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## Risk Management for Sustainable Development within the Radiation Departments at Governmental Hospitals in the Gaza Strip

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### Abstract:

This study was conducted on all radiation technologists and radiologists at the six main governmental hospitals in Gaza Strip, Palestine. Besides, four key informant interviews with radiation departments heads and managers were conducted. A pilot study was carried out before the implementation of the questionnaires. Thirty copies of the questionnaire were distributed appropriately to the respondents from the target group and the results of the pilot study were combined with the overall results of the respondents. Findings revealed that 63.5% of Radiation Technologists and Radiologists having Thermoluminescence Dosimeters, and only 38.7% notified of reading it. The results of the study in the field of "risk management" revealed the absence of risk management within the radiation departments of the six main hospitals in the Gaza Strip. Concerning the field of "sustainable development", participants fully agreed on the importance of sustainable development within the radiation departments.

**Keywords:** Governmental Hospitals, Gaza , Radiography, Sustainable Development, Risk Management.

### إدارة المخاطر لأجل التنمية المستدامة داخل الدوائر الإشعاعية في المستشفيات الحكومية في قطاع غزة

الملخص:

أجريت هذه الدراسة على جميع تقنيي وأخصائيي الأشعة في المستشفيات الحكومية الستة الرئيسية في قطاع غزة، فلسطين. إلى جانب ذلك، تم إجراء أربع مقابلات مع رؤساء ومديري أقسام الأشعة للحصول على المعلومات اللازمة. تم إجراء دراسة تجريبية قبل تنفيذ الاستبيانات، وتم توزيع ثلاثين نسخة من الاستبيان بشكل مناسب على المستجيبين من المجموعة المستهدفة وتم الجمع بين نتائج الدراسة التجريبية والنتائج الإجمالية للمستجيبين. كشفت النتائج أن 63.5% من تقنيي الإشعاع وأخصائيي الأشعة لديهم مقاييس التألق الحراري، وأفاد 38.7% فقط يقومون بقراءته.

كشفت نتائج الدراسة في مجال "إدارة المخاطر" عن عدم وجود إدارة للمخاطر داخل أقسام الإشعاع في المستشفيات الستة الرئيسية في قطاع غزة. وفيما يتعلق بمجال "التنمية المستدامة"، اتفق المشاركون تمامًا على أهمية التنمية المستدامة داخل أقسام الأشعة.

كلمات مفتاحية: المستشفيات الحكومية، غزة، الأشعة، التنمية المستدامة، إدارة المخاطر.

## 1. Introduction:

Radiology services are now the main tools for the diagnosis of many diseases and have an important role in monitoring treatment and predicting outcomes. Radiation service can include methods based on both ionizing and non-ionizing radiation that covering conventional radiation, fluoroscopy, nuclear medicine, computerized tomography, mammography, interventional radiology, bone density measurement, ultrasound and MRI (Pereira, et al., 2015). The field of radiation is rapidly evolving due to technological advances and the globalization of health care. This continuous development exhibits a significant impact on quality of care and delivery of services (Lauritzen, et al., 2016; Vilar-Palop, et al., 2018). Radiation departments play an effective and important role in hospitals in the early diagnosis of diseases, as well as treatment. Radiation dose, over load work, equipment damage, risks from external factors and high voltage electricity have adversely effects on both employees and patients. On the other hand, risk management seeks to identify, assess and prioritize risks to control of resources in order to reduce the likelihood and impact of unfortunate events or to limit opportunities. In addition, the field of radiation is rapidly evolving due to technological advances and the globalization of health care. This continuous development will have a significant impact on the quality and sustainability of care and delivery of services. Risk is an opportunity or possibility of a loss or a negative event that may cause injury to patients or medical practitioners. This will push to consider some approaches that are used in risk management in radiology. Thus, risk management in radiology is essential in the protection of patients and radiologists, medical regulation in terms of capital and broadening the organization's medical reputation with patients (Craciun, Mankad and Lynch, 2015). The risk management and development of radiology is primarily developed to help and protect patients, employees members and the entire organization (Malone et al., 2018). Risk management is to identify, evaluate and prioritize risks followed by the facilitated and financial application of assets to diminish the probability, affect and dangers of disastrous occasions or to restrain opportunities. The goal of risk management is to ensure that uncertainty does not distort the endeavor of business objectives (Abudulnabi, 2018). Risk management allows radiologists to focus on risk mitigation measures. This ensures that medical personnel follow appropriate and relevant protocols and guidelines for risk reduction in radiation departments (Royal College of Radiologists, 2017). The chosen method of risk identification may depend on culture, occupational practices and compliance. Selection methods are created from templates or templates are developed to determine the source, problem, or event (Western Sydney University, 2015).

Sustainable development is one of the objectives of national policies in all countries of the world and has a clear impact on the environment and natural resources and on the future of human development in general, and thus there is a relationship between sustainable development and the environment. The Sustainable Development Strategy for the Health, Public Health and Welfare System 2014-2020 was propelled in January 2014. It depicts the vision for a sustainable health and care framework by decreasing carbon outflows, securing natural assets, and planning communities for extraordinary climate occasions and advance sound ways of lifestyles and environments. The challenge is how to proceed to make strides health and well-being and to supply quality care presently and for future eras inside accessible budgetary, social and natural assets. Understanding these challenges and creating plans to realize moved forward health and well-being and the

proceeded arrangement of quality care are at the heart of sustainable development (Sustainable Development Unit, 2016).

