Knowledge and alertness of medical students at clinical phase towards hazards of ionizing radiations in Northern Saudi Arabia

Meshal Khunfur Alrashdi¹, Latifah Khalid Alrashed², Fayez Saud Alreshidi², Fatmah Fahad Alreshidi², Ebtehaj Saud Almughais², Tariq Hadyan Alruwaili³, Waad Saud Alswab³, Turki Abdul Aziz Alharbi⁴, Ahmed Yassen Alrefaei⁵, Ibrahim Alrashidi⁶, Hussain Gadelkarim Ahmed⁷,⁸

¹Family Medicine Department, Prince Mohammed bin Abdulaziz Hospital. MOH, Saudi Arabia
²Department of Family Medicine, College of Medicine, University of Ha’il, Hail, Kingdom of Saudi Arabia (KSA)
³College of Medicine, University of Aljouf, Saudi Arabia
⁴Diagnostic Radiology Resident, King Khalid University Hospital, Riyadh, Saudi Arabia
⁵College of Medicine, University of Tabuk, Saudi Arabia
⁶Interventional Radiology, Prince Sultan Military Medical City, Riyadh, Saudi Arabia
⁷Department of Pathology, College of Medicine, University of Ha’il, Hail, Saudi Arabia
⁸Department of Histopathology and Cytology, FMLS, University of Khartoum, Sudan

Corresponding author
Department of Pathology, College of Medicine, University of Ha’il, Hail, Saudi Arabia / Department of Histopathology and Cytology, FMLS, University of Khartoum, Sudan

Article History
Received: 03 April 2020
Reviewed: 04/April/2020 to 07/May/2020
Accepted: 08 May 2020
E-publication: 16 May 2020
P-Publication: July - August 2020

Citation
ABSTRACT

**Background:** The recent reported increased risks of radiation exposure in association with chronic illnesses have raised the issue of radiation safety. The present study aimed to assess the knowledge and alertness of Medical students at the clinical phase towards the hazards of ionizing rations in Northern Saudi Arabia. **Methodology:** This descriptive cross-sectional study, included 443 medical students at clinical phases of the study (4th, 5th, and 6th years). The study subjects were randomly selected from three medical colleges in 3 universities (Hail, Jouf, and Tabuk). **Results:** Regarding the prior knowledge of radiation doses, 85/433(19.6%), and 153/433(35.3%), have "No idea", and "Not confidence", in this order. On asking "Is it important to know radiation doses" 97/433(22%) answered "Not important", and 139/433(32%) answered, "May be important". The application of medical radiology as both diagnostic and therapeutic was indicated by 238/433(55%). **Conclusion:** Medical students in late clinical years have relatively low knowledge and awareness towards ionizing radiation exposure, organ dependent doses, and radiation associated hazards.

**Keywords:** ionizing radiation, radiation hazards, radiation doses, Saudi Arabia

1. INTRODUCTION

Exposure of ionizing radiation as a part of diagnosis or treatment carries potential health hazards (Asefa et al., 2016). For all medical services operating ionizing radiation, strict radiation safety should always present. The recent reported increased risks of radiation exposure in association with chronic illnesses have raised the issue of radiation safety (Ahmed & Taha, 2017). There is several harmful health effects associated even with the low dose of ionizing radiation for a long time. Such hazards are of special interest to medical staff who contacting X-rays machines on a daily bases. The prolonged exposure to low dose radiation is in most instances an inevitable occupational risk resulting in the importunity of oxidative stresses there after elevating DNA instability. Radiological workers receive the effect according to the time spent with ionizing radiation machines, as well as, the frequencies of patients ran very day and consequently can determine the risk of cancer development (Siama et al., 2019). Even though X-rays having note worthy diagnostic and therapeutic benefits, prolonged and intense exposure to X-rays imaging has been revealed to be accompanying numerous dose-dependent hazards (Naqvi et al., 2019; Bratschitsch et al., 2019; Liu et al., 2019; Barnard et al., 2019).

Knowledge and awareness of ionizing radiation among medical staff including medical students deemed important, particularly the hazards of X-ray imaging, as it is the most frequent source of prolonged low dose ionizing radiation. Consequently, the present study aimed to assess knowledge and alertness of Medical students at clinical phase towards hazards of ionizing rations in Northern Saudi Arabia.

