

Knowledge level of cardio-oncology in oncologist and cardiologist: A survey study in China

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Research

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Abstract

Background: With the rapid development of the field of cardio-oncology, it has been recognized as an important medical area to improve the healthcare quality of cancer patients with cardiac complications. In this study, we investigated the knowledge level of cardio-oncology of oncologists and cardiologists in China.

Methods: A structured questionnaire survey was conducted during 30th September, 2018 to 3rd December, 2019. Questionnaires were given to oncologists and cardiologists randomly selected. A general linear model was used to explore the significant factors associated with the knowledge level.

Results: In total, 973 responses were finally solicited and included in the analysis. Only 3 respondents reached the full marks. Results of knowledge level of cardio-oncology in China were not found satisfactory. The knowledge level was better in respondents with a cardiology background (P-value =0.001), worked in the higher-level hospital (P-value =0.01), from the east or west region of mainland China (P-value <0.001), at a high position of doctor (Chief doctor, P-value =0.009), with full awareness of cardio-oncology (P-value <0.001) and favorable attitude toward cardio-oncology development (P-value <0.001).

Conclusions: Our survey suggested that the demands of cardio-oncology service in China was huge but the low level of knowledge on cardio-oncology was alarming. Strong supports are needed to improve the dedicated education of cardio-oncology in China

Background

Cancer is the leading cause of death worldwide and the leading cause of death in China since 2010 [1]. In 2018, an estimate of new cancer cases in China have been reported as 4.3 million [2]. With the advances of cancer treatments and the development of public health care in China, the age-standardized 5-year survival rate of cancer patients increased to 40.5% for all cancers combined [3]. But at the same time, the number of complications caused by the cancer treatments is also on the rise, especially cardiovascular complications [4,5]. Previous studies showed that cancer patients undergo anthracycline chemotherapy, radiation therapy, androgen deprivation therapy, antibody therapy against HER2 are at greater risk of cardiovascular diseases (CVD) [6-9].

To preventing and solving the cardiovascular problems mediated by cancer treatments, a new discipline of medicine cardio-oncology was established. In 2000, the first cardio-oncology unit was opened at The University of Texas MD Anderson Cancer Center [10]. In 2009, the International CardioOncology Society was founded to strengthen the collaboration between oncologists and cardiologists. In the past few years, the field of cardio-oncology was developed rapidly and received worldwide recognition. Multiple organizations, such as: The International Society of Geriatric Oncology (SIOG) [11], The European Society of Cardiology (ESC) [12], The American Society of Clinical Oncology (ASCO) [6], have issued guidelines and recommendations relevant to cardiovascular complications and cardiotoxicity in cancer treatments.

The development of cardio-oncology is still at the beginning phase in China. Learning the experience from United States and Europe, the first cardio-oncology unit in China was established at the First Affiliated Hospital of Dalian Medical University in 2016. In recent years, more Chinese hospitals started to build a dedicated cardio-oncology team to meet the needs of cancer patients suffering from cardiovascular complications, such as: Harbin Medical University Cancer Hospital, Fuwai Hospital, Peking University People's Hospital, First Hospital of Shanxi Medical University, Zhongshan Hospital (Fudan University), Shanghai Chest Hospital, Chongqing Cancer Hospital & Institute, and Central Hospital of Guangdong Provincial Nongken. In early 2016, the China cardio-oncology network was initiated to facilitate the collaboration and academic communication between oncology experts and cardiology experts. The members in China cardio-oncology network have successfully organized a few academic meetings [13].

Despite the efforts to promote the development of cardio-oncology, the diffusion into regional hospitals is still limited. A huge amount of consultations about the cardiovascular problems in cancer patients were given by the local clinicians from the oncology or cardiology unit. Due to lack of a well-structured education program of cardio-oncology in China, the major method for clinicians to gain the relevant knowledge is self-motivated reading of literature. The knowledge level can be varied widely among clinicians. Little research has been done to focus on the knowledge level of cardio-oncology in oncologist and cardiologist in China.

In our survey, we focused on the examination of the knowledge of cardio-oncology, and also systematic assessed the awareness of, attitudes toward, barriers to, and implementation of cardio-oncology in Chinese oncologist and cardiologist.

