

An exploratory study on healthcare sustainability in Turkey: Satisfaction with work environment and perceived barriers towards reducing the environmental impact of pathology operations

Isil Yildiz Aktas

Yale University, Faculty of Medicine, Department of Pathology & VA Connecticut Healthcare System, New Haven, USA

Copyright © 2020 by authors and Annals of Medical Research Publishing Inc.

Abstract

Aim: This study aims to determine the self-reported satisfaction of pathologists in Turkey with the physical amenities of their workplace environment, gauge their awareness on its potential impacts to human health, and quantify perceived environmental impact of healthcare operations. Moreover, current knowledge and potential interest towards adoption of techniques and materials that reduce environmental impacts of pathology operations including applicable green laboratory techniques, material alternatives with less toxicity, material recycling programs, and reusable equipment were explored through the questionnaire.

Material and Methods: For this descriptive study of haphazard sampling, pathologists were invited to complete a 10-question online survey (administered through Google Survey) via Federation of Pathology Societies of Turkey by email and through posts on professional groups on social media. 149 complete responses were received and analyzed as part of the study.

Results: With respect to physical conditions, 58%, 44%, and 42% of responders indicated satisfaction with indoor temperature, physical conditions, and amount of daylight of their primary workspace, respectively. 83% indicated they would like to see more recycling of materials and chemicals used in pathology operations, where lack of knowledge and perceived cost were listed as the two main barriers preventing recycling of laboratory chemicals.

Conclusion: Results shed light on next steps to improve workplace conditions for pathologists in Turkey and reduce environmental impacts in pathology operations.

Keywords: Sustainability; survey; pathology

INTRODUCTION

There is sufficient literature on the effects of the working environment on employee productivity, morale, and health. While poorly designed work environments lead to absenteeism and poor performance in employees, well-designed interiors lead to an increase in staff satisfaction and retention, and productivity, and are also an important factor in achieving corporate sustainability goals (1,2).

In their study, Leder et al. (3) investigated the effect of workplace conditions on employee satisfaction. The two factors that were identified to affect job satisfaction the most were pollutant concentration (imperative in terms

of ventilation and temperature), and type of office setting (open plan or private space). It would be wrong to assume that health workers are exempt from the effects of workplace environments and conditions. In order to build or renovate effective health facilities, it is necessary to pay attention to the needs of healthcare personnel (4). In a study of nurses by Applebaum et al. (5), the relationships between environmental factors such as smell, noise, light and color, and perceived stress, job satisfaction and desire to change jobs were investigated. It has been concluded that common environmental stresses in the work environment can be stressful for staff, and may ultimately lead to departure from the facility and hence

Received: 29.11.2019 **Accepted:** 29.01.2020 **Available online:** 25.02.2020

Corresponding Author: Isil Yildiz Aktas, Yale University, Faculty of Medicine, Department of Pathology & VA Connecticut Healthcare System, New Haven, ABD **E-mail:** isil.yildiz@yale.edu

lead to retention problems. Reducing or eliminating negative environmental factors can contribute to staff satisfaction and employee retention. When hospital and nursing managers allow nurses to make decisions about their physical work environment, the result may be an increase in job satisfaction and a decrease in staff stress.

On the other hand, the health sector and laboratories are structures with high energy consumption and waste generation. Interestingly, modern health services that have the aim of improving human health, make significant contributions to various forms of pollution that adversely affect human health. Due to the growing interest in environmental impacts and emissions, as well as human-environment interactions, sustainability research foresees certain changes in both the physical condition and the functioning of the medical sector. Some of these changes focus on understanding and improving the working conditions of healthcare professionals, while others focus on reducing the overall environmental impact of the healthcare sector. Knowledge and perceptions of decision-makers in the healthcare sector are important in adopting new techniques and systems for the realization of changes. In this study, it was intended to determine the current status and awareness of sustainability concepts in the healthcare sector in Turkey by taking pathology laboratory operations as a model.

MATERIAL and METHODS

A survey was conducted to address the goal of the study. Ethical approval to carry out the research was obtained from the Internal Review Board of our university. All procedures were applied in accordance with the principles of the Declaration of Helsinki World Medical Association. The participants were informed about the study's intent and goal at the beginning of the survey. The questionnaire was answered on a voluntary basis. No promotions or gifts were offered to increase participation. Demographic information was not requested from the participants, nor were they recorded or used in the study's findings.

Professional pathologists practicing in Turkey have been invited to participate in the survey through announcements via email and social media to the Federation of Societies of Pathology. The invitation and announcement were repeated 3 times within a period of 2 months (March-April 2019). Data collection for the study was conducted with an online survey of 10 questions using the Google Surveys tool.

