IMPACT OF COVID-19 PANDEMIC ON MEDICAL PHYSICIST'S WORK IN ASIA & OCEANIA REGION

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Abstract—**Medical physicists and their respective workplace across the Asia and Oceania region has been dramatic because of the impact of COVID-19. Medical Physicists are under varying levels of stress and burn out during the ongoing COVID-19 pandemic and this is adversely affecting their working conditions in clinical practices. We present a broad review to evaluate the impact of COVID-19 in their respective work and changes in work practices among the medical physics community in Asia and Oceania countries. All together 186 medical physicists from twenty-two countries in the Asia & Pacific region have participated from Asia and Pacific region which consists of Low-income countries to High-Income Countries. Irrespective of the economies of the countries the overall responses were found similar. Due to COVID-19 pandemic, it is found that the treatment of cancer patients was somehow affected in their regular treatment, the most affected part was overall treatment time and five fraction regimens. It is found that almost all responder medical physicists who work in a hospital, have continued their work despite the pandemic. A regular supply of radiopharmaceutical and source used for brachytherapy was an issue in some countries because of lockdown and closure of international flight. COVID-19 pandemic adversely affecting the working environment of the overall hospital, but it has not adversely affected the work of medical physicists in the Asia Pacific region.**

Keywords— **Asia & Oceania, COVID-19, diagnostic radiology, nuclear medicine, medical physics, radiation therapy**

I. Introduction

The spread of COVID-19 has created difficult as well as fundamental challenges for both employees and employers across the world. In medical physics world, populations of safety measures and shutdown have affected medical physicists work and turned overnight into different working practices. Given the uncertainty of the COVID-19 shock, institution and work urgently need to apply the field's current knowledge to help individual workers and institutions to manage risks by developing and applying solutions. Severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) or Coronavirus disease 2019 (COVID-19) was first detected in Wuhan City in December 2019 [1]. After causing significant morbidity and mortality in China, by February 2020, COVID-19 had spread to other countries [2]. As of October 11, COVID-19 has spread to 214 countries, infecting 3.6 million people and causing almost 1.5 million deaths across the world and is therefore considered a global pandemic [3,4]. The phenomenal increase in the number of COVID-19 cases has put tremendous pressures on health care systems in most countries across the world. Healthcare workers (HCWs) are amongst the high-risk group to acquire this infection [5,6]. Given the high burden, there is a growing demand and focus on protecting HCWs across the world through the provision of personal protective equipment (PPE), training and countering the psychosocial consequences [7,8]. The COVID-19 pandemic has impacted cancer care services provided by all hospitals especially so due to the restrictions imposed by the nation-wide lockdown in majority of countires aimed at impeding the spread of the contagion. Under such circumstances, the timely implementation of various administrative policies to enable the continuation of cancer care along with preparations for effectively handling this medical emergency is of paramount importance. Notably, both patient-directed and employee-directed measures that minimize the risk of contracting COVID-19 should be adopted. However, the escalating trend in the number of positive cases, social stigma and fear of family members contracting the disease adds to the psychological and social trauma which has a demoralizing effect on the mental health of the cancer care providers. These are important problems that have to be addressed and comprehended for effective medical management of the pandemic.

Medical Physics is a branch of Applied Physics, pursued by medical physicists, that uses physics principles, methods and techniques in practice and research for the prevention, diagnosis and treatment of human diseases with a specific goal of improving human health and well-being. Medical physics may further be classified into several sub-fields (specialities), including Radiation Oncology Physics, Medical Imaging Physics, Nuclear Medicine Physics,

Medical Health Physics (Radiation Protection in Medicine), Non-ionizing Medical Radiation Physics, and Physiological Measurement. It is also closely linked to neighbouring sciences such as Biophysics, Biological Physics, and Health Physics [9,10]

1.1. Impacts of COVID-19 in Health Sector in Nepal

Nepal government issued a nationwide lockdown as a preventive measure from 24th March to 21st July 2020, prohibiting domestic and international travels by closing its airports and international borders. The government had also prohibited non-essential services including transportation and offices. The lockdown has ~~affected the health of individuals and~~ disrupted regular healthcare services including radiation therapy, diagnostic radiology and nuclear medicine. This pandemic crisis has significantly transformed the working environment in the medical field. Frontline health workers, including doctors, nurses, allied health workers, technologists with inadequate supplies of PPE, have provided their best healthcare services. [11]. In the Wuhan outbreak as reported, 63% of health care workers became infected, and 14.8% of cases in healthcare personnel were severe or critical [12].

