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# Infection Control Practices in Registered versus Unregistered Dental Clinics: A Comparative Cross-Sectional Study in Swat, Pakistan

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## ABSTRACT

**Objective:** To compare adherence to standard infection control practices between registered and unregistered dental clinics in Swat District, Pakistan.

**Methods:** *A comparative cross-sectional study was conducted in 160 dental clinics (80 registered, 80 unregistered). Data were collected using a 21-item structured questionnaire based on the Centers for Disease Control and Prevention guidelines. For each clinic, an infection control practices (ICP) score was calculated. Mean ICP scores and categorical variables were compared using independent samples t-tests and chi-square tests, with $p < 0.05$ considered statistically significant.*

**Results:** *Registered clinics had a higher mean ICP score than unregistered clinics (51.29 ± 1.90 vs 50.14 ± 2.46; $p = 0.001$). They more frequently reported handwashing before treatment, handpiece sterilization, disinfection of work surfaces, and safe disposal of needles in sharps containers. Unregistered clinics reported more frequent use of hand sanitizer but were less likely to document sharps injuries. In both groups, adherence was lowest for waste segregation and routine mask changing.*

**Conclusion:** *Registered dental clinics in Swat demonstrated better compliance with infection control practices than unregistered clinics, yet important gaps remained in both groups, particularly regarding waste management, documentation of sharps injuries, and mask use*

**Keywords**: Registered and unregistered dental clinics, healthcare disparities, preventive dentistry, infection control

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## *INTRODUCTION*

Infection control in the dental clinic is a worldwide public health concern because of potential direct or indirect, cutaneous or mucous membrane contact with blood, saliva, and aerosols that carry blood-borne pathogens, including hepatitis B virus (HBV), hepatitis C virus (HCV), and human immunodeficiency virus (HIV) [1]. The World Health Organization (WHO) emphasizes the importance of adhering to standard precautions, utilizing personal protective equipment (PPE), and implementing engineering control measures to mitigate the risk of cross-infection in dental settings [2]. Dental aerosol and droplets during routine dental procedures can spread infection to the entire operating environment, necessitating comprehensive strategies for preventing transmission of infections in dental practice,

including pre-procedure mouth rinses, rubber dam isolation, and high volume evacuation[3]. Developed country guidelines universally emphasize occupational hazards faced by dental healthcare workers, mainly via needle stick and contact with contaminated instruments, and the significance of vaccination programs, sharps policy interventions, and adherence to sterilization[4].

In Pakistan, especially in the KPK province, optimum infection control measures are still very hard to implement within dental healthcare. Recent cross-sectional studies from all over Pakistan have consistently reported significant knowledge-practice gaps among dental professionals, with one 2020 survey of dentists in Rawalpindi and Islamabad with high theoretical knowledge about infection control protocols but moderate to low practical practice[5]. Patient's perspective even underscores these concerns and insufficient patient-driven control as regards adequate protective modes[6]. In dental demonstrators and junior staff, it was observed that the use of protective eyewear, apron, and head covering was not uniform, vaccination against hepatitis B, and hand hygiene practices were also varied[7]. Bio-medical Waste Management Rules, lack of training of staff, and mechanisms of accountability in the Pakistani Health sector are insufficient[8]. A revised Strengths, Weaknesses, Opportunities, and Threats (SWOT) analysis of the Pakistani dental profession has identified an immediate need to address stronger legislation, increased licensing transparency, and expanded training programs to provide the proper preventative knowledge and better regulation across the nation[9].

The Swat District presents a unique healthcare environment, featuring both licensed and unlicensed dental clinics, which results in varying and uneven standards of care and infection control measures. From the available studies at the facility level in Swat, it was found that healthcare personnel have substantial knowledge shortfalls, which may directly hinder the implementation of infection control practices in a clinical setting10]. It is further complicated by the existence of unregistered dental practices, which operate outside the regulatory oversight and may not have access to appropriate sterilization equipment or an appropriately equipped waste disposal system and standard infection control guidelines[11,12]. Regional health inequities in KPK, such as insufficient enforcement and resource constraints, amplified this difference between registered and unregistered dental facilities[13,14].

Lack of comparative studies on infection control measures among the two types of dental clinics in the Swat region is a research gap and may have public health relevance, as unregistered personal practice is not monitored for infection control policies. Hence, the objective of this study is to evaluate and compare infection control practices in registered versus unregistered dental clinics in the Swat district, Pakistan. The findings will inform evidence-based policies, increasing regulations as well as developing targeted training interventions aimed at improving the level of infection control in all dental care settings within this area.

The aim of this study was to compare adherence to standard infection control practices between registered and unregistered dental clinics in Swat District, Pakistan.

