# Assessing the knowledge, attitudes, and safety practices of aesthetic laser hair removal providers in British Columbia

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## Abstract

**Background:** Aesthetic laser hair removal (LHR) has gained global popularity. Guidelines are present to assist LHR operators in safely providing their services, however, there is a need for prescriptive measures in the regulations that govern Personal Service Establishment (PSE), which Environmental Health Officers (EHOs) enforce. Inadequate training can lead to improper use of the LHR device, which can cause various injuries or disorders to both the clients and the operator. Practitioners must be sufficiently trained and educated on the risks, hazards, and safety measures required to provide LHR services adequately. Therefore, LHR providers should be assessed to determine any discrepancies in safety knowledge.

**Methods:** A self-administered online survey was advertised by a non-profit organization for cosmetologists called Beauty Council. A cover letter and the survey, containing the associated link and QR-code, were distributed via email and in person. The survey was hosted on Survey Monkey, and the collected data was analyzed on NCSS 2023, a statistical analysis software. The survey consisted of a knowledge-based questionnaire containing multiple-choice, open and closed-ended questions. Demographic information such as type of facility, level of experience, and frequency of service provided were also collected.

**Results:** Among the participants that completed the survey, 150 were from commercial-based facilities, and 72 were from home-based facilities. Pearson's chi-square analysis showed no significant association between knowledge of safety practices and the type of facility or frequency of service provided. However, commercial-based participants scored higher mean test scores than home-based participants. A significant association was found between the level of experience and safety knowledge, where more experience displayed higher mean test scores.

**Conclusion:** Although more experienced LHR practitioners demonstrated greater safety knowledge, discrepancies in training and education levels are present. These inconsistencies could be bridged by implementing a standardized accreditation program. LHR providers will benefit from a program that provides consistent training and education on safety knowledge.

**Keywords:** laser hair removal, reduction, safety, knowledge, risk, exposure, guidelines, legislation

## Introduction

The basic principle that LHR employs is photothermolysis – the absorption of light by hair melanin which leads to the selective destruction of hair (BC Centre for Disease Control, 2005). The devices use electromagnetic radiation to penetrate the skin at different depths damaging the hair

follicles. Additionally, the different wavelengths have better efficacy for different skin types (BC Centre for Disease Control, 2005). Improper use of laser devices can lead to an increased risk of side effects such as pain, burns (including laser track burns), persistent redness (erythema), swelling or inflammation (perifollicular edema), and infection (folliculitis) (Government of Canada, 2021; Pai et al., 2022). British Columbia has no prescriptive certification standard for operators before practicing with these medical-grade devices, and a license is not required to operate these devices. Health Canada recommends that clients research suitable facilities before making an informed decision and ask the operators about relevant training and experience (Government of Canada, 2021). Assessing aesthetic laser hair removal providers' knowledge, attitudes, and safety practices can help health authorities understand whether aesthetic laser hair removal providers require further education and training. This knowledge could lead to a uniform program to train aestheticians that provides aesthetic laser hair to minimize the health risks to the public.

## Literature Review

### What is Laser Hair Removal

LHR services are recognized treatments for unwanted hair and their ability to provide permanent hair reduction (Pai et al., 2022). Permanent hair reduction is a "noticeable, stable reduction in the amount of final hair for a period of time longer than the complete growth cycle of hair" (Atta-Motte & Zaleska, 2020). LHR is beneficial for individuals with hypertrichosis or hirsutism. Hypertrichosis is a condition that causes excessive hair growth, and it can impact either males or females. Hirsutism impacts women, causing atypical hair growth in androgen-dependent sites (Casey & Goldberg, 2008).

The skin, the largest organ in the human body, is the primary point of physical contact during laser hair removal and the site at which photothermolysis occurs. The skin consists of three layers, the epidermis (outermost layer), dermis (middle layer), and hypodermis, also known as the subcutaneous layer (innermost layer). Melanocytes are cells within the epidermis that manufacture melanin, giving rise to skin and hair pigmentation (Yousef, Alhaji, & Sharma, 2021). Hair grows from the hair follicles within the dermis and extends up through the epidermis to the skin surface (BC Centre for Disease Control, 2005). Melanocytes are also located in the hair bulb in the dermis, where melanin provides hair with its distinct color (BC Centre for Disease Control, 2005).