1.2. Impact of COVID-19 in Radiation Therapy

The COVID-19 positive patient in a radiation therapy creates significant challenges to the physicians, nurses, staffs, radiation therapy technologists and also medical physicists who are charged with not only that patient's care but also the care and well-being of other patients and the HCW in the clinic/institute. Patients who test positive for the novel coronavirus, at a minimum, require a 14-day quarantine per CDC recommendations has created additional significant challenges in treatment interruptions, planning and patient QA.

II. OBJECTIVE

The study aimed to understand the effects of the pandemic on medical physicist's perceptions and performance during a pandemic and the lockdown. It was also conducted to determine if statistically significant differences are still present between the perceptions before and during the pandemic.

III. MATERIALS AND METHODS

After the Nepal Health Research Council (NHRC) ethic board permission for the survey, data were collected from 2nd September to 15th October 2020. Eligibility criteria were selected only for medical physicists working in Asia and Oceania region countries.

3.1. Study participants and Sampling

We conducted a cross-sectional study using an online questionnaire, among medical physicists in Asia & Pacific (APAC) region in accord with the checklist for reporting results of internet surveys [13]. The study targeted specifically clinical medical physicists working on their different capacities in their respective institutes. The research questionnaire was distributed to medical physicist of the APAC countries through the Asia-Oceania Federation of Organizations for Medical Physics (AFOMP) network and also through personal contact. Google form was created for questionnaire and responses were recorded for analysis. Before participation, informed consent was obtained from all responders. Participants were requested to fill the questionnaires assuring confidentiality of the provided information. Word document was used for those who do not have access to Google forms. For literature search strategies, we have done an online search on health and workplace impact due to COVID-19, PubMed or other medical literature and google scholar for relevant articles from June to August 2020.

3.2 Data Sources and processing

The online questionnaire included a total of 49 questions including sub-questions on socio-demographic characteristics, medical physicists' perception on COVID-19, and perception toward corresponding institute response and preparedness to COVID-19. The responses were to be selected from binary variables of "Yes" and "No", scaled 1 and 0 for analysis, and 4-tier scales of "Very much", "Quite a bit", "A little", and "Not at all", scaled 1 to 4 respectively. Before conducting the survey, we have conducted pretest of the questionnaire to the medical physicists of Nepal to assess the reliability of the questionnaire items. The analysis revealed an overall Cronbach's alpha score of 0.803, indicating higher internal consistency [14].

IV. Results

A total of 203 medical physicists working in different capacities from twenty-two countries responded to the questionnaire from Asia and the Pacific region. During data processing, out of 203, only 186 responds were accepted. Eighteen responses were discarded citing the duplicacy and blank responses during the final evaluation process. It was seen that almost 81% of the study participants were radiation oncology medical physicist followed by around 11% diagnostic radiology medical physicist around 7% Nuclear medicine medical physicist and rest were academics, specialists etc. Country wise responses are shown in figure 1 which is denoted by a numerical number.