One notable example of sustainable development in healthcare is Healthcare Without Harm (HWH). HWH notes that the huge scale of the healthcare sector worldwide suffers from unsustainable practices such as poor waste management, the use of harmful chemicals, and dependence on contaminating technologies have a major negative impact on the health of individuals and the environment. The main objective of HWH is to ‘transform the healthcare sector worldwide, without compromising patient safety or care, so that it is ecologically sustainable and no longer a source of hurt to public health and the environment’ (Ling, et al., 2012).

The aim of this paper is to assess the role of risk management in achieving sustainable development within the radiation departments of six main government hospitals in Gaza Strip (GS).

**Problem statement :**

Gaza Strip is one of the largest overcrowded geographical area in the world, this requires a doubling of services adapted to the population growth (Palestinian Central Bureau of Statistics, 2015). The Ministry of Health (MoH) is the main provider of radiology services in Palestine, the number of radiation procedures in MoH hospitals were 654,616 procedure in 2017 which increased by 7.7% compared to 2016 by 81% of the total medical imaging services in hospitals in (GS). These services are represented in the following: conventional radiography 504,709, Computed Tomography (CT) 34,904, Magnetic Resonance Imaging (MRI) 8,159, Fluoroscopy 4,023 and others 13073. The Palestinian MoH observed a significant increase in medical imaging services in GS between 2008-2017 (Ministry of Health, 2017). The Israeli siege imposed on GS impact significantly on medical imaging services. Also, a significantly increase in breakdowns of radiation equipments resulting from overload work and scarcity of resources. This adversely affects both employees and patients. The GS also suffers from a severe economic crisis that has a clear impact on the services provided at governmental hospitals, especially the radiation departments, which increases the risks to employees and patients within the radiation departments. The effects of the economic crisis have led to complex radiation problems. This is reflected on the quantity and quality of outputs (European Society of Radiology, 2015). Based on direct contact with MoH, there is an ambiguity in the concept of plans and sustainable development within the radiation departments in the course of rapid technological development to raise the level of radiation prevention and reduce risk. Furthermore, little attention, follow-up and monitoring for risks and occupational safety compared with the international standards are reported in the GS.

**General objective:**

The overall aim of this study is to assess the role of risk management in achieving sustainable development within the radiation departments at governmental hospitals in GS.

**Specific objectives of the study:**

1. To assess the available risk management within radiation departments at governmental hospitals.
2. To Explore the existence of criteria for medical imaging practice at governmental hospitals to reduce the risk of radiation exposure.
3. To assess possibilities of sustainable development in the radiation departments at MoH.

### **Study questions:**

1. Is the available risk management effective within the radiation departments of government hospitals?
2. Is there any criteria for the practice of medical imaging in public hospitals to reduce the risk of exposure to radiation?
3. Are there sustainable development prospects in the radiation departments of the MoH?

## **2. Methods**

### **Strategy of the study**

To evaluate the role of risk management in achieving sustainable development within the radiation departments at governmental hospitals in GS. A quantitative and qualitative survey approach has been adopted. The questionnaire was chosen as a research technique to measure objectives, while interviews of well-prepared key informant interviews (KII) were selected as a qualitative method of data collection.

### **Setting of the study:**

The study was carried out in GS, Palestine, which consists of five governorates: Northern governorate, Gaza governorate, the mid zone governorate, Khan Younis governorate and Rafah governorate.

### **Study period**

The study was conducted for five months started from October 2018 to the end of March 2019.

### **Study Population**

The target population was the radiation technologist (RT) and radiologist working in radiation departments at the six major hospitals in GS which include (227 employees). The six main government hospitals that have been studied were: Al-Shifa Hospital, Nasser Hospital, European Gaza Hospital, Al-Aqsa Hospital, Indonesian Hospital, and Abu Yousef Al-Najjar Hospital.

### **Sample size**

The size of the study sample was determined according to Daniel, (1999), the required sample size was 143 employees, while 150 copies of the questionnaire, were distributed to the radiation technologist and radiologist working in radiation departments in GS hospitals where, 137 copies of the questionnaire were recovered (91.33%).

### **Eligibility criteria**

#### **Inclusion criteria**

All radiation departments at the six main governmental hospitals that are already exist and provide medical imaging and diagnosis services for patients. Also, all permanent and contract employees RTs and radiologist at the selected radiology services were included in the current study. The risks that identified in the current study were, radiation dose, overload work, equipment damage, external factors and high voltage electricity.

#### **Exclusion criteria**

The study excluded all volunteers and trainers either from RTs, radiologist. Also, the researchers excluded other risks that were not identified.

#### **Data Collection procedure**

The researchers used the questionnaire to be the main approach for data collection. The Key informant interview (KII) were used as a second data collection method (appendix 1). Semi

structured, open-ended statements were performed and filling the matrix. Four experts were selected for in-depth interviews to drill down the quantitative data. It should be noted that the interviews were conducted in Arabic and then translated into English. The numerical rating scale (three-point Likert scale) was chosen to format the questions of the questionnaire with some common sets of response categories called quantifiers (Naoum, 2007). The quantifiers codes were: 1 = disagree, 2 = don't know and 3 = agree which used to facilitate respondents understanding

### Measurements

Data analysis was performed using IBM-SPSS Statistics (version 22).

