-Entrance to Inflatable Colon		Post-Exit from Inflatable Colon	
Answer		Frequency	Percent	Frequency	Percent
	Yes	312	49.6	570	90.6
	No	271	43.1	58	9.2
	Don't know	46	7.3	1	0.2
	Total	629	100.0	629	100.0

The third knowledge question is: “*Colorectal cancer always has symptoms that you can feel*”, (Yes, No, or Don’t know). Table 4 displays how the percentage of nonconformity answer increased from 51.2% to 76.8%, after touring the giant colon. Additionally, the Related-Samples Wilcoxon Signed Ranks Test to the pre-entrance and post-exit responses to the aforementioned third knowledge question indicate a significant change ( $p=0.000$ ), thus rejecting the null hypothesis that the median of differences between the pre-entrance and post exit answers equals to zero.

**Table 4. Colorectal cancer always has symptoms that you can feel**

		Pre-Entrance to Inflatable Colon		Post-Exit from Inflatable Colon	
Answer		Frequency	Percent	Frequency	Percent
	Yes	262	41.7	143	22.7
	No	322	51.2	483	76.8
	Don't know	45	7.2	3	0.5
	Total	629	100.0	629	100.0

The fourth question related to knowledge of CRC is: “*If you have a family member with colon cancer, you are at a higher risk of having it too*” (Yes, No, or Other). Table 5 displays how the percentage of an agreeing answer increased from 71.4% to 85.2% after learning from the tour that anyone with a personal or family history of colon cancer, inflammatory bowel disease or other risk factor should be screened before 50 or above more often. The application of the Related-Samples Wilcoxon Signed Ranks Test to the pre-entrance and post-exit responses to this question denote a significant modification in answers ( $p=0.000$ ), thus rejecting the null hypothesis that the median of differences between the pre-entrance and post exit answers equals to zero.

**Table 5. If you have a family member with colon cancer, you are at a higher risk of having it too**

		Pre-Entrance to Inflatable Colon		Post-Exit from Inflatable Colon	
Answer		Frequency	Percent	Frequency	Percent
	Yes	449	71.4	536	85.2
	No	165	26.2	89	14.1
	Other	15	2.4	4	0.7
	Total	629	100.0	629	100.0

The fifth question that is asked upon entering and existing the giant inflatable colon is an intention question: “*How likely are you to get screened for colorectal cancer?*” (Very unlikely, Somewhat negative, Neutral, Somewhat positive, Very likely, Not applicable due to the fact of having been screened before or medical impediment). Table 6 portrays how the percentage of the affirmative “Very Likely” increased from 25.9% to 50.7% after learning from the tour that anyone with a personal or family history of colon cancer, inflammatory bowel disease or other risk factor should be screened before 50 or above more often. The application of the Related-Samples Wilcoxon Signed Ranks Test to the pre-entrance and post-exit responses to this question denote a significant modification in answers ( $p=0.000$ ), thus rejecting the null hypothesis that the median of differences between the pre-entrance and post exit answers equals to zero.

**Table 6. How likely are you to get screened for colorectal cancer?**

		Pre-Entrance to Inflatable Colon		Post-Exit from Inflatable Colon	
Answer		Frequency	Percent	Frequency	Percent
	Very unlikely	50	7.9	15	2.4
	Somewhat Negative	80	12.7	31	4.9
	Neutral	99	15.7	17	2.7
	Somewhat Positive	203	32.3	159	25.3
	Very likely	163	25.9	319	50.7
	Not applicable	34	5.4	88	14.0

<b>Total</b>	629	100.0	629	100.0
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The sixth question that is asked upon entering and leaving the giant inflatable colon is another intention question: “How comfortable are you talking about colorectal cancer screening?” (Very uncomfortable, Somewhat uncomfortable, Neutral, Somewhat comfortable, Very comfortable). Table 7 shows how the percentage of an “affirmative” “Very comfortable” increased from 46.4% to 74.1% after the informative tour. Likewise, the application of the Related-Samples Wilcoxon Signed Ranks Test to the pre-entrance and post-exit responses to this question denote a significant modification in answers (p=0.000), thus rejecting the null hypothesis that the median of differences between the pre-entrance and post exit answers equals to zero. In fact, the evidence shows how the participants’ comfort when talking about CRC screening has increased at the end of the inflatable colon tour.