Participants were asked about the type of institution they work in, and their environmental conditions related to temperature, noise, lighting, and natural light level in their primary work areas. In addition, their perceptions about chemical exposure and recycling of medical wastes in their units, recycling of pathological chemicals, factors preventing the recycling of hazardous laboratory chemicals, and techniques to reduce environmental impacts of pathology operations were inquired. The sample was random in this study to enable statistical analysis. Results were analyzed using descriptive statistics.

RESULTS

Data collected through the survey included 149 full answers. Of the participating pathologists, 124 (83%) were in public hospitals, 9 (6%) in pathology laboratories classified under 'other', 8 (5%) in non-profit hospitals, 5 (4%) in private hospitals, 3 (2%) worked in private laboratories. While 86 (58%) participants evaluated the temperature conditions of their work environment as appropriate, 78 (52%) stated that they were not satisfied with the physical conditions (noise, lighting) of their workspace (Figure 1a and 1b). With respect to natural light, 62 (42%) pathologists responded that they received sufficient natural light (daylight), whereas 33 (22%) did not receive any natural light (Figure 1c).

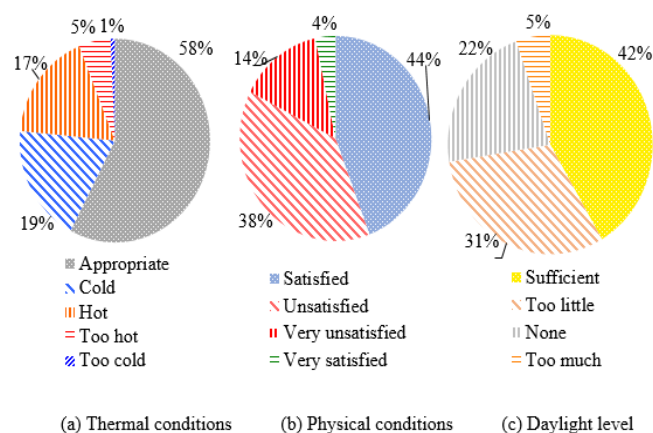


Figure 1. Self-assessment of participants regarding the physical and environmental conditions of pathology laboratories and workspaces. (a) Thermal conditions; (b) Physical conditions such as lighting, noise and the like; (c) Daylight level is indicated.

During self-assessment with respect to chemical exposure, 71 (48%) pathologists stressed that they were concerned about the long-term effects of the exposure level, and 42 (28%) stated that they had a desire to improve ventilation and procure improved materials (Figure 2). While 70 (47%) of the participants believed that medical waste was not recycled sufficiently, 20 (13%) stated that they do not have sufficient knowledge regarding the possibility of recycling chemicals used in pathology operations (Figure 3a). Furthermore, 124 (84%) of the surveyed pathologists stated that they would prefer to recycle harmful chemicals used in pathology operations, while 14 (9%) thought that recycling was not possible (Figure 3b). Inadequate information ($n = 112$, 75%) and cost ($n = 104$, 70%) have been brought to the fore as the main reasons preventing recycling of hazardous laboratory chemicals. The other reasons are as follows: attitude of employees and managers ($n = 78$, 52%); restricted space ($n = 50$, 34%); security ($n = 36$, 24%); time ($n = 32$, 22%); and recycling not possible ($n = 23$, 15%). Among techniques to reduce environmental impacts, pathologists were most interested in formaldehyde and xylene alternatives ($n = 95$, 64%), and

green laboratory approaches (n = 84, 56%). Formaldehyde (n = 79, 53%) and paper (n = 72, 48%) recycling, reusable equipment (n = 55, 37%), and interest in green hospital buildings (n = 49, 33%) were indicated at the specified percentages.

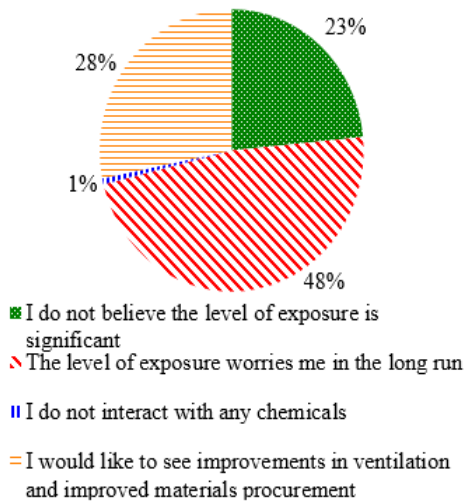


Figure 2. Results of self-assessment to determine the level of chemical exposure of pathologists