## 3. Results And Discussion

### General information about the respondents

Participants in the questionnaire were RT and radiologists working in radiation departments in GS hospitals, their personal information are given in Table 1. The results given in Table 1 show that most of the participants were young people between the ages of 30 and 40 years (55.5 %) and this indicates that they are newly employed in these jobs. And Al-Shifa Hospital has the largest number of RTs and radiologists (34.3%) because it covers the largest population in the general service category. Furthermore, the results showed that the number of males is about three times that of females working in radiation departments. The researchers attributed this to the level of awareness of both the Ministry of Health and females with the risk of radiation, especially during pregnancy, which makes them move away from such a job.

**Table 1** *General information of the respondents (n = 137)*

| Variable                  | Frequency (F) | Percent (%) |
|---------------------------|---------------|-------------|
| <b>Hospital</b>           |               |             |
| Indonesian                | 19            | 13.9        |
| Abu Yousef Al Najjar      | 5             | 3.6         |
| European Gaza             | 22            | 16.1        |
| Nasser                    | 31            | 22.6        |
| Al-Aqsa                   | 13            | 9.5         |
| Al-Shifa                  | 47            | 34.3        |
| <b>Age</b>                |               |             |
| 20 to less than 30        | 18            | 13.1        |
| 30 to less than 40        | 76            | 55.5        |
| 40 to less than 50        | 30            | 21.9        |
| 50 to 65                  | 13            | 9.5         |
| <b>Gender</b>             |               |             |
| Male                      | 105           | 76.6        |
| Female                    | 32            | 23.4        |
| <b>Place of residence</b> |               |             |
| North Gaza                | 22            | 16.1        |
| Gaza City                 | 30            | 21.9        |
| Mid-zone                  | 31            | 22.6        |
| Khan-younis               | 40            | 29.2        |
| Rafah                     | 14            | 10.2        |
| <b>Social status</b>      |               |             |

|         |     |      |
|---------|-----|------|
| Single  | 13  | 9.5  |
| Married | 124 | 90.5 |

### The variation in the opinion due to qualification level and years of experience

One-way Analysis of Variance (ANOVA) results regarding the qualification level and years of experience of respondents (Less than 5, 5 – 10 years, 11 – 15 years, and More than 15 years) are given in Table 2. The results show that there are no statistically significant differences due to educational level at the level of  $\alpha \leq 0.05$  toward the role of risk management in achieving sustainable development within the radiology departments at governmental hospitals in GS. The results also show there are no statistically significant differences due to years of experience at the level of  $\alpha \leq 0.05$  toward the role of risk management in achieving sustainable development within the radiology departments at governmental hospitals in the GS. The current results indicate that neither risk management nor sustainable development are considered in radiation departments.

**Table 2** *One-way ANOVA results regarding years of experience of employees*

| Scope                      | Factor                  | Test of Homogeneity of Variances |                | F-test | P-value (Sig.) |
|----------------------------|-------------------------|----------------------------------|----------------|--------|----------------|
|                            |                         | Levene Statistic                 | P-value (Sig.) |        |                |
| <b>Educational level</b>   | Risk Management         | 0.326                            | 0.722          | 1.174  | 0.325          |
|                            | Sustainable Development | 1.272                            | 0.284          | 2.609  | 0.057          |
| <b>Years of experience</b> | Risk Management         | 1.322                            | 0.270          | 0.278  | 0.841          |
|                            | Sustainable Development | 1.741                            | 0.174          | 1.254  | 0.274          |

### Analysis of Risk Management field.

Testing the availability of risk management efficiency within the radiation departments of the government hospitals was achieved by the descriptive statistics, i.e. means, standard deviations (SD), t-value (two tailed), probabilities (P-value), relative importance indices (RII), and finally ranks were established and given in Table 3. Regarding the whole paragraphs of “Risk Management” field, the RII equals (61.33%), Test-value = -4.28, and P-value = 0.001 which is smaller than the level of significance  $\alpha = 0.05$ . The sign of the test is negative, so the mean of this group is significantly smaller than the test value (2). So, respondents totally disagree about the

field of risk management, and this is evidence that there is a problem in the management of risks in the radiation departments in GS hospitals. A risk assessment can identify vulnerable areas where more resources can be allocated for safety (Pandey, et al., 2016).