2. MATERIALS AND METHODS

This descriptive cross-sectional study included 443 medical students at clinical phases of the study (4th, 5th, and 6th years). The study subjects were randomly selected from three medical colleges in 3 universities (Hail, Jouf, and Tabuk) during the period from September 2019 to March 2020. A purposeful questionnaire was designed and distributed electronically to collect the desired data. Besides demographical data the questionnaire included questions such as Knowledge of radiation doses, Is it important to know radiation doses, Medical uses of radiation, Principle-based on radiation, Job more likely exposed to ionizing radiation, Non-intended exposure of patients, and staff is common, Exposure pathways, Population at higher risk, It always necessary to declare the risk, the higher risk with chest ionized radiation, Damage to tissues and organs, Damage to DNA, Skin and hair loss, risk of Cancers, and sensitivity of organs to radiation.

**Data analysis**

Statistical analysis was performed using SPSS V22.0 SPSS. Frequencies and percentages and cross-tabulation of variables were obtained.
Ethical consent
Each participant was consented before participation in the study. The proposal of the study was approved by the Ethical Committee at College of Medicine, University of Ha’il, Hail, Saudi Arabia. Ethical Approval Number: EC-00046/CM/UOH.01/19

3. RESULTS
This study investigated 433 medical students in the late medical phases (4th, 5th, and 6th year of education levels). The majority of the study subjects were males representing 228 (52.7%), and the remaining 205(47.3%) were females. The students aged over 21 years with the majority at age range 21-24 years, as indicated in Table 1, Fig 1. The majority of the students were at the 4th Year level followed by 5th, and 6th Year, constituting 158(36.5%), 140(32.3%), and 135(31.2%), respectively, as indicated in Table 1, Fig 1.

Table 1 Distribution of medical students by gender, age, and education level.

<table>
<thead>
<tr>
<th>Variable</th>
<th>Males</th>
<th>Females</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>21-22</td>
<td>93</td>
<td>70</td>
<td>163</td>
</tr>
<tr>
<td>23-24</td>
<td>105</td>
<td>115</td>
<td>220</td>
</tr>
<tr>
<td>25-26</td>
<td>25</td>
<td>20</td>
<td>45</td>
</tr>
<tr>
<td>27+</td>
<td>5</td>
<td>0</td>
<td>5</td>
</tr>
<tr>
<td>Total</td>
<td>228</td>
<td>205</td>
<td>433</td>
</tr>
<tr>
<td>Study level</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4th year</td>
<td>91</td>
<td>67</td>
<td>158</td>
</tr>
<tr>
<td>5th year</td>
<td>73</td>
<td>67</td>
<td>140</td>
</tr>
<tr>
<td>6th year</td>
<td>64</td>
<td>71</td>
<td>135</td>
</tr>
<tr>
<td>Total</td>
<td>228</td>
<td>205</td>
<td>433</td>
</tr>
</tbody>
</table>

Figure 1 Description of the students’ levels by genders and age

Regarding the prior knowledge of radiation doses, 85/433(19.6%), and 153/433(35.3%), have “No idea”, and “Not confident”, in this order. On asking “Is it important to know radiation doses” 97/433(22%) answered “Not important”, and 139/433(32%) answered, “May be important”. The application of medical radiology as both diagnostic and therapeutic was indicated by 238/433(55%). On asking about the principles of radiation, justification, dose limitation, optimization, and all previous, representing 63, 109, 73, and 188 students correspondingly, as indicated in Table 2.
Table 3, Fig 2, summarized the distribution of the medical students by study level and means of radiation exposure. In response to “Job more likely exposed to ionizing radiation”, the majority pointed to the Radiographers followed by Nuclear medicine physicians, and Interventional Radiologists, constituting 160/433 (37%), 133/433 (31%), and 106/433 (24%), respectively. In response to “Non-intended exposure of patients, and staff is common”, 338/433 (78%) answered “Yes”. In response to the “Exposure pathway”; inhalation, food intake, through ambient radiation, and all preceded, were indicated by 65, 105, 154, and 109 in that order, as indicated in Table 3, Fig 2.