## MATERIALS AND METHODS

This cross-sectional comparative study was conducted between March and June 2025 in Swat, Khyber Pakhtunkhwa. Ethical approval was obtained by the Institutional Review Board & Ethical Committee of Iqra National University, Swat Campus, Ref No (INU/ORIC/132, 4th April 2025). Previous to data collection, written informed consent was obtained from all the participants. All private dental clinics that offer ambulatory dental services in the tehsils of Babuzai and Kabal were included. Clinics were ineligible if they were situated in hospital or teaching-hospital environments, were closed at the time of collecting data, and/or refused to


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participate. The sample size was calculated with G*Power. For an independent samples t-test assuming a medium effect size (Cohen's d = 0.5), with an alpha of 0.05 and power of 80%, the calculation yielded a minimum total requirement of 128 clinics (64 registered and 64 unregistered). Since non-response was anticipated, we increased the sample to 80 clinics per group for a target sample of 160 clinics overall. Clinics were selected using non-probability quota sampling.

A pre-determined quota sampling structure was established with 120 clinics (60 registered and 60 unregistered) from Babuzai tehsil and another set of 40 clinics (20 registered and 20 unregistered) from Kabal tehsil, to reflect the distribution of clinics in these areas and to ensure equal numbers of registered and unregistered clinics in each tehsil. Data were collected using a structured self-administered questionnaire based on the US Centers for Disease Control guidelines for infection control in dental health care settings. For each clinic, an overall infection control practices (ICP) score was calculated by summing the responses to the 21 ICP items, with higher scores indicating better adherence. For clarity and content validity, the questionnaire was pilot tested on 20 dental practitioners from areas not included in the main study. The internal consistency of the infection control practices section was found to be acceptable, with a Cronbach's Alpha of 0.650.

### Statistical analysis

Statistical analysis was performed using the SPSS version 25. Descriptive statistics (frequencies, percentages, means and standard deviations) were calculated for all variables. Independent samples t tests were used to compare the mean overall ICP scores between registered and unregistered clinics. Associations between clinic type and categorical infection control variables were assessed using chi square tests. A p value of $< 0.05$ was considered statistically significant.

## RESULTS

Most clinics (75%) were located in Babuzai tehsil and the remainder in Kabal. The majority of practitioners were male (144/160, 90.0%), and 60.0% belonged to the 30–39 year age group. Overall, 68 practitioners (42.5%) held a dental diploma, 61 (38.1%) had a Bachelor of Dental Surgery degree, 12 (7.5%) had a BS in Dental Technology and 19 (11.9%) reported postgraduate qualifications. Most clinics were general practices (141/160, 88.1%), whereas 19 clinics (11.9%) provided specialist services.**(Table 1)**

Most clinics reported adequate hand hygiene and glove use, and about three-quarters consistently used facemasks and protective eyewear; however, only 4 clinics (2.5%) always changed masks between patients, while 132 clinics (82.5%) rarely or never did so. All clinics disinfected instruments, almost all used an autoclave, and 146 clinics (91.3%) disinfected dental chairs and work surfaces after each patient. Although most clinics disposed of needles in puncture-resistant containers (154 clinics, 96.3%), waste segregation was poor, with only 14 clinics (8.8%) always segregating infectious waste and 131 clinics (81.9%) rarely or never doing so. No clinic consistently maintained sharps injury records, 144 clinics (90.0%) rarely or never kept such records, only 6 clinics (3.8%) had a written exposure protocol, and pre-procedural mouth rinses (2.5%) and displayed infection control policies (1.9%) were uncommon. **(Table 2)**

Registered clinics had a significantly higher mean ICP score than unregistered clinics (51.29 ± 1.90 vs 50.14 ± 2.48; t(158)=3.304, p<0.001). They more frequently reported handwashing before treatment (92.5% vs 81.3%; p=0.035), sterilization of handpieces and burs (100% vs 91.3%; p=0.014), disinfection of chairs and surfaces (100% vs 82.5%; p<0.001), safe needle disposal (100% vs 92.5%; p=0.028), and waste segregation (27.6% vs 8.8%; p=0.004). Unregistered clinics more often reported consistent hand sanitizer use (100% versus 92.5%; p=0.028) and occasional sharps injury documentation (15.0% vs 5.0%; p=0.035). Mask



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changing between patients was low in both groups (p=0.034). (**Table 3**)