These layers of the skin become the site for photothermolysis to occur - a technique that targets the melanin in the skin through the use of the electromagnetic spectrum. The photothermolysis technique is shown in Figure 1, as the pulse of laser light (infrared radiation) passes through the epidermis and dermis. The melanin then absorbs the laser light in the hair follicle, which is subsequently damaged (BC Centre for Disease Control, 2005). This selective process of targeting melanin allows the aesthetician to destroy hair follicles without damaging the skin (Jane & Mysore, 2018). There are multiple commercial laser hair removal devices on the market, including devices that emit at varying wavelengths (Jane & Mysore, 2018).

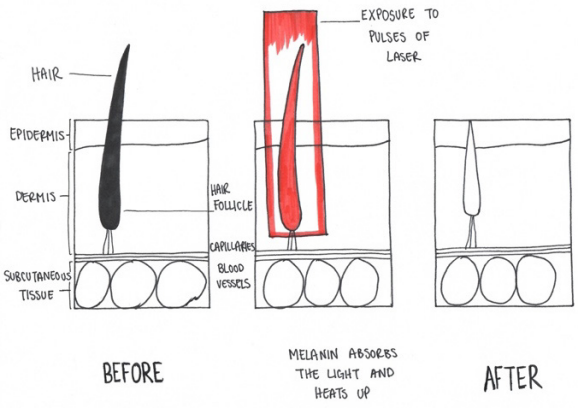


**Figure 1. Cross-sectional view of hair follicle before and after exposure to laser light.**

Potential Hazards and Health Risks

Previous literature shows that LHR services have a degree of efficacy; however, certain hazards and health risks could directly impact all parties in the treatment room (Alkhalifah, 2021; Sammour et al., 2016). One case reported a patient who developed vitiligo lesions that were potentially laser-induced. According to studies, skin damage or injuries can cause the appearance of vitiligo lesions (Alkhalifah, 2021). The patient had presented signs of vitiligo after two separate sessions of laser hair removal and indicated no other interventions to the affected areas (Alkhalifah, 2021). Another study investigated laser-induced Fox-Fordyce Disease (FFD), an inflammatory skin disease (Sammour et al., 2016). The five patients at the clinic presented signs of laser-induced FFD and indicated the use of different laser devices for their LHR sessions (IPL, Alexandrite, diode). Although the health risks of aesthetic LHR are minimal, case studies indicate potential laser-induced diseases and disorders.

Furthermore, studies have also demonstrated increased airborne particulate concentrations during LHR (Chuang et al., 2016; Eshleman et al., 2017; Ross et al., 2018). One study investigated the exposure of ultrafine particle concentration to the laser operators: without smoke evacuators, ultrafine particle concentrations were "2.89 times greater during the procedure and 2.09

times greater after the procedure" compared to background levels (Eshleman et al., 2017). Additionally, another study illustrated how different cooling methods could decrease the number of air particulates exposed to the operator. It was reported that specific cooling practices could expose the operator to air particulate concentrations beyond 200,000 parts per cubic centimeter (ppc). These air particulate plumes can be potentially hazardous to the operator (Eshleman et al., 2017; Ross et al., 2018).

Lasers are cataloged from lowest to highest potential risk: class 1, 1M, 2, 2M, 3R, 3B, and 4 (Government of Canada, 2019). In Canada, to operate class 3B or 4 laser devices, it is necessary to have professional training and a controlled treatment facility (Government of Canada, 2019). Since the human eye can only see visible light between 400-700 nm, class 3B and 4 lasers can produce hazardous infrared radiation. (Government of Canada, 2016). Infrared radiation has wavelengths above 700 nm, making it invisible but harmful to the eye (BC Centre for Disease Control, 2005). Even a brief exposure to near-infrared radiation can cause tissue damage to the fovea leading to temporary or permeant eye injuries (BC Centre for Disease Control, 2005). Everyone in the procedure room must use protective eyewear that meets the optical density requirement for the laser device. *Optical density* is defined as the "measure of how much the laser radiation is reduced when it passes through the protective eyewear" (BC Centre for Disease Control, 2005). An operator can choose the appropriate protective eyewear by determining the output power of the laser device. (BC Centre for Disease Control, 2005).