**Table 3** *RII's and test values for field of (Risk Management).*

| #  | Statement                                                                                                | Mean | Std. Dev | RII (%) | T value | P value | Sig. | Rank |
|----|----------------------------------------------------------------------------------------------------------|------|----------|---------|---------|---------|------|------|
| 1. | Your Radiation department determines your protection requirements to reduce radiation risks.             | 2.44 | 0.86     | 81.27   | 5.99    | 0.000*  |      | 1    |
| 2. | Supervisors / regulators able to assess the true risks inherent in radiation department.                 | 2.43 | 0.84     | 81.00   | 5.92    | 0.000*  |      | 2    |
| 3. | The radiation department have tools and procedures for protection of employee.                           | 2.42 | 0.89     | 80.54   | 5.48    | 0.000*  |      | 3    |
| 4. | The radiation department have contingency plans against disasters and accidents.                         | 2.41 | 0.84     | 80.29   | 5.72    | 0.000*  |      | 4    |
| 5. | There is a separation of duties between those who generate risks and those who manage and control risks. | 2.35 | 0.84     | 78.19   | 4.81    | 0.000*  |      | 5    |
| 6. | The manager responsible to review and identify the risk management systems, guidelines and risk reports. | 2.20 | 0.89     | 73.48   | 2.68    | 0.008*  |      | 6    |
| 7. | Department of Radiology adopted and utilized guidelines for protection employees.                        | 2.01 | 0.95     | 66.91   | 0.09    | 0.929   |      | 7    |
| 8. | Review and approve control process take place periodically.                                              | 1.97 | 0.94     | 65.69   | -0.36   | 0.716   |      | 8    |
| 9. | There is a section / committee responsible for identifying, monitoring and controlling radiology         | 1.93 | 0.94     | 64.23   | -0.91   | 0.367   |      | 9    |

|                       |                                                                                                                                                            |             |             |              |              |               |    |
|-----------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------|-------------|--------------|--------------|---------------|----|
|                       | risks.                                                                                                                                                     |             |             |              |              |               |    |
| 10.                   | Radiation department often measures occupational risk.                                                                                                     | 1.81        | 0.94        | 60.47        | -2.24        | 0.027*        | 10 |
| 11.                   | The radiation department have internal guidelines / rules and concrete procedures with respect to the risk management system.                              | 1.59        | 0.80        | 53.04        | -5.98        | 0.000*        | 11 |
| 12.                   | The Radiation department has a system to evaluate the causes of overworked work quantitatively.                                                            | 1.55        | 0.83        | 51.58        | -6.37        | 0.000*        | 12 |
| 13.                   | There is a disclosure about radiation risk in the annual report.                                                                                           | 1.48        | 0.67        | 49.39        | -9.12        | 0.000*        | 13 |
| 14.                   | Radiation exposure limits for employees are set and monitored.                                                                                             | 1.47        | 0.79        | 48.91        | -7.93        | 0.000*        | 14 |
| 15.                   | Radiation department complies with the standards of the International Protection Committee.                                                                | 1.47        | 0.69        | 48.91        | -9.08        | 0.000*        | 15 |
| 16.                   | The radiation department have in place a system for managing problems.                                                                                     | 1.45        | 0.65        | 48.42        | -9.82        | 0.000*        | 16 |
| 17.                   | The radiation department have in place a regular reporting system regarding risk management for senior officers and management                             | 1.42        | 0.68        | 47.20        | -10.02       | 0.000*        | 17 |
| 18.                   | You have formal system of Risk management in radiation department.                                                                                         | 1.38        | 0.72        | 45.99        | -10.10       | 0.000*        | 18 |
| 19.                   | The radiation department have in place an internal control system capable of dealing with newly recognized risks arising from changes in environment, etc. | 1.32        | 0.62        | 44.04        | -12.87       | 0.000*        | 19 |
| <b>All statements</b> |                                                                                                                                                            | <b>1.84</b> | <b>0.42</b> | <b>61.33</b> | <b>-4.28</b> | <b>0.001*</b> |    |

On the other hand, the KII conducted by the researchers revealed that there is a lack of risk management section in these departments. In addition, the results showed that there are no radiation



exposure limits for employees that are set and monitored. Also, all the heads of departments inform that there is a continuous breaking down of radiation devices due to the pressure of work and continuous cutting off the electricity as these devices are not provided with power supply units. Furthermore; the radiation departments do not have an internal control system capable of dealing with newly recognized risks arising from changes in the environment, etc. Therefore, there is no special vision for the radiation departments to develop a plan or program to achieve continuity during any emergency event that can occur.

Regarding the vocational safety standards, the views varied among the heads of departments. While, when asking the heads of departments concerning the existence of instructions to deal with risks among the workers for the vocational safety, some of them stated that there are no instructions related to this field and there is no specification and paying attention to these risks which were specified in this study. Also, there is a default among some employees caused a huge fire in the department of CT instrument in the Al-Shifa Hospital as a result of electrical fault which led to a complete stop inside the department.

Furthermore, the KII showed a clear lack of performance in conducting the meetings to discuss the means of prevention and safety and evaluating the real situation. Besides, there is neither an awareness system nor courses to raise awareness among the employees. The heads of the departments attributed this lack of performance to the absence of the coordination between the MoH and the Power Authority and the lack of logistics in the departments of radiation.

In addition, there is no formal risk management system or even problem management which acts as a guideline to protect the employees and ensure the continuity of work, so without risk management that covers all of its stages at radiation departments, it's difficult to achieve sustainable development.

### **The risk management policy issued in the radiation departments**

Analysis of the management policy of the radiation departments regarding the different actors that related to the health services in GS which include MoH, Power Authority, Hospital Directorate and external specialized agencies according to respondents response was conducted. The results show a high percentage (40.3%) for the Hospital Directorate regarding the administration of the risk management policy for the radiation departments followed by Power Authority (30.2%) and MoH (27.9%), while the external specialized agencies have the lowest percentage (1.6%). The researchers attributed the high rate of respondents tendency to choose hospital directorate as the body responsible for implementing the risk management policy because to it is the responsibility of the hospital administration to follow up periodically and continuously to maintain the employees and to continue the work through the development of a risk management policy by identifying risks and evaluating them and prioritizing dealing with them and coordination with the MoH and Power Authority.