Table 1: Demographic details of the study population

| Variable | N =160 |
|---|---|
| **Tehsil of Clinic** | |
| Babuzai | 120 (75.0) |
| Kabal | 40 (25.0) |
| **Clinic Registration** | |
| Registered | 80 (50.0) |
| Unregistered | 80 (50.0) |
| **Age Group (Years)** | |
| 20–29 | 44 (27.5) |
| 30–39 | 96 (60.0) |
| ≥40 | 20 (12.5) |
| **Gender of Practitioner** | |
| Male | 144 (90.0) |
| Female | 16 (10.0) |
| **Highest Qualification** | |
| BDS | 61 (38.1) |
| Dental Diploma | 68 (42.5) |
| BS Dental Technology | 12 (7.5) |
| Postgraduate (BDS + FCPS) | 19 (11.9) |
| **Type of Practice** | |
| General | 141 (88.1) |
| Specialty | 19 (11.9) |

## *DISCUSSION*

This cross-sectional study compared infection control practices between registered and unregistered dental clinics in Swat, Pakistan, and identified statistically significant differences between the two groups. The sample was heavily dominated by males (90.0%), and the majority of respondents belonged to the 30–39 years age group (60.0%), which is consistent with trends reported for private dental practitioners in Pakistan. This is different from the studies at the tertiary-care level, for example, a survey from Multan, which showed the majority of female dental house officers [14]. These differences suggest that private practice, particularly in rural or suburban regions, may attract a different workforce profile compared to academic institutions.

Overall adherence was better in registered clinics that reported a significantly higher mean ICP score (M = 51.29, SD = 1.90) compared to unregistered clinics (M = 50.14, SD = 2.46; t (158) = 33). 001). this is consistent with international studies that demonstrate licensed or regulated settings are more likely to follow infection prevention standards than informal providers[15,16]. Some key practices were highly compliant in both groups, such as changing gloves between patients (100%) and autoclave use (98.1%), and these are higher rates than those reported in Nigeria (79.2%)[17] and Palestine (59.4%)[18]. Better post-pandemic knowledge may account for the relatively high compliance observed in this study, as also suggested by recent data from Pakistan[19].

Compliance with handwashing was significantly higher among the registered clinics (p =. 035), sterilization of handpiece/bur (p =.014), surface disinfection (p <.001) and sharps disposal (p =0.028). This has been previously documented as well in Lucknow India, where the majority of dentists (96%) are aware that sharps container should be puncture-proof, but only 36% use them, and most throw the needle in general or infectious waste; further, 74% store sharps containers at corners except for point-of-use[19]. The relatively good performance of the registered clinics in contrast to these results is suggestive that there are better resources and monitoring at play. Second, their hand hygiene was higher than the 73.3% reported by Multan, and the authors had used PPE[14]. These comparisons further bolster the case that registration encourages consistent adherence to infection prevention practices.

Some counterintuitive findings emerged. Use of hand sanitizers was higher in unregistered clinics and less likely to infrequently document sharps injuries. These findings contrast with the general pattern of worse practices among informal providers[15]. Increased use of hand sanitizers could be due to insufficient access to running water and inconsistent reporting of sharps injuries likely


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reflects variation in ad-hoc data collection rather than safer practices.

While pockets of good adherence were observed, several important elements of IPC had very low compliance rates in both clinics. No clinic kept SIR records consistently, only 8.8% of the clinics always separately collected infectious waste using colored bags, and only 1.9% had an infection control policy posted at the workplace. Studies in other settings have also found high rates of needlestick injuries and lack of training, for example, in Cameroon, 60% of dental workers reported recent injury, and only 35% infection control education[20]. Inefficient waste separation mimics results from other low-resource areas[17,20]. Lack of written guidelines reflects structural gaps that hinder standardized implementation.

These gaps have major public-health consequences. Poor infection control practices contribute to the likelihood of transmitting HBV, HCV and HIV, especially in high prevalence settings where open exposure to blood and saliva is common[17,21]. Although the high proportion of gloves and autoclaves in use are encouraging, guideline-specific interventions, including improved waste management resources, standardized documentation form design and more stringent regulatory scrutiny would be needed to improve compliance.

## CONCLUSION

Registered dental clinics in Swat had better adherence to documented infection control practices than unregistered clinics, particularly for hand hygiene, instrument sterilization, surface disinfection and sharps disposal. However, important gaps were present in both groups. Only a small proportion of clinics segregated infectious waste correctly or changed masks between patients, and almost none kept a record of sharps injuries. These gaps suggest that recommended infection control measures are not being applied consistently at clinic level. Strengthening local regulatory check, providing clear written protocols and continuing professional education on infection control may improve practice and reduce the risk of cross-infection in dental clinics in this setting.

### Conflict of interest

The authors whose names are listed as authors certify that they have NO affiliations with or involvement in any organization or entity with any financial interest (such as honoraria; educational grants; participation in speakers' bureaus; membership, employment, consultancies, stock ownership, or other equity interest; and expert testimony or patent-licensing arrangements), or non-financial interest (such as personal or professional relationships, affiliations, knowledge or beliefs) in the subject matter or materials discussed in this manuscript.