**Similar Studies**

Currently, no literature directly assesses aesthetic laser hair removal providers' knowledge of safety practices. However, a study conducted by Vachiramon and McMichael investigated "Patient knowledge and attitudes on laser hair removal: a survey in people of color." A cross-sectional survey and questionnaire were utilized to gather knowledge and attitudes of African Americans regarding laser hair removal. The cross-sectional survey results reported that 44.8% of respondents either did not know or were unsure that laser hair removal could safely be administered to dark-pigmented skin. Additionally, responses regarding opinions on side effects were primarily reported as "Do not know," response rates were between 45.2% - 62.4%. The study by Vachiramon and McMichael illustrates how there can be

knowledge gaps with the public regarding laser hair removal.

BC Legislation

Section 23 of the *Public Health Act* provides Environmental Health Officers (EHOs) the authority to conduct the inspections.

"a health hazard exists or likely exists in or on the vehicle or place, or in relation to the activities of the person" (Government of British Columbia, n.d.a).

The Regulated Activities Regulation [B.C. Reg. 161/2011] (RAR), under the *Public Health Act*, defines a personal service establishment (PSE),

"an establishment in which a person provides a service to or on the body of another person" (Government of British Columbia, n.d.b).

LHR falls within the cosmetic laser services umbrella under the Personal Service Establishment Guideline (Government of British Columbia, 2017). Legislation regarding LHR requires a facility to have adequate washing stations, and hot and cold water, and for the operator to manage the facility safely (Government of British Columbia, n.d.b). The regulations are ambiguous and subject to interpretation regarding operating a facility safely. Additionally, it can lead to further challenges in enforcement and inconsistent oversight in the industry.

## Purpose of the Study

This study assesses knowledge, attitudes, and safety practices of aesthetic laser hair removal providers in British Columbia. Currently, no uniform training program ensures that technicians meet competencies or standardized requirements before practicing laser hair removal services. The study may help indicate the necessity for a standardized certification process for aesthetic laser hair removal providers.

## Materials and Methods

The materials included a laptop with internet access. The survey was hosted on Survey Monkey; participants accessed it via a web link or QR-code (SurveyMonkey, n.d.). The software included Microsoft Word, Microsoft Excel, and NCSS 2023 (NCSS Statistical Software, 2023).

The self-administered survey was advertised by Beauty Council, a non-profit organization, on their public Instagram account (Beauty Council, n.d.). The survey was distributed and advertised between February 18, 2023, through March 1, 2023.

The survey consisted of fourteen questions, which were a combination of multiple choice, select all that apply, along

with an "I do not know" option to avoid incorrect data.

Inclusion and Exclusion Criteria

The inclusion criteria encompassed facilities in British Columbia providing hair reduction procedures with lasers, including part-time LHR services (e.g., barbers providing LHR services). Anyone outside the criteria will be excluded.

Ethical Considerations

Ethics were approved by the BCIT Research Ethics Board (REB) to ensure the study was conducted ethically (BCIT, 2023). A cover letter indicated the study's purpose, use of collected data, and risks to participants. The participants consented to their voluntary role.

## Results

Descriptive Statistics

The survey collected multichotomous, ordinal, nominal, and numerical data regarding the type of facilities, experience level, service frequency, and resulting scores from the knowledge test. The demographic data are shown as bar graphs (Figures 2 and 3).

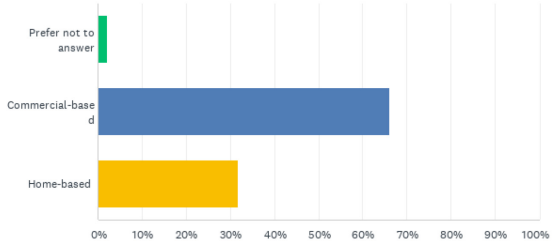


**Figure 2. Types of Facilities**

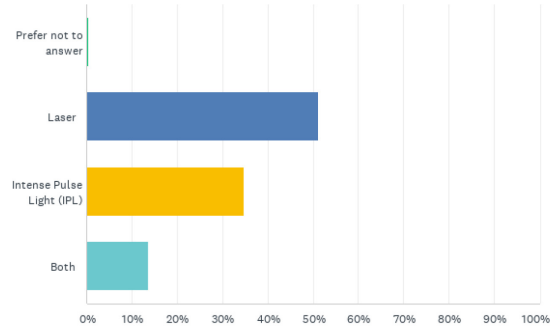


**Figure 3. Types of laser hair removal devices**

The number of participants and knowledge scores for associated demographics are displayed as bar graphs (Figures 4 – 6).