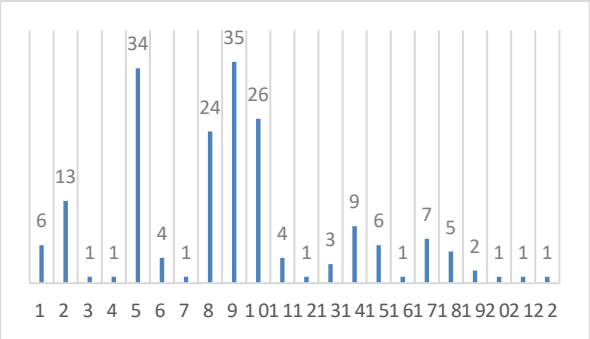

Fig: 1 Country wise responses

4.1. Socio-demographic characteristics

A total of 186 medical physicists working in different capacities from twenty-two countries out of forty-eight in the Asia Pacific (APAC) region [15] participated in the study as shown in Figure 1. The majority responses 143 (76.88 %) were male and 43 (23.12%) were female. Highest responses were from a HIC with 18.9% of the total responses followed consecutively by LICs and LMICs. Maximum of the respondents, 42.7%, were in the age group of 30-40 years. Work experiences of the respondents were mostly less than 5 years, between 5-10 years (27.4%). Almost half, around 48.9% of the respondents working as a medical physicist had completed Post Graduate studies followed by PhD scholars around 38.2%. Most of the respondents reside quite near to hospital having to travel between 5 km (n= 71, 38.2%) and 6-10 km (n = 41, 22.0%) of the hospital. A maximum number of respondents around 71.0% use their vehicle, 20.4% use public transportation and 8.6% use hospital vehicles for travel to their respective institutes. The demographic profile is shown in Figure 2.

Demographic Profile		N=186	
		N	%
Gender	Male	143	76.88
	Female	43	23.12
Marital Status	Single	59	31.72
	Married	127	68.28
Occupation	ROMP	157	84.41
	DOMP	13	6.99
	NMMP	7	3.76
	Others	9	4.84
History of smoking or tobacco use	No	141	75.81
	Yes	45	24.19
Experience (years)	<5	61	32.8
	5-10	51	27.4
	>11	74	9.8
Education	Graduate	24	12.9
	Post Graduate	91	48.9
	PhD	71	38.2

Figure 2: Demographic Profile

More than half of the respondents (52.2%) reported that they do not have any elderly people in their residence. Regardless of this, 40.3% of the respondents were “very much” worried about their family members getting COVID-19 infection while a maximum number of family member above the age of 60 years residing together with them was eight.

Regarding self-evaluation of overall health condition, 60.2% of the respondents considered themselves to have a “Good” overall health condition, similarly, 25.8% consider themselves to have an “Excellent” condition but one paticipant reported to have a poor health condition and still working in active duty. Most of the respondents (76.8%) after considering the missing responses had no serious medical histories that the COVID-19 infection could make more severe.

The main source of information was from the internet (83.6%), television (88%) and socialmedia (50.8%). Most of the responding medical physicists (75.8%) have continued

their work in the hospital despite the pandemic while the rest had the pleasure of special leave due to the perceived high risk of contracting COVID-19. As the work of medical physicists, do not include frequent contact or interaction with the cancer patient, our study also found that 50% of the respondents "rarely" interact/contact with a cancer patient. Only 29% of the respondents (n= 54) tested for COVID-19 of which six were hospitalized with COVID-19 infection. 10.8% of the respondents (n=20) had the close contact with confirmed COVID-19 positive cases during work while 17.7% of the respondents were quarantined and 6 respondents, 3.2% of the respondents were hospitalized for COVID-19. Majority of the respondents reported to have changed their lifestyle because of COVID-19 in their habits like washing hand regularly (93.5%), cough etiquettes (81.7%), social distancing and avoiding unnecessary visits (97.3%), wearing the mask (97.8%), workplace sanitizing (85%), avoid leaving personal belongings to the workplace (67.6%), sanitizing accessories (74.9%) and using appropriate PPE (70.3%) as shown in figure 3.