### Authors' contribution

***Yaseen Khan, Asad Ullah, Junaid Ali***- Concept, planning, data analysis/curation, drafting and final approval

***Shahid Ali, Yusra Tabassum, Noor ul Hasan***- Conception, drafting, data curation, data analysis and final approval

### Data availability

Can be available from corresponding author on reasonable request

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Table 2. Infection Control Practices in Dental Clinics (N = 160)

| Practice Variable | Always n (%) | Occasionally n (%) | Rarely/Never n (%) |
|---|---|---|---|
| **Hand hygiene** | | | |
| Wash hands before treatment | 139 (86.9) | 21 (13.1) | 0 (0) |
| Wash hands after treatment | 94 (58.8) | 61 (38.1) | 5 (3.1) |
| Use hand sanitizer if no washing | 154 (96.3) | 6 (3.8) | 0 (0) |
| **Personal protective equipment** | | | |
| Wear gloves for procedures | 155 (96.9) | 5 (3.1) | 0 (0) |
| Change gloves between patients | 160 (100) | 0 (0) | 0 (0) |
| Wear mask & eyewear | 119 (74.4) | 41 (25.6) | 0 (0) |
| Change/dispose mask between patients | 4 (2.5) | 24 (15.0) | 132 (82.5) |
| **Sterilization & disinfection** | | | |
| Disinfect used instruments | 160 (100) | 0 (0) | 0 (0) |
| Sterilize handpieces/burs | 153 (95.6) | 7 (4.4) | 0 (0) |
| Use autoclave | 157 (98.1) | 3 (1.9) | 0 (0) |
| Disinfect chair & surfaces | 146 (91.3) | 14 (8.8) | 0 (0) |
| **Waste management & safety** | | | |
| Dispose needles in sharps container | 154 (96.3) | 6 (3.8) | 0 (0) |
| Segregate infectious waste | 14 (8.8) | 15 (9.4) | 131 (81.9) |
| Record sharps injuries | 0 (0) | 16 (10.0) | 144 (90.0) |
| Written exposure protocol | 6 (3.8) | 3 (1.9) | 151 (94.4) |
| **Environmental practices** | | | |
| Hepatitis B vaccination | 157 (98.1) | 3 (1.9) | 0 (0) |
| Adequate ventilation/water | 160 (100) | 0 (0) | 0 (0) |
| Separate sterilization area | 160 (100) | 0 (0) | 0 (0) |
| Use disposable materials | 155 (96.9) | 5 (3.1) | 0 (0) |
| Pre-procedural mouth rinse | 4 (2.5) | 16 (10.0) | 140 (87.5) |
| Display infection control policy | 3 (1.9) | 0 (0) | 157 (98.1) |


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Table 3: Comparison of key infection control practices by clinic registration status

| Practice Variable | Response | Registered | Unregistered | p-value |
|---|---|---|---|---|
| **Hand Hygiene** | | | | |
| Wash hands before treatment | Always | 74 (92.5) | 65 (81.3) | .035 |
| | Occasionally | 6 (7.5) | 15 (18.8) | |
| Use hand sanitizer | Always | 74 (92.5) | 80 (100) | .028* |
| | Occasionally | 6 (7.5) | 0 (0) | |
| **Personal Protective Equipment** | | | | |
| Change or dispose of mask | Always | 0 (0) | 4 (5.0) | .034 |
| | Occasionally | 16 (20.0) | 8 (10.0) | |
| | Rarely/Never | 64 (80.0) | 68 (85.0) | |
| **Sterilization & Disinfection** | | | | |
| Sterilize handpieces and burs | Always | 80 (100) | 73 (91.3) | .014* |
| | Occasionally | 0 (0) | 7 (8.8) | |
| Disinfect chair & work surfaces | Always | 80 (100) | 66 (82.5) | < 0.001 |
| | Occasionally | 0 (0) | 14 (17.5) | |
| **Waste Management & Safety** | | | | |
| Dispose of needles in sharps container | Always | 80 (100) | 74 (92.5) | .028 |
| | Occasionally | 0 (0) | 6 (7.5) | |
| Segregate infectious waste | Always | 9 (11.3) | 5 (6.3) | .004 |
| | Occasionally | 13 (16.3) | 2 (2.5) | |
| | Rarely/Never | 58 (72.5) | 73 (91.3) | |
| Keep record of sharps injuries | Occasionally | 4 (5.0) | 12 (15.0) | .035 |
| | Rarely/Never | 76 (95.0) | 68 (85.0) | |

*Chi-squre test/fisher exact test

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