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Research Article

# Evaluation of National Oral Cancer Control Policies and Their Impact on Early Detection and Survival Outcomes of Patients with Oral Squamous Cell Carcinoma

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## ABSTRACT

Oral squamous cell carcinoma (OSCC) has an alarmingly high incidence rate in Pakistan, further worsened by the fact that most patients do not survive long enough after diagnosis which underscores the vital need for timely intervention. Although the main aim of the National Oral Cancer Control Policies (NOCCPs) is to prevent the ailments associated cancer through the means of public education, timely intervention, screening, and management, there seems to be very little research on the outcomes of such policies on Pakistan. This research aimed to pertained the impact of the NOCCPs on the early detection and the survival outcomes of OSCC patients in Pakistan. This cross sectional study included 35 patients aged 30-70 years diagnosed with OSCC in the tertiary care centres. Several tools were utilized to collect the data such as NOCCPs (National Oral Cancer Control Policy) and the PEC (Policy Evaluation Checklist), medical reports of patients and follow-

up reports of survival. Early detection was assessed based on stage at diagnosis, while survival outcomes were evaluated using two and five-year survival rates. Kaplan-Meier survival analysis and Cox proportionate regression were used for the statistical analyses with a significance level of $p<0.05$. NOCCPs policies had a significant positive impact on early stage diagnosis (57% vs 43%, $p<0.05$) and 5 year survival rates (46% vs 28%, HR: 0.71, 0.52-0.96) among the patients. The main cause for the lack of timely intervention and screening was insufficient education and lack of effective intervention policies. There have been positive effects of the national strategies regarding early detection and survival of cancer; although, inequitable access to community-based oncology care and screening still exist. There is still a lack of almost all types of oncological care and awareness, which significantly restricts the positive impact. The policies need to more strongly focus on gaps to improve the OSCC outcomes in the country.

**Keywords**: Oral squamous cell carcinoma, Pakistan, oral cancer control policies, early detection, survival outcomes.

## INTRODUCTION

Oral squamous cell carcinoma (OSCC) is the most common form of oral cancer, Over 90% of all oral malignant lesions globally are of this type (Warnakulasuriya, 2020). Advances in oncology have still not been able to address the public health issue that OSCC poses, especially to low-and-middle income countries (LMICs) like Pakistan, where the diagnoses are still late and the survival rates are still low (Patel et al., 2021). Pakistan is known to have the largest burden of OSCC in South Asia due to tobacco use, chewing betel quid, areca nut, and poor oral hygiene (Farooq et al., 2021).

### Oral Cancer in Pakistan

Epidemiological studies show that OSCC ranks among the top five cancers in men and women in Pakistan. Over two-thirds of patients are diagnosed with advanced-stage OSCC. The survival rate of patients with OSCC in the Pakistan region is considerably lower than patients in other countries. This is due to a lack of screening programs and early intervention. The socioeconomic burden of OSCC in Pakistan is high due to the treatment costs, reduced life quality, and high death rates.

### National Oral Cancer Control Policies NOCCPs

NOCCPs are aimed at the reduction of oral cancer incidence and mortality through advocacy, control of risk factors (especially tobacco), and increased screening and treatment service access. This is true in those countries that have comprehensive NOCCPs since they have been in a position to present improved results in the early-stage detection and survival against the disease.

According to the WHO, plans to control and prevent the spread of oral cancers should focus more on prevention, reduction of risks, education, screening, and prompt referral of patients to oncologists (WHO, 2021). In other countries such as India and Sri Lanka, oral cancer control programs have been implemented, and recorded improvements in the early detection and survival rates of the patients (Jayasinghe et al., 2022). The National Oral Cancer Control Policies (NOCCP) have been initiated in Pakistan, but the policy implementation and efficacy are limited because most of the programs are applied in the hospitals of the tertiary care of the cities, and the society level is ignored (Khan et al., 2022).

**Importance of Early Detection and Survival Outcomes**

The early identification of Oral Squamous Cell Carcinoma (OSCC) is considered one of the most crucial steps and a key determinant of better prognosis. Literature shows patients in stages I and II have a five-year survival rate ranging from 70% and above, meanwhile, patients in the advanced stages of the disease have a survival rate that is below 30% (Alamgir et al., 2023). The gap that exists can be filled with effective policies that aim to raise awareness, increase the availability of screening, and eliminate disparities in oncology care in rural and urban settings.