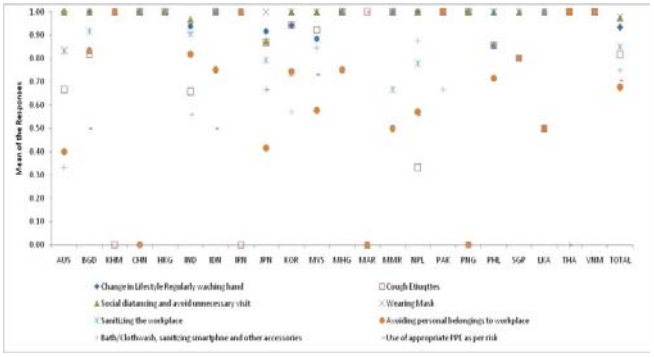

Figure 3: Mean responses to the change in lifestyle and etiquettes because of COVID-19 pandemic.

Regarding personal concern on the likelihood of contracting COVID-19 during the outbreak, 8.7% responded to not have any concern showing that 91.3% of the respondents were concerned at least a little. Accordingly, 93.5% responded that they are worried about their family members getting COVID-19 infection.

Half of the respondents (n=94, 50.5%) were involved in academic activities like teaching and training the graduates or the trainees. 79.8% of the academically involved respondents (n=75) had the option to work remotely. 54.8% of the respondents agreed that the COVID-19 pandemic has affected the residency/training program in their hospital.
The medical physicists who were also active in the academic field and have an option to work remotely put out three major problems during their remote work as problems with internet connectivity, harder communication with co-workers, and harder to keep a regular schedule. Correlations for the dependent variables were established with the predictor (constant) variables of country.

4.2. Effect on the working environment of medical physicist due to COVID-19 Pandemic:

Half of the respondents (51.1%) were satisfied with their institution preparedness for a safe working environment while 10.3% responded that they were not satisfied with institutional preparedness for a safe working environment. Regarding new patient planning, around 21.1% responded "Very Much", 24.3% responded "Quite a bit", 25.4% "A little" while 19.5% felt that there was no effect at all due to the COVID-19 pandemic. The mean score was 2.48 (95% CI 2.31-2.64). No significant differences were observed among the responses from different countries. Pearson correlation value was -0.003 with the approximate significance of 0.965 which is quite less. ANOVA test shows an F value of 1.226 with a significance value of 0.238 which is greater than 0.05 hence responses were statistically not significantly different with different countries. Also, a test of homogeneity of variances has a significance value of 0.376 (>0.05) which shows the variance within countries is statistically not different from each other. Eta squared value is 0.150 that means 15.0% of the variability in response in Effect on new treatment planning is accounted for by country. As shown in Figure 4.

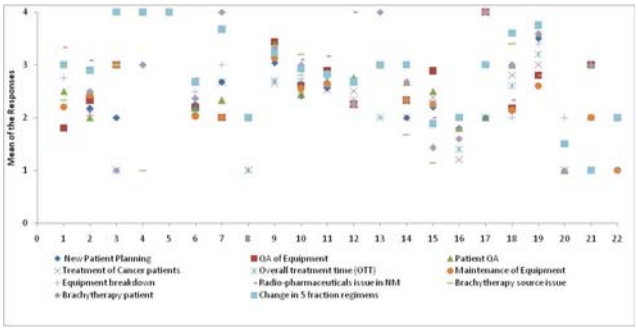

Figure 4: Mean responses of effects on the working environment differentiated according to countries

4.3. Effect on QA Equipment

30.2% of the respondents reported that the pandemic has affected QA of Equipment as "Quite a bit" while 19.8% felt the pandemic has "Very much" affected. Another 30.2% responded that it has not affected at all and the remaining 19.8% felt it has affected "A little". Pearson correlation was found to be -0.057. ANOVA test shows an F value of 1.807

with a significance value of 0.022 which is less than 0.05 hence responses were statistically significantly different with different countries. Test of homogeneity of variances has a significance value of 0.000 (>0.05) which shows the variance within the group is statistically not different from each other. Eta squared value is 0.201 that means 20.1% of the variability in response in Effect in QA of Equipment is accounted for by country. As shown in Figure 4.