**Table 7. How comfortable are you talking about colorectal cancer screening?**

Answer	Pre-Entrance to Inflatable Colon		Post-Exit from Inflatable Colon	
	Frequency	Percent	Frequency	Percent
Very uncomfortable	42	6.7	17	2.7
Somewhat uncomfortable	35	5.6	9	1.4
Neutral	95	15.1	20	3.2
Somewhat comfortable	163	25.9	115	18.3
Very comfortable	292	46.4	466	74.1
Missing	2	0.3	2	0.3
<b>Total</b>	<b>629</b>	<b>100.0</b>	<b>629</b>	<b>100.0</b>

Now, on asking the participants: “Have you been screened for colorectal cancer?” Out of the 629 participants, only 56 admitted that they had undergone a screening process; this is slightly less than 9%, which if compared with some reported international figures, 35% in Redwood et al. (2013) and 40% in Lauby-Secretan et al. (2018) shows that the Lebanese community is well behind on this track. Out of the 56 who have had CRC screening, 16 (2.5%) admit that they have seen blood, and another 11 (1.7%) stated that their doctors have advised them to do so. Another 7 said that they had pain (1.1%), one heard of screening in the media (0.2%), one is a parent of a physician (0.2%), 4 admitted suffering from constipation (0.6%), 3 experienced diarrhea(0.5%), 5 suffered from bloating (0.8%), one admitted that screening was done for safety (0.2%) , 3 were directed by their physicians to perform screening due to their family history (0.5%), and 4 have lived abroad and are aware of the CRC screening process (0.6%).

As for the 569 (90.5%) who gave a negative answer for: “Have you been screened for colorectal cancer”, they presented many answers in justification of their answers. The numbers of the excuses of not performing an early CRC screening show that 444 out of 629 (70.6%) have reported that they are unaware of early screening tests. 385 admit that they have not suffered from any symptoms, so why do screening (61.2%). Likewise, 292 participants (46.4%) believe that CRC is not a common disease in their families. Moreover, those who have declared that “the doctor never asked me to do it” are 452 (71.9%). Similarly, “I cannot afford to pay for colonoscopy” got a share of 40 participants (6.4%), and “I hate taking the preparation drink” got 77 (12.2%). On the other hand, “I am afraid of the colonoscopy” got 84 (13.4%), and “I don't want to know if I have cancer” got 45 (7.2%). Those who have chosen “I believe in God, and fatalism” got 144 (22.9%). Finally, those who reported that their age is less than that recommended for screening are 88 participants (14.0%).

### V. Dependence Analysis

On asking “At what age should a person have his/her first screening for colorectal cancer” before the IC tour, 162 persons out of 629 participants (25.76%) did indicate the correct answer: 50 years. It is noticeable that 71% of these 162 participants are females (115), meaning that only 47 males are able to identify the correct age for the first CRC screening. The results after the IC tour indicate that 474 participants did identify the correct age for the first screening; this time males are 167 (35.2% of the 474) and females are 307 (64.8%). Likewise, it is worth mentioning that among the 629 participants (221 males and 408 females), the number of “no idea” and “don't know” responses decreased from a total of 48 (25 males and 23 females) before entering the IC to only 5 (2 males and 3 females) after completing the tour.

On performing a chi-square test on the participants’ answers prior to entering the IC to “At what age should a person have his/her first screening for colorectal cancer?” to check the dependency on gender; the test resulted in a p-value = 0.071, implying that the gender based answers to the aforementioned question do not differ significantly from each other at the .05 level. Likewise, on performing the same test after touring the IC, a p-value = 0.863 resulted, implying that answers under the two sex categories do not differ significantly from each other at the 0.05 level of significance.

On asking prior to entering the IC “Removing a polyp from your colon can prevent cancer”, the chi-square test to check the dependency of the participants’ answers on gender, resulted in a p-value = 0.110, indicating that the aforementioned question answers do not differ significantly from each other for both sexes at the 0.05 level of significance. This same conclusion is obtained on leaving the IC (p-value = 0.226). Here it is noticeable that prior to the IC tour, those who have answered negatively to the question are 173 females (out of a total of 408) and 98 males (out of a total of 221). These numbers considerably diminished after touring the IC to become 34 females (out of 408) and 24 males (out of 221).

The pre-entrance to the IC gender-answers dependency for the question “Colorectal cancer always has symptoms that you can feel”, is also tested. The chi-square dependency test gave a p-value of 0.004, demonstrating a significant relation between the participants’ genders and their corresponding answers. This fact changed upon exiting the IC, where the p-value for the same question became 0.508, implying no significant relation between the participants’ answers to the question and their genders. On the other hand, the answers to the question “If you have a family member with colon cancer, you are at a higher risk of having it too”, show gender independency where it is significant for the pre-tour (p-value = 0.050) and for the post-tour (p-value = 0.291) cases.

The gender-question relationship for “How comfortable are you talking about colorectal cancer screening?” demonstrate a significant (5% level) independency with p-value = 0.196 prior to visiting the IC, and another significant (5% level) independency with p-value = 0.281 upon exiting the IC. In fact, prior to entering the IC, 158 males (out of 221) and 297 females (out of 407) have expressed their feelings of being either somewhat comfortable or very comfortable with talking about CRC screening. These numbers improved upon leaving the IC to become 199 males (out of 221) and 382 females (out of 407).