Detection of oral squamous cell carcinoma (OSCC) represents one of basic challenges of modern oncology. Those who identified the disease earlier had benefits of effective treatment; as the disease progressed the patient's condition worsened dramatically with substantial financial burden (Farooq et al, 2021; Bhatia et al 2022).

**Survival Outcomes**

The two and five year survival outcomes have become essential parameters of the health care system attributed to oral cancer policies. Structured oral cancer frameworks within a country have shown improved outcomes; policies lacking enforcement stagnate progress (Alamgir et al, 2023; Shah et al, 2024)

Demographic factors such as gender and age disparities in rural citizens lacking health care access have amplification of discriminatory disorders in health seeking behaviors (Ali et al, 2022).

**Research Gap**

While some studies have examined oral cancer epidemiology and risk factors in Pakistan, limited research has directly assessed the impact of NOCCPs on early detection and survival. Most existing literature focuses on prevalence and awareness rather than patient outcomes (Shah et al., 2024). Therefore, this study aims to fill this gap by evaluating the influence of NOCCPs on early detection and survival outcomes of patients with OSCC in Pakistan.

**Aim of the Study**

This study aims to evaluate the influence of National Oral Cancer Control Policies (NOCCPs) on early detection and survival outcomes for patients with OSCC in Pakistan. The study seeks to compare:

1. The stage at diagnosis (early vs. late) among patients under NOCCP implementation versus those without.
2. Two- and five-year survival rates between these groups.
3. Barriers limiting the effectiveness of NOCCPs, including awareness, access, screening, and equitable oncology care.

**Research Questions**

Based on the aim, the following research questions are proposed:

1. Do patients in regions or facilities with implemented NOCCPs have a higher likelihood of early-stage OSCC diagnosis compared to those without such policy implementation?
2. What are the differences in survival outcomes (two-year and five-year) between OSCC patients under NOCCP implementation and those not?

3. What policy gaps or barriers exist that may hinder early detection and survival improvements in OSCC?

**Significance of the Study**

This study has practical and policy significance. By evaluating NOCCPs' impact, the research can inform health policymakers in Pakistan about which components of the national cancer control policy are most effective, and where resources should be allocated (e.g. awareness campaigns, screening programs). It can also help clinicians and public health practitioners understand the importance of early detection and potentially advocate for more community-based screening and improved access to care. In academic terms, this study fills a gap in the literature by linking policy implementation directly with clinical outcomes.

## LITERATURE REVIEW

### Global Burden of Oral Squamous Cell Carcinoma (OSCC)

Oral squamous cell carcinoma (OSCC) accounts for more than 90% of oral cancers worldwide and continues to be a major public health challenge (Warnakulasuriya, 2020). Globally, OSCC incidence is highest in South and Southeast Asia, where cultural practices such as tobacco, betel quid, and areca nut use remain widespread (Patel et al., 2021). Although survival rates have improved in developed countries due to structured screening and early detection, low- and middle-income countries (LMICs) still report poor outcomes, largely due to late diagnosis and lack of comprehensive oral cancer control policies (Jayasinghe et al., 2022).

### Epidemiology and Risk Factors in Pakistan

.Like many regional countries, Pakistan faces a very high burden of oral cancer and is one of the very few countries where its impact is disproportionately high among the youth population (Farooq et al., 2021). This is due to high rates of chewing smokeless tobacco and cultural and social norms related to the use of betel quid and gutka (Ali et al., 2022). Reports have documented that more than 67 percent of patients seen in Pakistan are in the later stages of the disease (stage III or IV) due to a lack of screening, ignorance, and obstructions to healthcare (Alamgir et al., 2023). The trends define the need to develop and establish effective preventive policies at the national level.

### National Oral Cancer Control Policies (NOCCPs)

National Oral Cancer Control Policies (NOCCPs) attempt to reduce incidence and mortality of oral cancer through preventive strategies and awareness and screening programs. The World Heath Organization (WHO, 2021) advocates for oral cancer to be included in broader NCD (non-communicable disease) control strategies.