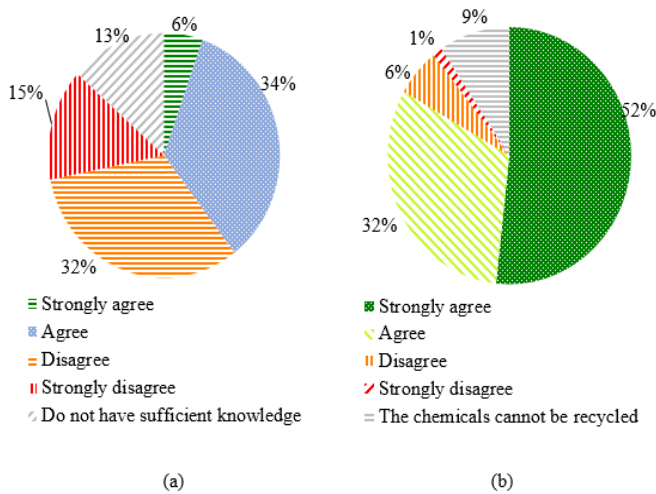


Figure 3. Results on medical waste and recycling of chemicals. (a) "Medical waste is recycled sufficiently"; (b) "I prefer that the chemicals used for pathology be recycled"

DISCUSSION

Based on the results of the study, it was determined that the physical environment where pathologists spend most of their time while working needs improvement. Among the factors analyzed, daylight level of their workspace was the most frequently cited factor that needed improvement. Sufficient literature evidence on the positive effects improvements on daylighting would have is shared in this article.

Studies on waste generation and environmental emissions of the healthcare sector are increasing. Thiel et al. (6) examined two cataract surgery centers in India and

calculated that each phacoemulsion process produces 250 grams of waste and 6 kg of carbon dioxide equivalent gas that act as a greenhouse gas. In two separate studies carried out in the United States (US) where environmental impacts related to birth and hysterectomy procedures were investigated, it was found that the greatest impact was due to the use of indoor space heating, ventilation, and air conditioning, and disposable sets / surgical materials used (7-8). It has been estimated that the use of disposable materials in the US healthcare sector generates an estimated 15 kg waste per day per hospital bed, and a total of approximately 5.9 million tons of waste per year (9). The healthcare industries of the US, Australia, the UK, and Canada combined are estimated to release 748 million metric tons of carbon dioxide equivalents annually. In order to put this amount into perspective, if the healthcare industries of these countries were treated as an independent country, that country would be the seventh in the world in terms of annual greenhouse gas emissions (10). Another study examining the impacts of green hospital buildings by comparing a newly built children's hospital with the old one showed that following improvements in the building, employee productivity and satisfaction, and patient care quality improved, while electricity and energy usage decreased by 50% per square meter, and water consumption and waste generation reduced by 60% (11).

Sustainability in laboratory operations has become a sought-after goal today. The relevant professional organizations (Association for the Improvement of Sustainability in Higher Education, the American Energy Community, and the International Institute for Sustainable Laboratories) were established and certification programs have been initiated. Under the heading of green laboratory, energy and water saving measures, best practices for reducing waste, eliminating the use of hazardous / toxic chemicals, applying good inventory management, and creating recycling programs are examined and recommendations are made to reduce the environmental impact of laboratories (12).

Xylene is an important aromatic hydrocarbon solvent in tissue processing, staining and preparation closure stages suitable for and commonly found in pathology laboratories. However, xylene is also toxic, teratogenic, and carcinogenic. The standard set by the US Occupational Safety and Health Administration (OSHA) specifies that a laboratory worker may at a maximum be exposed to 100 parts per million (ppm) xylene per eight-hour shift. Although it has been known for many years that it constitutes important health risks, xylene alternatives are not used in many laboratories, suggesting old habits, prejudice, and cost reasons for the lack of transition. The use of xylene alternatives and / or recycling of xylene / xylene alternatives is favorable in terms of cost and safety (13,14). There is also literature on biosecure xylene alternatives (e.g. dishwashing detergent, vegetable oils) (15,16). Formaldehyde is the most widely used chemical for fixing and protecting tissues. However, it is highly toxic and has been proven to be harmful to human health

and the environment. Formaldehyde has been classified as a possible human carcinogen and cause for genetic mutation since 2016 in Europe. Studies on the use of aminolipine, a pyrrolidine derivative as an alternative to formaldehyde, continue in Germany (17).