### **Issuing reports of radiation departments.**

Analysis of reports issued regarding the different risks accompanied during the routine work in the radiation departments with respect to the respondents response was conducted. The main risks that could be present and required reporting are radiation dose, overload work, equipment damage, external factors (power cuts, Israeli attacks, political crises, etc.) and high voltage electric risk report. The results show a large proportion of employees in the radiation departments believe that

many reports concerning the risk of overload work and occupational safety are not issued, including reports of high voltage electric risk. This calls on the officials and heads of departments attention and accuracy in the issuance of these reports to maintain the safety of employees and ensure continuity of work and achieving sustainability. On the other hand, the lowest percentage of reports was about the risk of radiation dose. The researchers attributed this attitude to the absence of radiation dosimeters (radiation dose measurement) received by the employees during the working time.

**The regular risk management technique that used in radiation departments.**

Regarding the techniques or approaches used for risk management by the radiation departments, the statistical analysis was conducted and given in Table 4. The results show that the technique of the duration of equipment has a lower percentage (32.8%) and the researchers here refer to the intervention of other factors such as frequent power outages and over loud work and misuse which negatively effect on life span of machines. While, the results show that the risk of external factors such as irregularity of electricity, Israeli attacks, political crises, ...etc. are treated in alternative ways according to respondents perception by a large percentage reached to 76.6%. For example, the irregularity of electricity suffered by the GS since 2007, where the power outage reaches 12 hours. Sometimes, generators are used as a mean for continuing work and providing medical services to patients. While in the case of Israeli wars on GS and political crises, alternative hospitals are used by transferring injuries cases and patients to other hospitals. This happened in the Israeli war on GS in 2014 when the medical services in Abu Youssef Al-Najjar Hospital were stopped. On the other hand, the results showed that most radiation departments in the six main government hospitals rely on a contingency plan for continuity of work as a way to deal with the risk of external factors. Where the percentage of approval of respondents (72.3%) shows that these plans are developed for the continuation of services within the sections of radiation and were linked to an emergency plan that includes all sections of the hospital. On the other hand, the KII conducted by the researchers revealed that there is a lack of risk management section in these departments. In addition, the results showed that there are no radiation exposure limits for employees that are set and monitored. Also, all the heads of departments inform that there is a continuous breaking down of radiation devices due to the pressure of work and continuous cutting off the electricity as these devices are not provided with power supply units. Furthermore; the radiation departments do not have an internal control system capable of dealing with newly recognized risks arising from changes in the environment, etc. Therefore, there is no special vision for the radiation departments to develop a plan or program to achieve continuity during any emergency event that can occur.

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**Table 4** *Frequency and percentage of risk management technique used in the radiation departments*

| #  | Type of risk                                                                      | Approach (technique)          | Yes (Uses) |      | No (not used) |      |
|----|-----------------------------------------------------------------------------------|-------------------------------|------------|------|---------------|------|
|    |                                                                                   |                               | F          | %    | F             | %    |
| 1. | <b>Radiation dose risk</b>                                                        | 10 - day rule approach        | 30         | 21.9 | 107           | 78.1 |
|    |                                                                                   | ICRP approach                 | 27         | 19.7 | 110           | 80.3 |
| 2. | <b>Over loud work risk</b>                                                        | Number of case/ Time          | 110        | 80.3 | 27            | 19.7 |
|    |                                                                                   | Occupational safety standards | 88         | 64.2 | 49            | 35.8 |
| 3. | <b>Equipment damage risk</b>                                                      | Engineering approach          | 104        | 75.9 | 33            | 24.1 |
|    |                                                                                   | Time Duration                 | 45         | 32.8 | 92            | 67.2 |
| 4. | <b>External factor risk (Power cuts, Israeli attacks, political crises, etc.)</b> | Alternatives approaches       | 105        | 76.6 | 32            | 23.4 |
|    |                                                                                   | Emergency plan                | 99         | 72.3 | 38            | 27.7 |
| 5. | <b>High voltage electric risk</b>                                                 | Engineering approach          | 48         | 35.0 | 89            | 65.0 |
|    |                                                                                   | Protection approach           | 105        | 76.6 | 32            | 23.4 |

#### **The use of a documented risk management policy by radiation departments.**

The statistical analysis about the use of a documented risk management policy in the radiation departments was conducted with respect to respondents responses. The results showed that the majority (90.5%) said that radiation departments in the six main government hospitals don't have a credible risk management policy. The researchers attributed this to overload work, which reflects the increase of exposure to radiation and the risk of damage to equipment.

### **Responsibility of the implementation of risk management policy**

Regarding the responsibility of the implementation of risk management policy, the results indicate that about (60.6 %) of respondents believe that no one implementing risk management policies within the radiation departments. While, low implementation of risk management policy is conducted by heads of departments (13.9 %), specialists (6.6%), MoH (9.5%) and Energy Authority (9.5%). These results indicate that there is no specific entity implementing the risk management policy. The researchers attribute the previous results to the absence of a documented policy that manages these risks.