4.4. Patient QA

21.6% responded "Very Much", 25.7% "Quite a bit", 24.6% "A little" and 28.1% "Not at all". The Mean value for the score of effect on Patient QA was 2.59 with 95% CI 2.42-2.76. Pearson correlation of the Effect of Patient QA with Country is 0.093 and significance with the country is 0.104. ANOVA test shows an F value of 2.023 with a significance value of 0.008 which is less than 0.05, hence responses were statistically significantly different with different countries. Test of homogeneity of variances has a significance value of 0.101 (>0.05) which shows the variance within different countries is statistically not different from each other. Eta squared value is 0.221 that means 22.1% of the variability in response in Effect in Patient QA is accounted for by country. As shown in Figure 4.

4.5. Treatment of Cancer Patient

23.7% responded "Very Much", 30.2% "Quite a bit", 29.6% "A little" and 16.6% "Not at all".
The mean value for the score of effect on the treatment of cancer patient was 2.39 with 95% CI 2.23-2.55. ANOVA test shows an F value of 1.403 with a significance value of 0.126 which is greater than 0.05, hence responses were statistically not significantly different with different countries. However, the test of homogeneity of variances has a significance value of 0.009 (<0.05) which shows the variance within countries is statistically different from each other. Eta squared value is 0.166 that means 16.6% of the variability in response in Treatment of Cancer patientsaccounted for by country. As shown in Figure 4.

4.6. Overall Treatment Time (OTT)

19.0% responded "Very Much", 33.9% "Quite a bit", 28.0% "A little" and 19.0% "Not at all". The mean value for the score of effect on overall treatment time was 2.47 with 95% CI 2.32-2.62. Pearson correlation of the Effect on overall treatment time with Country is -0.031 and significance with the country is 0.340. ANOVA test shows an F value of 1.523 with a significance value of 0.078 which is greater than 0.05 hence responses were statistically not significantly different with different countries. Test of homogeneity of variances has a significance value of 0.036 (<0.05) which shows the variance within countries is statistically different from each other. Eta squared value is 0.179 that means 17.9% of the variability in response in Treatment of Cancer patients accounted for by country. As shown in Figure 4.

4.7. Maintenance of Equipment

21.4% responded "Very Much", 32.4% "Quite a bit", 24.9% "A little" and 21.4% "Not at all". The mean value for the score of effect on Maintenance of Equipment was 2.46 with 95% CI 2.30-2.62. Pearson correlation of the effect on Maintenance of equipment with the country is -0.024 and significance with the country is 0.371. ANOVA test shows an F value of 1.513 with a significance value of 0.081 which is greater than 0.05 hence responses were statistically not significantly different with different countries. Test of homogeneity of variances has a significance value of 0.052 (>0.05) which shows the variance within countries is notstatistically different from each other.Eta squared value is 0.173 that means 17.3% of the variability in response in Effect on Maintenance of equipment is accounted for by country. As shown in Figure 4.

4.8. Effect on when Equipment breaks down

12.9% responded "Very Much", 30.4% "Quite a bit", 30.4% "A little" and 26.3% "Not at all". The mean value for the score of effect on when equipment breaks down was 2.70 with CI 2.55-2.85. Pearson correlation of the Effect on when Equipment breaks down with Country is -0.116 and significance (1-tailed) with the country is 0.057. ANOVA test shows F value of 1.693 with a significance value of 0.037 which is less than 0.05 hence significant. Test of homogeneity of variances has significance value of 0.099 (>0.05) which shows the variance within countries is notstatistically different from each other. Eta squared value is 0.192 that means 19.2% of the variability in response in effect on when equipment breaks down is accounted for by country. As shown in Figure 4.

4.9. Radiopharmaceutical Issues in Nuclear Medicine

10.6% responded "Very Much", 23.2% "Quite a bit", 28.9% "A little" and 37.3% "Not at all". The mean value for the score of Radiopharmaceutical Issues in Nuclear Medicine was 2.93 with 95% CI 2.76-3.10. Pearson correlation of the

Radiopharmaceutical Issues in Nuclear Medicine with Country is -0.205 significance (1-tailed) with the country is 0.003. ANOVA test shows an F value of 2.319 with a significance value of 0.003 which is less than 0.05 hence responses were statistically significantly different with different countries. Test of homogeneity of variances has a significance value of 0.004 (<0.05) which shows the variance within countries is statistically different from each other. Eta squared value is 0.275 that means 27.5% of the variability in response in effect on radiopharmaceutical issues in Nuclear Medicine is accounted for by country. As shown in Figure 4.