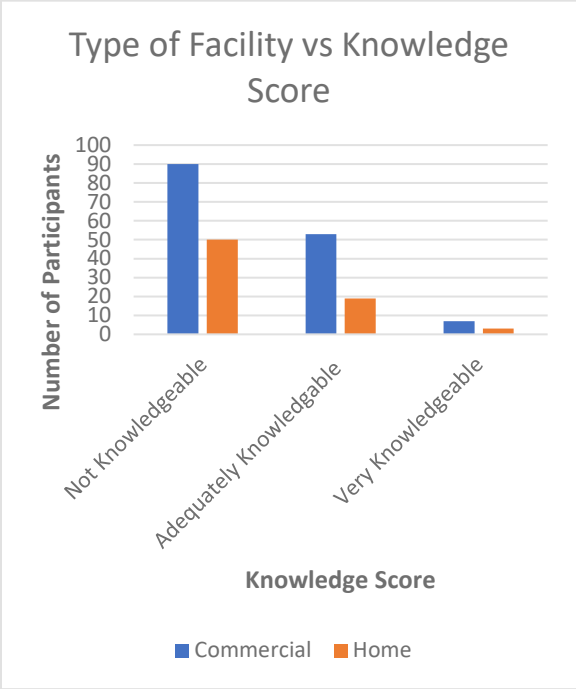


**Figure 4. The number of participants and the knowledge scores for type of facility**

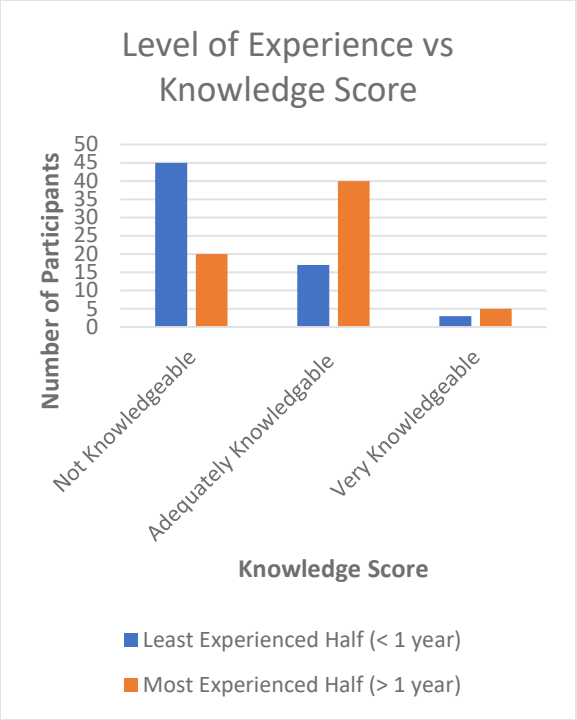


**Figure 5. The number of participants and knowledge scores for level of experience**

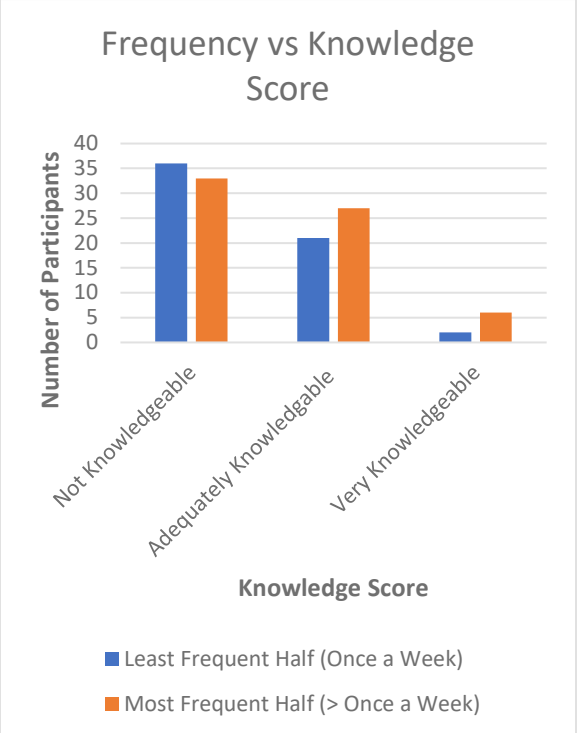


**Figure 6. The number of participants and knowledge scores for frequency of service provided on a weekly basis**

The level of experience is denoted by two categories, and the frequency of service provided were open-ended questions. Operators deemed more experienced comprised the participants in the top half of the recorded experience level. Similarly, operators deemed as less experienced comprised the bottom half of the recorded experience level. The co-investigator equally allocated the responses into the two categories, and the data was equally allocated into two categories (regularly provided services and occasionally provided services) for the frequency of service provided. Operators deemed to regularly provide service consisted of surveyed operators in the top half of the weekly frequency, while occasional service providing operators were in the bottom half. The co-investigator equally allocated the responses into the two categories.