On the other hand, when asking the heads of radiation departments regarding a mechanism to specify the risks inside the departments, the results showed that there is no specification to these risks because there is no committee exists to evaluate and supervise these risks. Also, there is no committee exists to manage these risks. In another context, the results of KII showed that all heads of departments are not responsible for any accident which could cause harm to the employees. These accidents could occur as a result of neglecting the principle of taking a suitable procedure for prevention, and all the heads of departments showed that all the employees know that radiation is risky. The most important is that the section provided them with radiation protection equipments. Therefore, the researchers concluded that the lack of these committees caused an obstacle to achieve sustainable development which aimed to protect the workers and continuity of the work.

### **Analysis of Sustainable Development**

#### **Existence extent of the notion of sustainable development**

The statistical analysis results for existence extent of the notion of sustainable development shows that the majority of employees (75.2 %) in the radiation departments of the six main government hospitals included in the study sample have heard about the concept of sustainable development, which enhances the objectives of the question and the importance of sustainable development and the possibility of achieving it.

#### **Importance of sustainable development**

To investigate the respondents response about the importance of sustainable development, some statistical parameters were studied include a descriptive statistic, i.e. means, standard deviations (SD), T-value (two-tailed), probabilities (P-value), relative importance indices (RII) and finally, ranks were established as given in Table 5. From Table 5, regarding the whole paragraphs of the sustainable development analysis, the RII equals (92.33%), Test-value =44.60, and P-value=0.000 which is smaller than the level of significance  $\alpha=0.05$ . The sign of the test is positive, so the mean of this group is significantly greater than the test value (2). The respondents agreed about the importance of sustainable development as shown in Table 5. The researchers attributed this to the fact that they work in a similar work environment and all of them need reforms and developments that will support sustainable development. This result ensures the need for professional protection of employees, the maintenance of equipment and the sustainability of work.

**Table 5** *RII's and test values for field of (sustainable development)*

| #  | Statement                                                                                                                                                                                                                       | Mean | Std. Dev | RII (%) | T value | P value<br>Sig. | Rank |
|----|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------|----------|---------|---------|-----------------|------|
| 1. | A good clinical examination of the condition of the patient and the need for radiographic imaging helps to reduce the randomness and congestion on the sections of radiation, which helps in the sustainability of the service. | 2.95 | 0.25     | 98.30   | 44.06   | 0.000*          | 1    |
| 2. | Having respect rights of protection of other in your department is necessary for sustainable development.                                                                                                                       | 2.93 | 0.25     | 97.81   | 43.98   | 0.000*          | 2    |
| 3. | For sustainable development, radiology employees need to be educated in how to protect themselves against radiation risk.                                                                                                       | 2.93 | 0.28     | 97.81   | 39.53   | 0.000*          | 3    |
| 4. | I think the government should provide financial assistance to encourage risk management to make the workplace safe.                                                                                                             | 2.93 | 0.28     | 97.81   | 39.53   | 0.000*          | 4    |
| 5. | The acquisition of modern and computerized equipment to reduce effort and time helps to sustainability                                                                                                                          | 2.93 | 0.29     | 97.57   | 37.69   | 0.000*          | 5    |
| 6. | Sustainable development demands to organize number of courses (courses include for example, radiation protection, good practices, emergency management).                                                                        | 2.93 | 0.29     | 97.57   | 37.69   | 0.000*          | 6    |
| 7. | I think that the government should make all its decisions on the basis of sustainable development.                                                                                                                              | 2.93 | 0.26     | 97.57   | 41.56   | 0.000*          | 7    |
| 8. | Preserving department equipment's is necessary for sustainable development.                                                                                                                                                     | 2.92 | 0.27     | 97.32   | 39.47   | 0.000*          | 8    |
| 9. | I think that risk management could be educated in how to work sustainably.                                                                                                                                                      | 2.92 | 0.30     | 97.32   | 36.07   | 0.529           | 9    |

|     |                                                                                                                                                                                   |      |      |       |       |        |    |
|-----|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------|------|-------|-------|--------|----|
| 10. | Wiping out risk associated with radiation departments is necessary for sustainable development.                                                                                   | 2.91 | 0.32 | 96.84 | 33.30 | 0.000* | 10 |
| 11. | I think it is important to put emergency plan that ensure business continuity during emergency incidences.                                                                        | 2.91 | 0.36 | 96.84 | 29.31 | 0.000* | 11 |
| 12. | I think that the government should be using building back better approach when renewing or reconstruction by using safety standards and sustainability.                           | 2.91 | 0.32 | 96.84 | 33.30 | 0.000* | 12 |
| 13. | Sustainable development demands that radiology employees understand how the equipment's functions and maximum work load for each machine.                                         | 2.90 | 0.30 | 96.59 | 34.57 | 0.000* | 13 |
| 14. | I think that it is important to do something about problems which have to do with overload work.                                                                                  | 2.90 | 0.33 | 96.59 | 32.11 | 0.000* | 14 |
| 15. | For sustainable development, occupational radiation dose must be reduced.                                                                                                         | 2.89 | 0.34 | 96.35 | 31.02 | 0.000* | 15 |
| 16. | Improving people's health and opportunities for a good life contribute to sustainable development.                                                                                | 2.88 | 0.34 | 96.11 | 30.02 | 0.000* | 16 |
| 17. | The organization of specialized courses on a continuous basis for employees in the departments of radiation allows for the development of the quality of work and sustainability. | 2.88 | 0.38 | 96.11 | 26.87 | 0.000* | 17 |
| 18. | Sustainable development requires equitable distribution, for example a periodic follow-up of equipment and ways of protecting employees.                                          | 2.88 | 0.34 | 96.11 | 30.02 | 0.000* | 18 |
| 19. | I think there is strong relation between risk management and                                                                                                                      | 2.88 | 0.37 | 96.11 | 28.31 | 0.000* | 19 |