Methods

1. Study design

A structured questionnaire was developed by the cardio-oncology team in National Cancer Center and National Center for Cardiovascular Disease, the study was conducted during 30th September, 2018 to 3rd December, 2019. This survey study was approved by the institutional Review Boards of Cancer Hospital, Chinese Academy of Medical Sciences. The questionnaire was randomly distributed to a cardiologist or an oncologist drawn from the pool of the physicians attended to the 29th Great Wall international congress of cardiology (GW-ICC), Asia Pacific heart congress 2018, International congress of cardiovascular prevention and rehabilitation 2018 and China cancer management symposium 2019. Responses were solicited until valid and adequate samples of questionnaires had been received. A questionnaire was marked as invalid if the questionnaire with incomplete and/or inconsistent responses. Central illustration of this study can be seen in Supplementary Figure-1.

2. Subjects

The target respondent for this survey was defined as the oncologist and cardiologist worked in the tertiary hospitals, cancer centers, and cardiovascular centers in mainland China. The exact number of cardiologists and oncologists in practice is unknown. According to the data from China health statistics 2019

[14], the number of physicians of all specialties in tertiary hospitals, cancer centers, and cardiovascular centers was 1450976, 24116 and 6491 respectively, the estimated population of interest in China was 80000 (cardiologist) and 100000 (oncologist). A simplified Yamane formula was adopted to calculate sample size [15]. With a margin of error of 5%, and 95% confidence interval, the required the sample size was 398 in each specialty to generalize to the total population of cardiologists and oncologists.

3. Questionnaire

The structured questionnaire included 3 items for the awareness of cardio-oncology/ the need of cardio-oncology, 1 item for the attitude toward the building of a cardio-oncology unit, 4 items for the barriers to the development of cardio-oncology unit, 34 items for measuring the knowledge level of cardio-oncology, and 2 items for the implementation of cardio-oncology knowledge into practice (Supplementary material-1). For the awareness of cardio-oncology, three aspects were designed to survey, including the awareness of cancer patients with CVD complications, awareness of cardio-oncology discipline and awareness of the building of cardio-oncology unit. 4 items in the barriers' sections were related to recognition of barriers existence and sculpting barriers to lack of knowledge, lack of demands and lack of supports. The knowledge level of cardio-oncology was referred to the following aspects: (1) the proper timing to run the CVD risk assessment for cancer patients, (2) the recommended approaches to monitoring the heart function of cancer patients at risk for CVD, (3) the types of cancer treatment that led to higher risk for developing cardiac dysfunction, (4) the commonly seen cardiovascular complications of cancer treatments, (5) the cardioprotective drugs for cancer patients with heart failure or left ventricle dysfunction. 2 items about the implementation of CVD risk assessment and medical history checking were asked. Questions were rated using a dichotomous scale (Yes or No, Agree or Disagree). Background information was also collected, including specialty, location, level of hospital, level of physician. Level of hospital was classified as tertiary grade-A and tertiary grade-B [16]. Level of doctors was divided into 5 groups: medical student, junior doctor, doctor in charge, assistant chief doctor and chief doctor [17].

For the items to measure the knowledge level, the correct answer was scored 1 and the wrong answer was scored 0, total scores were calculated by adding the correct answers together. Scores were used as a proxy for measuring the knowledge level. The higher the total score, the better the knowledge level.

The content validity was examined by 6 experts worked at cardio-oncology units. the content validity index was 0.923 indicated an adequate content validity (Supplementary table-1) [18].

4. Statistical analyses

Data was checked, cleaned, and analyzed using SPSS software (SPSS, Chicago, IL, USA). Categorical variables were described by percentages and counts. The score of the knowledge level was described by mean and standard deviation (SD). Categorical variables were analyzed using a Chi-square test. Comparisons of mean score of the knowledge level were done by ANOVA. To explore the significant factors of the knowledge level of cardio-oncology, a general linear model (GLM) was used. $P < 0.05$ was considered statistically significant.

Results

A total of 1049 responses were received; however, 76 were rated as an invalid response because of the questionnaire with incomplete and/or inconsistent answers. 973 responses were finally solicited and included in the analysis. Of the 973 physicians responded, 444 (45.6%) were oncologists and 529 (54.4%) were cardiologists; 885 (91.0%) practiced in Tertiary grade A hospitals. The surveyed physicians were from 22 provinces, 4 autonomous regions, and 4 municipalities of mainland China; we only failed to reach the physicians in the Tibet autonomous region. 25.5% (N=248) of surveyed physicians worked in the middle region of mainland China, 33.2% (N=323), and 41.3% (N=402) of surveyed physicians practiced in the western and eastern of mainland China, respectively. The geographical characteristics of surveyed physicians were nicely correlated with the geographical profile of tertiary hospitals (Supplementary table-2) (14). The proportion of surveyed physicians appointed as a chief doctor, assistant chief doctor, doctor in charge, the junior doctor was 22.7% (N=221), 28.8% (N=280), 27.5% (N=268) and 12.1% (N=118), respectively. 86 (8.9%) medical students who worked in the hospital as trainees also took our survey.