Table 2 Distribution of the students by knowledge of key radiation categories

<table>
<thead>
<tr>
<th>Category</th>
<th>Variable</th>
<th>4&lt;sup&gt;th&lt;/sup&gt; Year</th>
<th>5&lt;sup&gt;th&lt;/sup&gt; Year</th>
<th>6&lt;sup&gt;th&lt;/sup&gt; Year</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Knowledge of radiation doses</td>
<td>No idea</td>
<td>51</td>
<td>15</td>
<td>19</td>
<td>85</td>
</tr>
<tr>
<td></td>
<td>Not confident</td>
<td>64</td>
<td>48</td>
<td>41</td>
<td>153</td>
</tr>
<tr>
<td></td>
<td>Moderately confident</td>
<td>36</td>
<td>63</td>
<td>67</td>
<td>166</td>
</tr>
<tr>
<td></td>
<td>Highly confident</td>
<td>7</td>
<td>14</td>
<td>8</td>
<td>29</td>
</tr>
<tr>
<td></td>
<td>Total</td>
<td>158</td>
<td>140</td>
<td>15</td>
<td>433</td>
</tr>
<tr>
<td>Is it important to know radiation doses</td>
<td>Yes important</td>
<td>26</td>
<td>16</td>
<td>18</td>
<td>60</td>
</tr>
<tr>
<td></td>
<td>Not important</td>
<td>32</td>
<td>34</td>
<td>31</td>
<td>97</td>
</tr>
<tr>
<td></td>
<td>May be important</td>
<td>48</td>
<td>52</td>
<td>39</td>
<td>139</td>
</tr>
<tr>
<td></td>
<td>Highly important</td>
<td>52</td>
<td>38</td>
<td>47</td>
<td>137</td>
</tr>
<tr>
<td>Medical uses of radiation</td>
<td>Diagnostic</td>
<td>42</td>
<td>30</td>
<td>23</td>
<td>95</td>
</tr>
<tr>
<td></td>
<td>Therapeutic</td>
<td>27</td>
<td>46</td>
<td>27</td>
<td>100</td>
</tr>
<tr>
<td></td>
<td>Both</td>
<td>89</td>
<td>64</td>
<td>85</td>
<td>238</td>
</tr>
<tr>
<td>Principle-based on radiation</td>
<td>Justification</td>
<td>23</td>
<td>20</td>
<td>20</td>
<td>63</td>
</tr>
<tr>
<td></td>
<td>Dose limitation</td>
<td>43</td>
<td>39</td>
<td>27</td>
<td>109</td>
</tr>
<tr>
<td></td>
<td>Optimization</td>
<td>20</td>
<td>36</td>
<td>17</td>
<td>73</td>
</tr>
<tr>
<td></td>
<td>All the above</td>
<td>72</td>
<td>45</td>
<td>71</td>
<td>188</td>
</tr>
</tbody>
</table>

Figure 2 Students’ level by study level and means of radiation exposure
Table 3 Distribution of the students’ level by study level and means of radiation exposure

<table>
<thead>
<tr>
<th>Category</th>
<th>Variable</th>
<th>4th Year</th>
<th>5th Year</th>
<th>6th Year</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Job more likely exposed to ionizing radiation</td>
<td>Nuclear medicine physicians</td>
<td>40</td>
<td>50</td>
<td>43</td>
<td>133</td>
</tr>
<tr>
<td></td>
<td>Radiographers</td>
<td>63</td>
<td>53</td>
<td>44</td>
<td>160</td>
</tr>
<tr>
<td></td>
<td>Interventional Radiologists</td>
<td>41</td>
<td>28</td>
<td>37</td>
<td>106</td>
</tr>
<tr>
<td></td>
<td>Non-interventional radiologists</td>
<td>11</td>
<td>7</td>
<td>6</td>
<td>24</td>
</tr>
<tr>
<td></td>
<td>Surgeons</td>
<td>3</td>
<td>2</td>
<td>5</td>
<td>10</td>
</tr>
<tr>
<td></td>
<td>Total</td>
<td>158</td>
<td>140</td>
<td>135</td>
<td>433</td>
</tr>
<tr>
<td>Non-intended exposure of patients and staff is common</td>
<td>Yes</td>
<td>123</td>
<td>103</td>
<td>112</td>
<td>338</td>
</tr>
<tr>
<td></td>
<td>No</td>
<td>35</td>
<td>37</td>
<td>23</td>
<td>95</td>
</tr>
<tr>
<td>Exposure pathways</td>
<td>Inhalation</td>
<td>29</td>
<td>22</td>
<td>14</td>
<td>65</td>
</tr>
<tr>
<td></td>
<td>Food intake</td>
<td>32</td>
<td>39</td>
<td>34</td>
<td>105</td>
</tr>
<tr>
<td></td>
<td>Through ambient radiation</td>
<td>64</td>
<td>44</td>
<td>46</td>
<td>154</td>
</tr>
<tr>
<td></td>
<td>All the above</td>
<td>33</td>
<td>35</td>
<td>41</td>
<td>109</td>
</tr>
</tbody>
</table>