4.10. Brachytherapy source issues

20.0% responded "Very Much", 18.1% "Quite a bit", 25.8% "A little" and **36.1%** "Not at all". The mean value for the score of Brachytherapy source issues was 2.78 with CI 2.60-2.96. Pearson correlation of the Brachytherapy source issues with Country is -0.060 and significance with the country is 0.208. ANOVA test shows an F value of 3.242 with a significance value of 0.000 which is less than 0.05 hence responses were statistically significantly different with different countries. Test of homogeneity of variances has a significance value of 0.007 (<0.05) which shows the variance within countries is statistically different from each other. Eta squared value is 0.337 that means 33.7% of the variability in response in effect on brachytherapy source issue is accounted for by country. As shown in Figure 4.

4.11. Effects on Brachytherapy patient

19.0% responded "Very Much", 22.8% "Quite a bit", 23.4% "A little" and 34.8% "Not at all". The mean value for the score of Effects on Brachytherapy patients was 2.74 with CI 2.56-2.92. Pearson correlation of the Effects on Brachytherapy patients with Country is -0.040 and significance with the country is 0.294. ANOVA test shows an F value of 2.533 with a significance value of 0.001 which is less than 0.05 hence responses were statistically significantly different with different countries. Test of homogeneity of variances has a significance value of 0.006 (<0.05) which shows the variance within countries is statistically different from each other. Eta squared value is 0.280 that means 28.0% of the variability in response in effect on brachytherapy patient is accounted for by country.As shown in Figure 4.

4.12.Effects on 5 fraction regimen

11.0% responded "Very Much", 27.1% "Quite a bit", 28.4% "A little" and 33.5% "Not at all". The mean value for the score of Effects on 5 fraction regimen was 2.85 with CI 2.68-3.01. Pearson correlation of the Effects on 5 fraction regimen with Country is -0.095 and significance with the country is 0.100. ANOVA test shows an F value of 1.885 with a significance value of 0.017 which is less than 0.05 hence responses were statistically significantly different with different countries. Test of homogeneity of variances has a significance value of 0.013 (<0.05) which shows the variance within countries is statistically different from each other. Eta squared value is 0.228 that means2 2.8% of the variability in response in Effect on Brachytherapy patient is accounted for by country.As shown in Figure 4

Twenty-three responders had provided comments and additional information regarding COVID-19, which on were very positive and encouraging.

V. Discussion

The COVID-19 pandemic has drastically transformed the day to day life of every individual. The most affected area was among the health sector, its staffs and their working environment. Increased risk of exposure to the COVID-19 with the addition of precautionary measures during work potentially exacerbates the fear, anxiety and distress among medical physicists. Immune-suppressive state in cancer patients poses themselves an increased risk of COVID-19, which results inthe threat of exposure to the health workers in radiation therapy.

All together 186 medical physicists from twenty-two countries in the Asia & Pacific region have participated in this study. Asia and the Pacific region consists of Low-income countries (LIC) to High-Income Countries (HIC) and the responses received in this study, medical physicists from HIC which made out 38.1% of the responses. Irrespective of the economies of the countries the overall responses were found similar.

It's well-known fact that most number of medical physicists is working in radiation oncology hence most of the respondents are working in radiation oncology followed by diagnostic radiology and nuclear medicine.

Highest respondents, almost 85%, falls in young to middle age group and with a post-graduate and PhD degree in the field of medical physicists inferring that most of the medical physicists are well qualified and have good experience in their respective field. It is also found that most of the physicists are residing very near to their respective institute and use their mode of transportation.