1. The awareness of cardio-oncology

Of 973 respondents, only 3 were not aware of cardio-oncology at all, and 970 (99.7%) respondents were aware of cardio-oncology or related concepts. 343 (35.3%) respondents were fully aware of cardio-oncology in terms of patients, discipline, and special units. Full awareness of cardio-oncology was associated with the following characteristics of respondents: specialty (P -value < 0.0001), level of the hospital (P -value < 0.001), and level of the physician (P -value =0.01) (Table 1). The highest awareness of cardio-oncology was among the oncologists worked in a tertiary grade-A hospital as a chief doctor.

2.The attitude toward and barriers to building a cardio-oncology unit

Among the 973 respondents, the majority (N=929, 95.5%) of them were in favor of building a special unit of cardio-oncology (Supplementary Table-3). The oncologists who worked in a tertiary grade-A hospital were more supportive of the development of cardio-oncology unit compared to cardiologists.

And 960 (98.7%) respondents admitted that it would not be easy to establish a cardio-oncology unit since many barriers existed (Table 2). The most recognized barrier was a lack of awareness and knowledge in this multidisciplinary area, particularly among the respondents who worked in a tertiary grade-A hospital. In addition, about 22% of respondents believed that a lack of enough demand from cardio-oncology service was also a barrier to open a cardio-oncology unit in the hospital.

3.The knowledge level of cardio-oncology

The average/median score was 22.8/23 (out of 34 cardio-oncology questions) for all the respondents. Only 3 respondents were fully correct about the total of 34 questions. The scores for questions related to the CVD complications and cardioprotective drugs were marked a lower correctness rate (approximately 51%

and 65% correct, respectively), scores are summarized in Supplementary Table-4. The correct rate was 78%, 75%, and 72% in questions related to the proper timing to run the CVD risk assessment, the recommended approaches to monitoring the heart function, and the types of cancer treatment that led to a higher risk for developing cardiac dysfunction, respectively.

There were 33.4% of respondents who could correctly answer all questions about the timing of CVD risk assessment. 26.1% of respondents were correct about the recommended approaches for monitoring heart function. 37.1% of respondents gained the full marks of questions related to the types of cancer treatments affected heart functions. The percentages of respondents who reached the full marks in questions of the CVD complications and cardioprotective drugs were 7.4% and 3.3% respectively, which were quite low (Table 3).

GLM regression analysis was used to examine the factors associated with a better knowledge level of cardio-oncology (Table 4). Our results demonstrated that knowledge level of cardio-oncology was better in respondents with a cardiology background (P-value =0.001), worked in the higher-level hospital (P-value =0.01), from the east or west region of mainland China (P-value <0.001), at a high position of doctor (Chief doctor, P-value =0.009), with full awareness of cardio-oncology (P-value <0.001) and favorable attitude toward cardio-oncology development (P-value <0.001).

4. The implementation of cardio-oncology knowledge

Of the 973 valid respondents, 863 respondents believed the CVD risk assessment for cancer patients should be run before the cancer therapy initiated. Among the 863 respondents who opt to run the CVD risk assessment before the treatment, 781 of them stated that they did perform the CVD risk assessment and 81 respondents who thought the pre-treatment CVD risk assessment was not essential also evaluated the CVD risks. Of the 966 respondents who were aware of cancer patients with cardiac complications, 908 of them always check the clinical history of cancer and cardiovascular disease of patients, and 6 respondents who have not seen a cancer patient with cardiovascular complications were willing to check the clinical history thoroughly. The chief doctors and oncologists implemented these good practices more often (Table 5).

Discussion

As the treatment of cancer advanced, the survival rate of cancer is improved but at the same time, many cancer patients and cancer survivals suffered from CVD as a result of the intense anti-cancer treatment [19,20]. To improving patient care, mastery of the knowledge of cardio-oncology is a cornerstone for our fellow oncologists and cardiologists. In this study, we looked at the knowledge level of cardio-oncology of the oncologists and cardiologists worked in the tertiary hospitals. And we also try to analyze what are the factors associated with the knowledge level.