On asking about the population at high risk, 174, 135, and 124 students answered children, adults, and both (the same), correspondingly. In response to “It always necessary to declare the risk”, 216, 85, 87, 28, and 17 students, answered “always”, “For <18 years old”, “Just for patients”, “For <65 years”, and “Never”, in that order, as indicated in Table 4, Fig 3.

Figure 3 Students by study level and risk of radiation exposure

On asking them “Higher risk with chest ionized radiation occurs to” about 204/433(47%) answered “females” followed by both gender representing 134/433(31%). In response to “Damage to tissues and organs, mostly occurring immediately in”, 192/433(44%) answered stochastic radiation effect (SRE), and 241/433(56%), answered Deterministic radiation effect (DRE). For “Damage to DNA”, 2017/433(50.1%) pointed to SRE, and 216(49.1%) indicated DRE. For “Skin and hair loss” 213(49%) answered “SRE” and 220(51%) answered “DRE”. For “cancer”, 195(45%) answered “SRE” and 238(55%) answered “DRE”, as described in Table 5.

Table 6, summarized the distribution of the students by study level and organ sensitivity to radiation. For “Ovaries and testis”, the majority of students pointed to as “Non-sensitive” followed by “very sensitive”, representing 201/433(46%), and 92/433(21%), in this order. For “Breast”, most of the students indicated “Moderate insensitivity” followed by “Non-sensitive”, constituting 170/433(39%), and 111/433(26%), respectively. For “Skin”, most of the students indicated “Moderate insensitivity” followed by “Non-sensitive”,
constituting 172/433(40%), and 123/433(28%), respectively. For “Lung and Colon”, most of the students indicated “Moderate insensitivity” followed by “Non-sensitive”, constituting 189/433(44%), and 113/433(26%), respectively. For “Kidney, liver, bladder”, most of the students indicated “Moderate insensitivity” followed by “Moderately sensitivity”, constituting 192/433(44%), and 111/433(26%), respectively.

**Table 4** Distribution of the students by study level and risk of radiation exposure

<table>
<thead>
<tr>
<th>Category</th>
<th>Variable</th>
<th>4th Year</th>
<th>5th Year</th>
<th>6th Year</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>The population at higher risk</strong></td>
<td>Children</td>
<td>55</td>
<td>52</td>
<td>67</td>
<td>174</td>
</tr>
<tr>
<td></td>
<td>Adults</td>
<td>50</td>
<td>51</td>
<td>34</td>
<td>135</td>
</tr>
<tr>
<td></td>
<td>Both (the same)</td>
<td>53</td>
<td>37</td>
<td>34</td>
<td>124</td>
</tr>
<tr>
<td></td>
<td>Total</td>
<td>158</td>
<td>140</td>
<td>135</td>
<td>433</td>
</tr>
<tr>
<td><strong>It always necessary to declare the risk</strong></td>
<td>Always</td>
<td>78</td>
<td>73</td>
<td>65</td>
<td>216</td>
</tr>
<tr>
<td></td>
<td>For &lt;18 years old</td>
<td>29</td>
<td>35</td>
<td>21</td>
<td>85</td>
</tr>
<tr>
<td></td>
<td>Just for patients</td>
<td>32</td>
<td>24</td>
<td>31</td>
<td>87</td>
</tr>
<tr>
<td></td>
<td>For &lt;65 years</td>
<td>9</td>
<td>5</td>
<td>14</td>
<td>28</td>
</tr>
<tr>
<td></td>
<td>Never</td>
<td>10</td>
<td>3</td>
<td>4</td>
<td>17</td>
</tr>
</tbody>
</table>