The two-tail independent mean t-tests assess the null and alternative hypotheses regarding commercial and home-based facilities, and experienced and inexperienced LHR providers. No prior literature indicates that any demographic questions will score higher on the knowledge-based test. Therefore a two-tail independent mean t-test was used, which can be implemented to identify a potential statistical difference

between the means of the two groups (Bevans, 2022). This study utilized the t-test to compare the mean results in the knowledge test, the types of facilities, the level of experience, and the frequency of service provided.

Statistical Packages

Data collected from the study was transferred from SurveyMonkey to Excel, and was organized. It was then exported to NCSS 2023 for statistical analysis.

Inferential Statistics

The co-investigator used inferential statistics to assess the null and alternative hypotheses of Pearson's Chi-Square test and two-tail independent mean t-tests. Pearson's Chi-Square test determines whether an association exists between the demographic questions and knowledge test result categories. Pearson's chi-square tests the distribution of the categorical variables (Turney, 2022). The result from Pearson's Chi-Square test indicates whether or not an association exists between the facility and categorical variables, the level of experience and categorical variables, and finally, the frequency of service provided and categorical variables.

Interpretation

Table 1 and Table 2 provide an interpretation of the data analysis that can be viewed in Appendix IV.

**Table 1. Interpretation of Pearson's Chi-Square of Null ($H_o$) and Alterative ($H_a$) Hypothesis**

| $H_o$ and $H_a$ | Results | Interpretation |
|---|---|---|
| $H_o$ = There is no association between knowledge of safety practices and the type of facility that provides laser hair removal services.<br><br>$H_a$ = There is an association between knowledge of safety practices and the type of facility that provides laser hair removal services. | 0.3838 | p = 0.3838, therefore we accept the $H_o$ and conclude that there is no statistically significant association between the knowledge of safety practices and the type of facility. There is no potential for beta error as the p-value is far greater than 0.05. |
| $H_o$ = There is no association between knowledge of safety practices and level of experience of the operator.<br><br>$H_a$ = There is an association between knowledge of safety practices and level of experience the operator. | 0.0001 | p = 0.0001, therefore reject $H_o$ and conclude that there is a statistically significant association between the knowledge of safety practices and the experience of the operator. More years of experience resulted in more knowledge. There is no potential for alpha error as the p-value is far less than 0.05. |
| $H_o$ = There is no association between knowledge of safety practices and how frequently laser hair removal services are provided.<br><br>$H_a$ = There is an association between knowledge of safety practices and how frequently laser hair removal services are provided. | 0.2870 | p = 0.2870, therefore we accept the and conclude that there is no statistically significant association between the knowledge of safety practices and the frequency that the service is provided. There is no potential for beta error as the p-value is far greater than 0.05. |

**Table 2. Interpretation of T-test analysis of Null ($H_o$) and Alterative ($H_a$) Hypothesis**

| $H_o$ and $H_a$ | Results | Interpretation |
|---|---|---|
| $H_o$ = The mean score of the knowledge test for home-based LHR providers = to the mean score in the knowledge-based test for commercial-based LHR providers.<br><br>$H_a$ = The mean score of the knowledge test for home-based LHR providers ≠ to the mean score in the knowledge-based test for commercial-based LHR providers. | 0.02423 | p = 0.02423, therefore reject $H_o$ and conclude that there is a statistically significant difference between the knowledge of laser hair removal safety practices. The commercial-based LHR providers had a significantly higher test score mean than home-based LHR providers. There is potential for alpha error as the p-value is close to 0.05. |
| $H_o$ = The mean score in the knowledge test for the more experienced half of operators surveyed = to the mean score in the knowledge for the less experienced half of operators surveyed.<br><br>$H_a$ = The mean score in the knowledge test for the more experienced half of operators surveyed ≠ to the mean score in the knowledge for the less experienced half of operators surveyed. | 0.00028 | p = 0.00028, therefore reject $H_o$ and conclude that there is a statistically significant difference between the experience of operators surveyed. The more experienced operators had a significantly higher test score mean than the less experienced operators. There is no potential for alpha error as the p-value is far less than 0.05. |