In general, the knowledge acquisition of a doctor is mainly driven by clinical questions that arise during the care of patients. As shown in our survey, 99.3% of respondents met with cancer patients with cardiac complications. And according to a survey (convenience sampling) we conducted in our own clinics, 97% of the interviewed cancer patients were willing to take advice from cardio-oncologists since they did have concerns about their heart conditions. The need and motivation for a doctor to equip with knowledge of cardio-oncology seem to be huge. But the overall awareness of cardio-oncology was not very high, only 35.3% which mainly due to many of the respondents (61.4%) were not aware of the building of special cardio-oncology units in China. This result is not a surprise to us since the development of cardio-oncology in China is still in the early phase and there is still a long way to go for the promotion of cardio-oncology in China.

There were important differences related to the awareness between the two professional groups. The oncologists were more aware of cardio-oncology than cardiologists. In terms of the attitude toward cardio-oncology development, the oncologists were also more supportive. But, the better awareness and attitude of oncologists did not lead them to a better knowledge level of cardio-oncology. There were more questions related to cardiology that may partially explain the higher correctness rate of cardiologists. As shown in the result, cardiologists did better in answering the questions related to approaches for monitoring heart function, CVD complications in cancer patients, and cardioprotective drugs. And the oncologists only outperformed the cardiologists in the questions about the types of anti-cancer treatment affected heart function. This result showed that they all answered the questions in their own field better. Cardio-oncology is a multidisciplinary area. One of the major missions in this new area is to bring cardiologists and oncologists together and learn from each other. And our results indicated that the overall knowledge level of cardio-oncology in professional physicians is still low in China, considering our respondents all worked in the tertiary hospitals which provide the highest level of health care.

Only 3 (0.3%) respondents were able to answer the 34 basic questions related to cardio-oncology correctly. That was an unexpected result because 221 of respondents are the chief doctor who has rich clinical experiences and high academic credentials. But it also demonstrated the importance of cardio-oncology education and training. Without a dedicated cardio-oncology training program, physicians have limited opportunities to access the comprehensive information of cardio-oncology. Consequently, our physicians are lack of cardio-oncology knowledge which inevitably lead to inconsistency or even mistakes in cardiovascular care for cancer patients. Now the cardio-oncology training is still blank in China and we really need the support.

In addition, our study highlighted other factors in relation to the knowledge level, such as the hospital level, the doctor level, and region. There are several characteristics of medical practice in China. First, the more developed the region is, the better medical resource the region has; second, most oncology and cardiology clinics are in large general hospitals. And third, patients are more willing to have a consultation with the doctor at a higher level. Naturally, physicians who came from the more developed area, worked in the high-level hospital, and at higher doctor level have better and richer clinical experiences. It proved that the knowledge gained from experiences is also crucial.

Study limitations

There are some limitations to this study. First, the sampling method is non-probability sampling which provides less accuracy and reliability. In China, there is no registration system for sub-specialty, it is difficult to reach the accurate number and distribution of cardiologists and oncologists, and that makes the

probability sampling inapplicable. Second, our respondents are mainly from the tertiary grade A hospitals, that does not show the full picture of the level of cardio-oncology in China. Third, a few more cardiology-related questions are listed in the questionnaire in which the design is imperfect and may introduce confounding factors. The design of the questionnaire needs to be improved in the future. Fourth, inability to reach a certain population is one of the general limitations of web-based survey, for example, elder physicians who are not good with computer/internet are less willing to take a web-based survey. Younger and computer-savvy physicians are possibly over-represented.

Conclusion

The present study showed that the demands of cardio-oncology service in China was huge but the current knowledge level of cardio-oncology in the cardiologists and oncologists was still low. Other than professional groups, the significant factors (P-value <0.001) associated with the knowledge level were region, attitude, and awareness. The dedicated education may help to improve the knowledge level of physicians on the subject of cardio-oncology, and ultimately, the cardiovascular care for cancer patients in practice.

Declarations

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Compliance with ethical standards

Conflict of Interest

The authors declare that they have no competing interests.

Ethics approval

This study was approved by the Institutional Review Boards of Cancer Hospital, Chinese Academy of Medical Sciences (No. NCT03537339), and the protocol has been registered on ClinicalTrials.gov with the number NCC201712029.

Consent to participate

We have informed the participants before the questionnaire survey starts that the data of the questionnaire will be published in some way, and we have obtained the consent of the participants.