|     |                                                                                                                                                                                   |      |      |       |       |        |    |
|-----|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------|------|-------|-------|--------|----|
|     | achieving sustainable development.                                                                                                                                                |      |      |       |       |        |    |
| 20. | Sustainable development demands that we humans reduce all sorts of (Risk).                                                                                                        | 2.87 | 0.36 | 95.62 | 28.23 | 0.000* | 20 |
| 21. | I think that we who are alive now should make sure that people in the future will be as well off as we are today.                                                                 | 2.87 | 0.42 | 95.62 | 24.39 | 0.000* | 21 |
| 22. | Economic development is necessary for sustainable development.                                                                                                                    | 2.86 | 0.39 | 95.38 | 26.05 | 0.000* | 22 |
| 23. | Connecting radiation departments in government hospitals and non-governmental hospitals to a computerized network that allows for follow-up and achieves sustainable development. | 2.86 | 0.41 | 95.38 | 24.86 | 0.000* | 23 |
| 24. | To achieve sustainable development, radiation departments must treat their employees in a fair way.                                                                               | 2.84 | 0.44 | 94.65 | 22.27 | 0.000* | 24 |
| 25. | To achieve sustainable development, all the people must have access to good radiology awareness.                                                                                  | 2.81 | 0.49 | 93.67 | 19.23 | 0.000* | 25 |
| 26. | A culture where conflicts are resolved peacefully through discussion in radiation department is necessary for sustainable development.                                            | 2.71 | 0.54 | 90.27 | 15.22 | 0.000* | 26 |
| 27. | I think that we need stricter laws and regulations to protect our self from excess radiation dose.                                                                                | 2.62 | 0.75 | 87.35 | 9.70  | 0.000* | 27 |
| 28. | I think the MoH has a responsibility to reduce the use of radiation by raising awareness among communities.                                                                       | 2.17 | 0.94 | 72.26 | 2.10  | 0.038* | 28 |
| 29. | Radiation maintenance technicians receive advanced courses to repair emergency faults and maintain the safety of devices contributes to                                           | 1.96 | 0.81 | 65.21 | -0.63 | 0.529  | 29 |



|                       |                                                                                                               |             |             |              |              |               |    |
|-----------------------|---------------------------------------------------------------------------------------------------------------|-------------|-------------|--------------|--------------|---------------|----|
|                       | sustainability.                                                                                               |             |             |              |              |               |    |
| 30.                   | Using more X-ray resources than we need does not threaten people's health or medical prospects in the future. | 1.35        | 0.71        | 45.01        | -10.66       | 0.000*        | 30 |
| <b>All statements</b> |                                                                                                               | <b>2.77</b> | <b>0.20</b> | <b>92.33</b> | <b>44.60</b> | <b>0.000*</b> |    |

According to the results achieving sustainable development it is clearly requires good clinical examination of the patient's condition. In addition, the need to reduce the randomness and congestion of the radiation sections and the excessive exposure to radiation, which helps to sustain the service. Rights of protection of others at the radiation department are necessary for sustainable development. For sustainable development, radiology employees need to be educated in how to protect themselves against radiation risk. Preserving department equipments is also necessary for sustainable development.

The KII showed that there is a consensus among heads of departments that the MoH has a policy towards sustainability in providing the service in the radiation departments through developing a computerized web. This computerized web sends the X-ray images and dispensing with the chemical materials that used in image processing. In line, there is a problem revealed in some departments as a result of breaking down some of radiation devices. After all, the heads of departments agreed on the existence of a default in the MoH with updating and renewing these devices in addition to saving spare part as well as. The interviews showed that many radiation devices have stopped in working for more than a year and this hinders providing the services in some hospitals.

Finally, when asking the heads of radiation departments regarding the impediments to sustainable development, they stated that there is an attempt to achieve sustainability in the service as it is basic in diagnosing the diseases. Also, they cannot initiate more departments because of the difficulty of political and economic circumstances. In addition, there is no clear development plan to implement risk management policy in the MoH, as the ministry current accreditation depends on projects submitted by donors.