## Discussion

The study aimed to assess aesthetic laser hair removal providers' knowledge, attitudes, and safety practices and explore the associations between knowledge of safety practices, type of facility, level of experience, and frequency of service provided. This study has indicated no association between knowledge of safety practices and the type of facility. However, commercial-based LHR providers had a higher test score mean than home-based providers. Health authorities such as Fraser Health and Vancouver Coastal Health inspect both types of facilities based on the same requirements. Operators are required to produce proof of training and present a treatment room with correct safety requirements before receiving an approval to practice. Commercial-based operators had a slightly higher mean test score, which could suggest that they may be able to either hire more qualified staff or provide existing staff with additional training. Conversely, owner-operators typically run home-based facilities without the help of additional employees. An owner-operator is usually the sole practitioner in their LHR facility; therefore, their individual training and education levels

are assessed. There is no standardized certification process, which could be attributed to the discrepancies in training results.

There is no significant association between knowledge of safety practices and service frequency, but results from this study indicate a significant association between knowledge of safety practices and experience level. The mean test score results show that more experienced operators had a significantly higher mean test score than the less experienced operators. The survey results also indicate that LHR services are provided infrequently. The results from the survey established two categories: the "least frequent half" and "most frequent half" categories comprised 44% and 56% of the total sampled population. The "least frequent half" category provided LHR services once a week, whereas the "most frequent half" category provided LHR services more than once a week. The nonsignificant results could be justified by how intermittently the services are provided on a weekly basis.

Categories for the level of experience were equally distributed. Both the "least experienced half" and "most experienced half" comprised 50% of the sampled population each. Participants that indicated one year of experience or less were put in the "least experienced half." In contrast, the participants with greater than one year of experience were put in the "most experienced half" category. The results suggest that it may take operators more than one year of experience to have an increased knowledge of safety practices versus those with less than one year of experience. This suggests that operators may require more exposure over time in providing LHR services rather than the service rate.

This study also revealed that 68% of LHR operators agree that there should be a standardized education and training program for LHR operators.

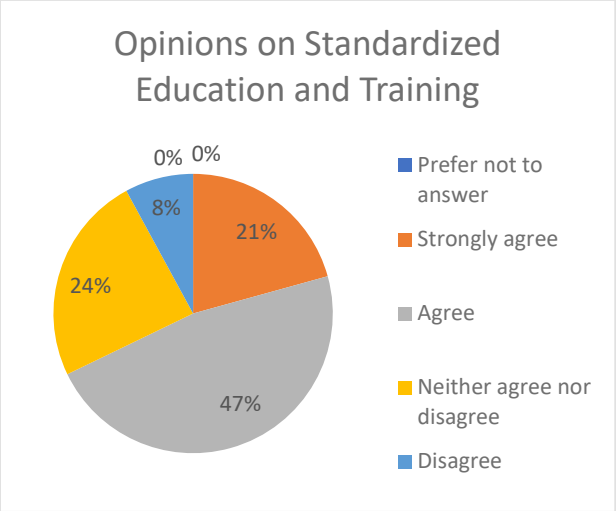


**Figure 7. Operator opinion on a standardized education and training program for all laser hair removal operators to complete prior to practicing**

Most respondents (77%) felt it is either usually or always safe to go over tattoos with a laser hair removal device. This

indicates a need to understand using LHR over tattoos. Lasers cannot differentiate between melanin and the dark pigment of tattoos, therefore, the tattoo will absorb the high energy from the laser device (Australian Skin Clinics, 2019). Without appropriate training and proper equipment, LHR devices are not recommended over tattoos, as this can lead to burns, blisters and scarring (Australian Skin Clinics, 2019 & London Premier Laser & Skin Clinic, 2019).