**Table 5** Distribution of the students by study level and expected health risk

<table>
<thead>
<tr>
<th>Category</th>
<th>Variable</th>
<th>4th Year</th>
<th>5th Year</th>
<th>6th Year</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Higher risk with chest ionized radiation</strong></td>
<td>Males</td>
<td>37</td>
<td>23</td>
<td>35</td>
<td>95</td>
</tr>
<tr>
<td></td>
<td>Females</td>
<td>73</td>
<td>78</td>
<td>53</td>
<td>204</td>
</tr>
<tr>
<td></td>
<td>Both</td>
<td>48</td>
<td>39</td>
<td>47</td>
<td>134</td>
</tr>
<tr>
<td></td>
<td>Total</td>
<td>158</td>
<td>140</td>
<td>135</td>
<td>433</td>
</tr>
<tr>
<td><strong>Damage to tissues and organs</strong></td>
<td>SRE</td>
<td>72</td>
<td>58</td>
<td>62</td>
<td>192</td>
</tr>
<tr>
<td></td>
<td>DRE</td>
<td>86</td>
<td>82</td>
<td>73</td>
<td>241</td>
</tr>
<tr>
<td><strong>Damage to DNA</strong></td>
<td>SRE</td>
<td>77</td>
<td>73</td>
<td>67</td>
<td>217</td>
</tr>
<tr>
<td></td>
<td>DRE</td>
<td>81</td>
<td>67</td>
<td>68</td>
<td>216</td>
</tr>
<tr>
<td><strong>Skin and hair loss</strong></td>
<td>SRE</td>
<td>78</td>
<td>71</td>
<td>64</td>
<td>213</td>
</tr>
<tr>
<td></td>
<td>DRE</td>
<td>80</td>
<td>69</td>
<td>71</td>
<td>220</td>
</tr>
<tr>
<td><strong>Cancers</strong></td>
<td>SRE</td>
<td>65</td>
<td>61</td>
<td>69</td>
<td>195</td>
</tr>
<tr>
<td></td>
<td>DRE</td>
<td>93</td>
<td>79</td>
<td>66</td>
<td>238</td>
</tr>
</tbody>
</table>

**Table 6** Distribution of the students by study level and organ sensitivity to radiation

<table>
<thead>
<tr>
<th>Category</th>
<th>Variable</th>
<th>4th Year</th>
<th>5th Year</th>
<th>6th Year</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Ovaries and testis</strong></td>
<td>Non-sensitive</td>
<td>70</td>
<td>69</td>
<td>62</td>
<td>201</td>
</tr>
<tr>
<td></td>
<td>Moderate insensitivity</td>
<td>37</td>
<td>17</td>
<td>22</td>
<td>76</td>
</tr>
<tr>
<td></td>
<td>Moderately sensitivity</td>
<td>31</td>
<td>15</td>
<td>18</td>
<td>64</td>
</tr>
<tr>
<td></td>
<td>Very sensitive</td>
<td>20</td>
<td>39</td>
<td>33</td>
<td>92</td>
</tr>
<tr>
<td></td>
<td>Total</td>
<td>158</td>
<td>140</td>
<td>135</td>
<td>433</td>
</tr>
</tbody>
</table>
4. DISCUSSION

Raising the awareness of the medical students in the late years of the clinical phase is an essential part of their future protection against the hazards of ionizing radiation exposure. Therefore, the current study aimed to assess the knowledge and alertness of Medical students at the clinical phase towards the hazards of ionizing rations in Northern Saudi Arabia. Medical students at three clinical levels (4th, 5th, and 6th years) were investigated. In general, we didn't observe a relatively significant variation in the level of knowledge and awareness among the three groups.

In the present study, approximately 55% of the students were not confident or have no idea about "Knowledge of radiation doses". Moreover, about 55% of the students stated regarding "Is it important to know radiation doses" that it is not important or have no idea. The majority of these students were at the 4th-year level. A similar study has been conducted in Saudi Arabia including medical students at 4th, 5th, and 6th levels. The study showed generally poor knowledge about ionizing radiation doses. Incorrect dose estimation was ranged from 19% to 92% for different organs and various radiation machines (Abuelhia, 2017). Another report from Norway assessed medical students during the final year their study for their knowledge of ionizing radiation dose and related risks, has reported similar findings. Their findings included; most students misjudged ionizing radiation doses for most examinations with poor awareness of ionizing ration doses for numerous radiological methods (Kada, 2017; Scali et al., 2017).