The gender-question relationship for “How likely are you to get screened for colorectal cancer?” demonstrate a significant (5% level) independency with p-value = 0.057 prior to visiting the IC and surprisingly a significant (5% level) dependency with p-value = 0.001 upon exiting the IC. The affirmative answer of ‘very likely’ is selected by 63 males and 100 females before entering the IC, and by 121 males and 198 females upon concluding the tour (total males=221 and total females = 407).

## **VI. Conclusions and Recommendations**

In Lebanon, the incidence of different types of cancer is 179 new cases per 100,000 inhabitants and digestive cancers account for 14.1% of all types of cancer, with more than 50% of them located in the rectum and colon (Abou Rached, Khater, Aftimos, Khairallah& Mokarbel, 2007). In fact, reported information indicates that both cancer incidence and mortality are expected to increase dramatically in the near future (Kulhánová et al., 2017). The natural development of CRC, as a malignant transformation of a benign adenoma in the majority of cases, gives hope that the detection of adenomas and polyps with malignant potential could reduce the mortality rate (Abu Rached et al., 2016). Thus, there is an urgent need to launch population-wide campaigns that assist to inform the Lebanese residents about cancer, the underlying risk factors, and the promising remedies.

This paper is the first contemporary research in Lebanon to address the use of an Inflatable Colon as a tool for spreading awareness of Colorectal Cancer Screening and assessing the attitude of Lebanese citizens, in gamut of Lebanese regions, towards CRC. Its first merit emanates from the aforementioned fact; in addition, results and outcomes enrich the current scarcity of information about the topic. The aim is to explore the impact of the tool within selected Lebanese communities. The empirical assessment and findings enlighten interested stakeholders as to the extent of people’s unawareness due to the scarcity of disseminated information either by the public sector or by NGOs. This research, with its extensive results, leads to the conclusion that there should be aggressive campaigning at every possible location, including Lebanese universities.

This study presents significant evidence that the use of an inflatable colon increases knowledge of colorectal cancer and its corresponding screening practice. The study shows that awareness of the importance of CRC screening did increase significantly. For “At what age should a person have his/her first screening for colorectal cancer”, the increase came up to be 49.6% (25.8% before the IC tour to 75.4% after performing the tour). In fact, the “before entering the IC” percentage matches the result of a similar CRC survey (Zubaidi, AlSubaie, AlHumaid, Shaffi, AlKhayal& AlObeed, 2015), and at the same time for “after performing the IC tour”, the percentage increase of (49.6%) beats the 33% increase reported in previous IC related works (Briant, Wang, Holte, Ramos, Marchello& Thompson, 2015). As for the question: “Removing a polyp from your colon can prevent cancer” (Yes, No, or Don’t know), the percentage of an affirmative answer increased from 49.6% to 90.6% following the walk through the inflatable colon. Surprisingly, a survey among 1070 participants in Riyadh, demonstrate that less than 20% of the respondents believe that polyps are a risk factor (Zubaidi et al., 2015). Likewise, for “How comfortable are you talking about colorectal cancer screening?” the increase for the “Very comfortable” class came up to be 27.7% (from 46.4% prior to entering the IC to 74.1% after the informative IC tour). In general, we can say that all the differences for pre-entry and post-exit questions related to CRC knowledge and behavior are significant, indicating the effectiveness of the IC to instruct participants; a



result which again matches the results reported in the literature in other parts of the world (Briant et al., 2015, p. 6). In summary, the outcomes of this research agree with other reported results that the IC is a promising “community-level intervention” that potentially contributes to the increase in CRC screening and prevention (Redwood et al., 2013; Sanchez et al., 2014).

Finally, if this work is to be summarized in few words, it can be concluded that a walk-through inflatable colon is an attractive innovative tool to increase CRC awareness and the odds on screening. After all, in the USA, CRC screening has resulted in 550,000 fewer colorectal cancer cases over the past three decades (Yang, Gross CP, Soulos, & Yu, 2014).

The knowledge gained from this study will guide public policy makers in formulating and adjusting policies to promote awareness and support NGOs that are active in this field, and will foster the community’s well-being efforts accompanied by an adequate health support system; a fact that will boost both the patient’s morale and the health care teams’ performance which will in turn promote the effectiveness of screening and the preventive measures before it is too late. Furthermore, this study serves as an eye opener to other researchers as it provides useful guidelines concerning empirical results emanating from several community groups. Also, this research work serves as a reference material for further research on this field of study. In addition, it serves as a study material for both health and medical school faculty members and students interested in this topic. Moreover, as the study guides policy makers in making and adjusting policies to achieve a more effective performance, it will help the specialized NGOs to grow, resulting in enhanced standards of living of the community at large.

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Ale J. Hejase, Hana Nemer, Hussin Jose Hejase, & Gladys Honein-AbouHaidar  
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