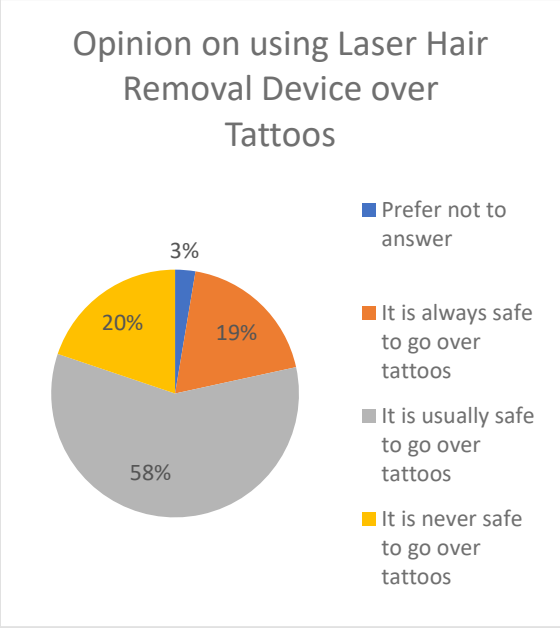


**Figure 8. Operator opinion on using laser hair removal devises over tattoos**

The premise of this study has brought attention to the knowledge gaps that still exist in safety training for LHR practitioners. The three factors assessed in this study include home-based versus commercial-based facilities, frequency of services provided, and experience level. The results from the assessment showed a discrepancy in the answers provided by the surveyed practitioners.

The survey results suggest a need for additional training for LHR operators, specifically through one of the survey questions. The equivalent of a standardized curriculum, such as FOODSAFE in the food services industry, is imperative to educate all LHR providers to have adequate safety knowledge before practicing.

**Knowledge Translation**

The results from this study indicate that there needs to be more safety knowledge among LHR operators. The BCCDC recommends "that operators not be permitted to work with lasers" until they achieve a 100% score on the Laser Operator Knowledge Questionnaire in the Laser Hair Removal Devices: Safety Guidelines for Owners/Operators (BC Centre of Disease Control, 2005). The survey in this study consisted of questions based on the Laser Operator Knowledge Questionnaire. No governing body ensures that the technicians meet specific competencies or standardized requirements before practicing laser hair removal services. This study suggests that additional training should be required for operators before providing LHR services.

The results also indicate industry's interest in supplemental training. The Food Premises Regulation requires operators of food service establishments to hold a FOODSAFE or equivalent certification. Implementing a comprehensive training program, like the FOODSAFE certification, will help standardize the training of LHR operators in British Columbia.

Finally, the Laser Hair Removal Devices: Safety Guidelines for Owners/Operators guideline has been identified as an essential resource for safety information for LHR operators. However, knowledge gaps were identified in the increased usage of intense pulsed light devices for hair removal. Furthermore, the most up-to-date guideline has been adopted since 2011, so it is essential for health authorities to review and revise the laser hair removal guidelines.

**Limitations**

The co-investigator identified a few limitations throughout the study. The primary respondents were LHR operators that are members of Beauty Council or follow Beauty Council's social media page. The results from this survey may also not accurately reflect the knowledge base of LHR providers due to the lack of invigilation. Furthermore the response rate from email and in-person modes of distribution was low, as the co-investigator's affiliation to BCIT may have dissuaded participants as they may have seemed like an unofficial "enforcement" individual.

In-person invigilation of the survey may yield more accurate safety knowledge results versus unmonitored self-administered surveys. In this case, the in-person method was not practicable due to the limited time to conduct the survey.

Finally, the sample size for this study is relatively small compared to the actual number of LHR providers in British Columbia. Therefore, the results of this study may reflect something other than the actual safety knowledge of LHR operators in British Columbia.

**Future Research**

The following are recommendations for future research project ideas:

- Survey the safety practices knowledge of LHR providers with in-person interviews
- Assess safety knowledge of public or Environmental/Public Health Officers regarding LHR services
- Assess the nature of the certification process, and the type of certifications that laser hair operators have

completed and their impact on safety knowledge test scores

## Conclusion

This study revealed a statistically significant association between safety knowledge and the experience of the LHR operator. The study also revealed no statistically significant association between safety knowledge and the type of facility nor the frequency of LHR services provided. By implementing a legislated education requirement, EHOs will be able to enforce standardized training similar to what is seen in the food services industry.

Acknowledgment

The lead author would like to thank Dale Chen and Amardeep Kambo for their guidance, unwavering support, and flexibility throughout the course.

Competing Interests

The authors declare that they have no competing interests

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