The application of medical radiology as both diagnostic and therapeutic was indicated by 55% of the medical students in this study. The uses of medical radiology as diagnostic (Unberath et al., 2019) and therapeutic (Mortezaee et al., 2019) are widely known even among non-medicals. Regarding "Principle-based on radiation" were collectively interpreted by only 43% of the students in the present study. Justification, optimization, and dose limited are referred to as principles of protection against the risk of ionizing radiation (Do, 2016). For the facts "Job more likely exposed to ionizing radiation", "Non-intended exposure of patients and staff is common", variable responses were submitted with overall poor evidenced oriented knowledge. Many people are exposed to radiation because of their occupation, which might be medical radiology related or not. The risk depends on the intensity of exposure and time length of exposure (Wakeford, 2009). Variable concepts were also reported for the "Exposure pathway", which also indicates relatively poor knowledge (Committee on the Analysis of Cancer Risks, 2012). On asking them "Higher risk with chest ionized radiation occurs to" about 47% answered "females". Besides different radiation-induced cancers, ionized chest exposure might be a risk of breast cancer (Hilal & Rudy, 2016).

Variables interpretations for the harmful effects of ionizing radiation on tissue components, as well as orang’s sensitivity for ionizing radiation exposure, were claimed with a general indication of poor evidence-based knowledge. Although the study provided fruitful information on the knowledge of medical students about radiation exposure measures, which might be a key for further medical curriculum reforming, it has some limitations including its cross-sectional setting.

<table>
<thead>
<tr>
<th></th>
<th>Non-sensitive</th>
<th>Moderate insensitivity</th>
<th>Moderately sensitivity</th>
<th>Very sensitive</th>
</tr>
</thead>
<tbody>
<tr>
<td>Breast</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>42</td>
<td>31</td>
<td>38</td>
<td>111</td>
</tr>
<tr>
<td></td>
<td>57</td>
<td>61</td>
<td>52</td>
<td>170</td>
</tr>
<tr>
<td></td>
<td>36</td>
<td>33</td>
<td>27</td>
<td>96</td>
</tr>
<tr>
<td></td>
<td>23</td>
<td>15</td>
<td>18</td>
<td>56</td>
</tr>
<tr>
<td>Skin</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>44</td>
<td>35</td>
<td>44</td>
<td>123</td>
</tr>
<tr>
<td></td>
<td>64</td>
<td>61</td>
<td>47</td>
<td>172</td>
</tr>
<tr>
<td></td>
<td>38</td>
<td>37</td>
<td>30</td>
<td>105</td>
</tr>
<tr>
<td></td>
<td>12</td>
<td>7</td>
<td>14</td>
<td>33</td>
</tr>
<tr>
<td>Lung and Colon</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>34</td>
<td>35</td>
<td>44</td>
<td>113</td>
</tr>
<tr>
<td></td>
<td>73</td>
<td>67</td>
<td>49</td>
<td>189</td>
</tr>
<tr>
<td></td>
<td>44</td>
<td>32</td>
<td>33</td>
<td>109</td>
</tr>
<tr>
<td></td>
<td>7</td>
<td>6</td>
<td>9</td>
<td>22</td>
</tr>
<tr>
<td>Kidney, liver, bladder</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>36</td>
<td>36</td>
<td>33</td>
<td>105</td>
</tr>
<tr>
<td></td>
<td>69</td>
<td>62</td>
<td>61</td>
<td>192</td>
</tr>
<tr>
<td></td>
<td>44</td>
<td>38</td>
<td>29</td>
<td>111</td>
</tr>
<tr>
<td></td>
<td>9</td>
<td>4</td>
<td>12</td>
<td>25</td>
</tr>
</tbody>
</table>
5. CONCLUSION
Medical students in late clinical years have relatively low knowledge and awareness towards ionizing radiation exposure, organ dependent doses, and radiation associated hazards. Ionizing rations exposure-related factors should be considered in curriculum reforming for the training of the medical students in the late clinical phases.

Acknowledgment
The authors would like to thank medical students at the University of Hail, Tabuk University, and Jouf University for their cooperation for data collection.

Funding: This research received no external funding.

Conflicts of Interest: The authors declare no conflict of interest.

Ethical Approval
EC-00046/CM/UOH.01/19.

REFERENCE