Author contributions

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Abbreviations

ASCO: American Society of Clinical Oncology

CVD: cardiovascular diseases

ESC: European Society of Cardiology

GW-ICC: Great Wall international congress of cardiology

GLM: general linear model

SD: standard deviation

SIOG: International Society of Geriatric Oncology

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Tables

Table-1: Awareness of Cardio-oncology

	All respondents (N=973)	Aware of cancer patient with cardiac complication (N=966, 99.3%)	P-value	Aware of cardio-oncology discipline (N=808, 83.0%)	P-value	Aware of the establishment of cardio-oncology unit (N=376, 38.6%)	P-value	Full awareness of cardio-oncology (N=343, 35.3%)	P-value
Specialty									
Oncology	444	442, 99.5%	0.597	386, 86.9%	0.004	208, 46.8%	<0.0001	196, 44.1%	<0.0001
Cardiology	529	524, 99.1%		422, 79.8%		168, 31.8%		147, 27.8%	
Level of hospital									
Tertiary grade A	885	879, 99.3%	0.860	740, 83.6%	0.173	354, 40.0%	0.008	327, 36.9%	<0.001
Tertiary grade B	88	87, 98.9%		68, 77.3%		22, 25.0%		16, 18.2%	
Region									
Middle	246	244, 99.2%	0.777	198, 80.5%	0.054	111, 45.1%	0.058	99, 40.2%	0.169
Western	323	320, 99.1%		261, 80.8%		117, 36.2%		107, 33.1%	
Eastern	402	400, 99.5%		348, 86.6%		148, 36.8%		137, 34.1%	
Level of physician									
Chief doctor	221	220, 99.5%	0.841	202, 91.4%	<0.0001	98, 44.3%	0.019	92, 41.6%	0.010
Assistant chief doctor	280	277, 98.9%		238, 85.0%		101, 36.1%		98, 35.0%	
Doctor in charge	268	267, 99.6%		224, 83.6%		115, 42.9%		101, 37.7%	
Junior doctor	118	117, 99.1%		74, 62.7%		35, 29.7%		29, 24.6%	
Medical student	86	85, 98.8%		70, 81.4%		27, 31.4%		23, 26.7%	

Table 2- The barriers to the development of cardio-oncology unit

	All respondents (N=973)	Barriers exist (N=960, 98.7%)	P-value	Lack of awareness and knowledge of cardio-oncology (N=749, 77.0%)	P-value	Lack of demand for cardio-oncology service (N=220, 22.6%)	P-value	Inadequate supports from cardiologist & oncologist (N=691, 71.0%)	P-value
Specialty									
Oncology	444	437, 98.4%	0.750	345, 77.7%	0.678	103, 23.2%	0.7455	328, 73.9%	0.0001
Cardiology	529	523, 98.9%		404, 76.4%		117, 22.1%		363, 68.6%	
Level of hospital									
Tertiary grade A	885	874, 98.8%	0.752	691, 78.1%	0.014	198, 22.4%	0.6685	641, 72.4%	0.003
Tertiary grade B	88	86, 97.7%		58, 65.9%		22, 25.0%		50, 56.8%	
Region									
Middle	246	239, 97.2%	0.058	188, 76.4%	0.064	56, 22.8%	0.7328	160, 65.0%	0.008
Western	323	320, 90.1%		263, 81.4%		77, 23.8%		248, 76.8%	
Eastern	402	399, 99.3%		298, 74.1%		86, 21.4%		282, 70.1%	
Level of physician									
Chief doctor	221	215, 97.3%	0.225	166, 75.1%	0.649	51, 23.1%	0.8606	158, 71.5%	0.027
Assistant chief doctor	280	278, 99.3%		216, 77.1%		58, 20.7%		191, 68.2%	
Doctor in charge	268	264, 98.5%		209, 78.0%		60, 22.4%		199, 74.3%	
Junior doctor	118	118, 100%		90, 76.3%		29, 24.6%		92, 78.0%	
Medical student	86	85, 98.8%		68, 79.1%		22, 25.8%		51, 59.3%	

Table 3- The number and percentage of respondents who reached the full marks in different aspects of cardio-oncology knowledge