Chemical solvent (formaldehyde, xylene, alcohol, xylene alternative) recycling devices have been commercially available for many years in various sizes and combinations. The lifetime of such devices are estimated to be 10-15 years by companies, and a product yield purity of 95-99.9% (18,19). Doubts and differing perceptions on the necessary time, exposure, initial cost of setting up the system, and the quality of the end product may be listed as the reasons for the limited applications and market penetration of such devices. On the other hand, the University of Washington in the United States presents a unique model where xylene recycling has been applied in its pathology department since 1993 with documented significant savings in materials acquisition and disposal costs (20).

CONCLUSION

The results and discussions of this study are important to improve workplace conditions of pathologists in Turkey, and to identify the necessary steps to reduce the environmental impact of pathology operations. It was found that there is a need to inform pathologists about available tools and techniques to reduce environmental impacts of pathology. Following the development and dissemination of such information, sharing this knowledge with other decision-making stakeholders and carefully evaluating alternatives with a cost-benefit and life-cycle analyses will be an appropriate step to make investments towards sustainability.

Financial Disclosure: There are no financial supports.

Ethical approval: Procedures followed were in accordance with the ethical standards of the Helsinki Declaration.

Isil Yildiz Aktas ORCID: 0000-0001-9511-5123

REFERENCES

- Clements-Croome D. Creative and productive workplaces: a review. *Intelligent Buildings International* 2015;7:164-83.
- Fisk WJ. Health And Productivity Gains From Better Indoor Environments And Their Relationship With Building Energy Efficiency. *Annual Review of Energy and the Environment* 2000;25:537-66.
- Leder S, Newsham GR, Veitch JA, et al. Effects of office environment on employee satisfaction: a new analysis. *Building Research & Information* 2016;44(1): 34-50.
- Tanja-Dijkstra K, Pieterse ME. The psychological effects of the physical healthcare environment on healthcare personnel. *Cochrane Database Syst Rev* 2011;1.
- Applebaum D, Fowler S, Fiedler N, et al. The impact of environmental factors on nursing stress, job satisfaction, and turnover intention. *J Nurs Adm* 2010;40:323-8.
- Thiel CL, Schehlein E, Ravilla T, et al. Cataract surgery and environmental sustainability: Waste and lifecycle assessment of phacoemulsification at a private healthcare facility. *J Cataract Refract Surg* 2017;43: 1391-8.
- Campion N, Thiel CL, DeBlois J, et al. Life cycle assessment perspectives on delivering an infant in the US. *Sci Total Envir* 2012;425:191-8.
- Thiel CL, Eckelman M, Guido R, et al. Environmental Impacts of Surgical Procedures: Life Cycle Assessment of Hysterectomy in the United States. *Environ Sci Technol* 2015;49:1779-86.
- Campion N, Thiel CL, Woods NC, et al. Sustainable healthcare and environmental life-cycle impacts of disposable supplies: a focus on disposable custom packs. *Journal of Cleaner Production* 2015;94:46-55.
- Sherman JD, MacNeill A, Thiel C. Reducing Pollution From the Health Care Industry. *JAMA* 2019;322:1043-44.
- Thiel CL, Needy KLS, Ries R, et al. Building design and performance: A comparative longitudinal assessment of a Children's hospital. *Building and Environment* 2014;78:130-6.
- My Green Lab. <https://www.mygreenlab.org/> Access date: 13.11.2019.
- What to Consider When Selecting Substitutes for Xylene. <https://www.cbgbiochem.com/blog/what-to-consider-when-selecting-substitutes-for-xylene> Access date: 13.11.2019.
- Xylenes (o-, m-, p-isomers) Ethylbenzene. <https://www.osha.gov/dts/sltc/methods/mdt/mdt1002/1002.html> Access date: 13.11.2019.
- Negi A, Puri A, Gupta R, et al. Biosafe alternative to xylene: A comparative study. *J Oral Maxillofac Pathol* 2013;17:363-6.
- Swamy SRG, Nandan SRK, Kulkarni PG, et al. Bio-Friendly Alternatives for Xylene - Carrot oil, Olive oil, Pine oil, Rose oil. *J Clin Diagn Res* 2015;9.
- Aminolipine for formaldehyde-free fixing of biological materials. <https://go-bio.de/en/aminolipine-formaldehyde-free-fixing-biological-materials> Access date: 13.11.2019.
- Solvent Recovery Systems for Your Laboratory Needs. <https://www.cbgbiochem.com/laboratory> Access date: 13.11.2019.
- Solvent Recycling. <https://brinstrument.com/fractional-distillation/general-solvent-recycling.php> Access date: 13.11.2019.
- Xylene Distillation. <https://green.uw.edu/promote/snapshots/xylene-distillation> Access date: 13.11.2019.