### Conclusion

The availability of risk management, the existence of criteria for medical imaging practice and possibilities of sustainable development were checked based on an arbitrated questionnaire filled by radiographers in the six governmental hospitals in the Gaza Strips. In addition, interviews were held with a number of departments heads and the director of the technical department at the MoH in order to obtain more accurate and in-depth information about the objectives of the study, as well as in order to obtain estimates of the probability of the occurrence of the risks and the degrees of influence. Regarding risk management, the results indicated that the radiation departments do not provide full protection for employees and the quality control process is not performed periodically. Moreover, radiation departments do not comply with the standards of the International Commission on Radiation Protection, as there are no restrictions on radiation exposure to employees that are

controlled and monitored. Furthermore; the radiation departments do not have an internal control system capable of dealing with newly recognized risks arising from changes in the environment, etc. There is no definition or detection for the risks at radiation departments that could be threat the employees and the work continuity, in other words, there is no risk management within the radiation departments of the six major hospitals in GS. Regarding sustainable development at radiation departments, more than three-quarters of respondents have an idea about the concept of sustainable development from different places, most of them through the Internet. The education of the radiation employees is required to protect themselves against radiation risk. Also, a good clinical examination of the patients condition and for radiography is necessary to reduce the randomness and congestion of the radiation sections and the excessive exposure to radiation. Also, respect the rights of protection of others at the radiation departments and preserving of department equipments are necessary for sustainable development. The majority of employees in the radiation departments agreed on the importance of sustainable development, as well as, there is a consensus among heads of departments that the MoH has the policy to move towards sustainability in providing the service in the radiation departments. But there are some impediments to sustainable development because of the difficulty of political and economic circumstances. In addition, there is no clear development plan to implement risk management policy in the MoH, as the Ministry current accreditation depends on projects submitted by donors.

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## REFERENCES

- Abudulnabi, H.M. (2018) *The Application Of Risk Management In Buildings Projects In Libya* (Doctoral dissertation, Department of Civil Engineering Shepherd Institute of Engineering & Technology, SAM Higginbottom University Of Agriculture, Technology & Sciences Allahabad-211007,(UP), India).
- Craciun, H., Mankad, K., & Lynch, J. (2015) 'Risk management in radiology departments' *World journal of radiology*, Vol.7 No.6, pp.134–138.
- Daniel W. (1999) *Biostatistics: A Foundation for analysis in the health sciences*, 7<sup>th</sup> ed. John Wiley & Sons. New York.
- European Society of Radiology (2015) Risk management in Radiology in Europe. The European Society of Radiology [online] [http://www.myesr.org/html/img/pool/ESR\\_2006\\_IV\\_Riskmanagement\\_Web.pdf](http://www.myesr.org/html/img/pool/ESR_2006_IV_Riskmanagement_Web.pdf) [Accessed 30 Nov 2018].
- Lauritzen, P. M., Andersen, J. G., Stokke, M. V., Tennstrand, A. L., Aamodt, R., Heggelund, T., Dahl F. A., Sandbæk G., Hurlen P., Gulbrandsen, P. (2016) 'Radiologist-initiated double reading of abdominal CT: retrospective analysis of the clinical importance of changes to radiology reports' *BMJ Quality & Safty*, 25(8), pp. 595-603.
- Ling, T., Pedersen, J. S., Drabble, S., Celia, C., Brereton, L., Tiefensee, C. (2012). *Sustainable Development in the National Health Service (NHS)*. UK: Rand Europe.
- Malone, J., Zölzer, F., Meskens, G. and Skourou, C. (2018) *Ethics for Radiation Protection in Medicine*, CRC Press.

- Ministry of Health (2017) *Annual report of hospital in the Gaza Strip*. Gaza, Palestine health information system.
- Naoum S.G. (2007) *Dissertation research and writing for construction students*, 2<sup>nd</sup> ed. Oxford: Butterworth-Heinemann.
- Palestinian Central Bureau of Statistics (2015) *Population, Housing units, Building and Establishment*. Ramallah-Palestine: Palestinian Central Bureau of Statistics.
- Pandey A., Singh M., Sen A., Rane D.M. (2016) *Sonawane AU. Risk Assessment and Management of Radiation Safety in Industrial Applications of Ionizing Radiation: An Overview*. India : Radiological Safety Division, Atomic Energy Regulatory Board, Niyamak Bhavan, Anushakti Nagar, Mumbai 400094.
- Pereira, A. G., Vergara, L. G. L., Merino, E. A. D. and Wagner, A. (2015) 'Solutions in radiology services management: a literature review', *Radiologia brasileira*, 48(5), pp. 298-304.
- Royal College of Radiologists (2017) Good practice guide for clinical radiologists, The Royal College of Radiologists [Online] [http://www.rcr.ac.uk/docs/radiology/pdf/BFCR\(12\)1\\_GoodPractice.pdf](http://www.rcr.ac.uk/docs/radiology/pdf/BFCR(12)1_GoodPractice.pdf) (Accessed 30 Nov 2018).
- Sustainable Development Unit (2016). Sustainable development in the health and care system e Health Check 2016 [Online] <https://www.sduhealth.org.uk/policy/strategy/reporting/sustainable-development-inhealth-and-care-report-2016.aspx>
- Vilar-Palop, J., Hernandez-Aguado, I., Pastor-Valero, M., Vilar, J., González-Alvarez, I. and Lumbreras, B. (2018) 'Appropriate use of medical imaging in two Spanish public hospitals: a cross-sectional analysis, *British Medical Journal open*, 8(3) [online].
- Western Sydney University (2015) Hazard Identification, Risk Assessment and Control Procedure [online] [https://www.westernsydney.edu.au/\\_\\_data/assets/pdf\\_file/0020/12917/12917\\_Hazard\\_Identification,\\_Risk\\_Assessment\\_and\\_control\\_Procedure.pdf](https://www.westernsydney.edu.au/__data/assets/pdf_file/0020/12917/12917_Hazard_Identification,_Risk_Assessment_and_control_Procedure.pdf) (Accessed 1 Dec 2018).