	All respondents (N=973)	Correct about the timing of CVD risk assessment (N=325, 33.4%)	P-value	Correct about the recommended approach for monitoring heart function (N=210, 21.6%)	P-value	Correct about the cancer treatments affected heart functions (N=361, 37.1%)	P-value	Correct about the common cardiovascular complications in cancer patients (N=72, 7.4%)	P-value	Correct about the drugs proved to be cardioprotective (N=32, 3.3%)	P-value
Specialty											
Oncology	444	144, 32.4%	0.604	77, 17.3%	0.004	197, 44.4%	<0.0001	21, 4.7%	0.005	9, 2.0%	0.001
Cardiology	529	181, 34.2%		133, 25.1%		164, 31.0%		51, 9.6%		23, 4.3%	
Level of hospital											
Tertiary grade A	885	305, 34.5%	0.035	201, 22.7%	0.010	338, 38.2%	0.034	65, 7.3%	0.996	28, 3.1%	0.701
Tertiary grade B	88	20, 22.7%		9, 10.2%		23, 26.1%		7, 8.0%		4, 4.5%	
Region											
Middle	246	69, 28.0%	0.001	39, 15.9%	0.031	74, 30.1%	0.020	11, 4.5%	0.067	7, 2.8%	0.001
Western	323	95, 29.4%		80, 24.8%	0.013	122, 37.8%		29, 9.0%		4, 1.2%	
Eastern	402	161, 40.0%		91, 22.6%	0.046	165, 41.0%		32, 8.0%		21, 5.2%	
Level of physician											
Chief doctor	221	80, 36.2%	0.485	50, 22.6%	0.543	83, 37.6%	0.767	23, 10.4%	0.271	9, 4.1%	0.701
Assistant chief doctor	280	82, 29.3%		57, 20.4%		99, 35.4%		16, 5.7%		8, 2.9%	
Doctor in charge	268	95, 35.4%		55, 20.5%		105, 39.2%		21, 7.8%		10, 3.7%	
Junior doctor	118	40, 33.9%		24, 20.3%		46, 39.0%		8, 6.8%		2, 1.7%	
Medical student	86	28, 32.6%		24, 27.9%		28, 32.6%		44.7%		3, 3.5%	

Table 4-Summary of regression results using GLM to explore the factors associated with the knowledge level

Parameter	Coefficient	SE of Coefficient	t-value	P-value
Intercept	15.798	1.48	10.676	<0.001
Specialty				
Oncology	-0.984	0.292	-3.371	0.001
Cardiology	Ref			
Level of hospital				
Tertiary grade A	1.279	0.497	2.571	0.01
Tertiary grade B	Ref			
Region				
Middle	-1.793	0.357	-5.023	<0.001
West	0.162	0.339	0.477	0.634
East	Ref			
Level of physician				
Chief doctor	1.473	0.564	2.61	0.009
Assistant chief doctor	0.715	0.549	1.303	0.193
Doctor in charge	0.859	0.551	1.56	0.119
Junior doctor	0.797	0.625	1.275	0.203
Medical student	Ref			
Awareness of cardio-oncology				
Full awareness	1.925	0.302	6.372	<0.001
Lack of awareness	Ref			
Attitude towards developing a cardio-oncology unit				
Favorable attitude	5.571	0.681	8.175	<0.001
Unfavorable attitude	Ref			
Barriers to build the cardio-oncology unit				
Recognition of barriers	-0.205	1.227	-0.167	0.867
Lack of recognition of barrier	Ref			

Ref: set as reference.

Table 5 – Implementation of cardio-oncology related knowledge in practice

	All respondents (N=973)	Running CVD risk assessment before cancer therapy (N=862, 88.6%)	P-value	Checking the history of cancer and cardiovascular disease (N= 914, 93.9%)	P-value
Specialty					
Oncology	444	423, 95.3%	<0.0001	426, 95.9%	0.023
Cardiology	529	439, 83.0%		488, 92.2%	
Level of hospital					
Tertiary grade A	885	789, 89.2%	0.117	835, 94.4%	0.138
Tertiary grade B	88	73, 83.0%		79, 89.8%	
Region					
Middle	246	211, 85.8%	0.176	235, 95.5%	0.340
Western	323	286, 88.6%		299, 92.6%	
Eastern	402	364, 90.5%		378, 94.0%	
Level of physician					
Chief doctor	221	204, 92.3%	0.018	215, 97.3%	0.039
Assistant chief doctor	280	245, 87.5%		260, 92.9%	
Doctor in charge	268	239, 89.2%		253, 94.4%	
Junior doctor	118	95, 80.5%		105, 89.0%	
Medical student	86	79, 91.9%		81, 94.2%	

Supplementary Files

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