More than half of the respondents mentioned that they are living without an elderly family member which means they are staying in a nucleus family. Those who have elderly family members are worried about their family members getting COVID-19 infection. Irrespective of them residing with or without an elderly family, the respondents were equally worried about their family members contracting COVID-19.

Regarding self-evaluation of overall health condition, it is noticed that most of the respondents have a good health condition without any serious medical historiesthat the COVID-19 infection could make more severe. Some respondents indicated to have hypertension and diabetes,and few haveindicated to have thyroid and bronchial asthma.

It is found that almost all responding medical physicists who work in a hospital, have continued their work in the hospital despite the pandemic but some radiation therapy departments were closed for a few days during the lockdown. After a few days, they had started again with adequate safety measures to treat the growing number of cancer patients. While some had the pleasure of special leave due to the perceived high risk of contracting COVID-19.

As the work of medical physicists, do not include frequent contact or interaction with the cancer patient, our study also found that half of the respondents have rare interaction/contact with a cancer patient. That is why it is also noticed that most of the medical physicists were not given special leave because of the perceived high risk of contracting COVID-19.

Regarding COVID-19 contact history, only some of the respondents tested for COVID-19 of which few were quarantined and few were hospitalized with COVID-19 infection. It is found that COVID-19 has highly impacted a change of lifestyle of the majority of the respondents. Day to day lifestyle has been changed because of COVID-19 with regularly washing hand, cough etiquettes, social distancing and unnecessarily using and bringing personal belongings to the workplace.

Questionnaire regarding institutional preparedness to provide secure and safe working environment during COVID-19 outbreak, responses were almost the same for both satisfied and not satisfied. Most of the positive responses from HIC and MIC countries and those who were not satisfied are formed LMIC and LICs.

Around half of the respondents were also involved in academic activities and only academically involved respondents had the option to work remotely. It is found that working from home is still a challenge in LIC. More than half of the respondents mentioned that the COVID-19 pandemic has affected academic activities, training and residency program. Those who are active in the academic field and have an option to work remotely, have raised internet connectivity, difficulty in communication with co-workers, and keeping the regular schedule as the major problems they facedduring their remote work. But it is found that of COVID-19 pandemic has increased the e-learning platform in those institutions having academic program [16].

Due to COVID-19 pandemic, it is found that the treatment of cancer patients was somehow affected in their regular treatment; the most affected part was overall treatment timeand five fraction regimens. The study has found that COVID-19 pandemic had affected in new patient planning and brachytherapy treatment in radiation therapy. The study found that the impact of COVID-19 was less in QA of equipment and was not much affected while patient QA has been affected a bit during the pandemic. It is found that equipment breakdown and maintenance of the equipment has some issues in LIC countries but it has not an issue in HIC or MIC. A regular supply of radiopharmaceutical and source used for brachytherapy was an issue in some countries because of lockdown and closure of international flights. It is also found that in some HIC there is no effect in radiation therapy, diagnostic radiology and nuclear medicine. All the above-mentioned issues have not affected them.

VI. Conclusion

This study has provided a situational analysis of the state of medical physicist due to the impact of the COVID-19 in their routine work. It has analyzed the impacts the pandemic has had on medical physicists work in the field of radiation oncology, diagnostic radiology and nuclear medicine. All together 186 medical physicists from twenty-two countries in the Asia &Pacific region have participated from Asia and Pacific region consists of Low-income countries (LIC) to High-Income Countries (HIC). Irrespective of the economies of the countries the overall responses were found similar. Due to COVID-19 pandemic, it is found that the treatment of cancer patients was somehow affected in their regular treatment, the most affected part was overall treatment time and five fraction regimens. It is found that almost all responding medical physicists who work in a hospital, have continued their work in the hospital despite the pandemic. A regular supply of radiopharmaceutical and source used for brachytherapy was an issue in some countries because of lockdown and closure of international flights. COVID-19 pandemic adversely affecting the working environment of

the overall hospital, but it has not adversely affected the work of medical physicists in the Asia Pacific Region.

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