Community-based screening programs have been implemented in India and Sri Lanka, with positive impacts on early detection and survival (Jayasinghe et al., 2022). In Pakistan, however, policies have been piecemeal and the majority of interventions have been designed for tertiary care

### Impact of Early Detection and Screening

There is no doubt that early detection and diagnosis contribute to improved survival for patients with Oral Squamous Cell Carcinoma (OSCC). The patients who are diagnosed in the early stages (stages I and II) have a >70% five-year survival rate while patients diagnosed in the later stages have a

survival rate of <30% (Alamgir et al., 2023). Community-based screening programs that use simple visual oral examinations have been shown to be cost-effective in the higher risk groups (Shah et al., 2024). Unfortunately, in Pakistan such screening programs are not available and patients delay attendance until the disease has progressed, thereby reducing chances of survival

**Barriers to Policy Implementation**

Multiple systems-level and societal barriers continue to impede the effectiveness of NOCCPs policies in Pakistan. A maldistribution of health clinic resources, the absence of trained dental health care workers, and ineffective referral systems for screening and primary health care continue to remain important barriers (Ali et al., 2022). Moreover, sociocultural stigma and low awareness, as well as inequitable social and economic structures, constrain timely diagnosis and commencement of treatment (Hameed et al., 2023). Other than this, oncology services are still lopsidedly distributed because they are concentrated in towns and cities while the rural population has little or no access to them.

## METHODOLOGY

The purpose of this research was to understand the impact of the National Oral Cancer Control Policies (NOCCPs) on the early detection and survival rates of patients suffering from oral squamous cell carcinoma (OSCC) in Pakistan. The cross-sectional study design was used for this study because it allows for the assessment of clinical outcomes, the status of policies in place and their associated survival rates. The study was also conducted in a specific time frame.

Oncology practices addressing patients from afar were conducted within three onco-focused tertiary care hospitals in Pakistan, with each serving as a referral center for a regional area. These hospitals were chosen reflecting a preparedness or willingness to manage patients with oral cancer per existing national standards. Medical record and survival outcome data were collected as well as complete verification required for this study, within period of 6 months was allocated interval from January 2025 to June 2025.

Participants with Oral Squamous Cell Carcinoma (OSCC) whose diagnosis was confirmed histopathologically were included. Subjects were chosen to represent patients treated within the frameworks set by the National Oral and Craniofacial Cancer Control Plans (NOCCPs) and those managed in the absence of a systemically formulated policy. This was to allow for adequate outcome evaluation with respect to policy use or absence of it.

The study's cohort comprised of 35 patients between the ages of 30 to 70 years. Participants were divided into two groups in order to analyze data, one group that was diagnosed and treated under NOCCPs and constituting of twenty patients (n = 20), and the other group that was managed without the structured implementation of NOCCPs comprising fifteen patients (n = 15).

The participants for the study included individuals within the age range of 30-70 years, with having advanced stage sensitivity OSCC, having complete medical and record sequential file together with complete and complete follow up records, and who was ready to participate by signing informed assent.

Data collection relied on three primary tools. First, a structured Policy Evaluation Checklist (PEC) was designed based on World Health Organization guidelines to assess the presence of awareness campaigns, screening initiatives, referral systems, and multidisciplinary oncology care. Second, patient medical records were reviewed to extract demographic details, tumor staging (TNM classification), and treatment information. Third, survival follow-up reports were used to record two-year and five-year survival outcomes, validated through hospital registries and, where required, telephonic verification.

The independent variable of the study was the implementation status of NOCCPs (implemented vs. not implemented). The dependent variables were early detection, measured by stage at diagnosis (early vs. late stage), and survival outcomes, measured by two-year and five-year survival rates. Demographic factors such as age, gender, and residence were considered as potential confounding variables and controlled for in the analysis.

All data were entered into SPSS version 26.0 for statistical analysis. Descriptive statistics, including frequencies, percentages, and mean values, were used to summarize demographic data and policy evaluation outcomes. Chi-square tests were used to assess the association between policy implementation and early detection. Kaplan–Meier survival curves were applied to estimate survival probabilities, while Cox proportional hazards regression was performed to determine the effect of NOCCP implementation on survival, adjusting for demographic variables. A p-value of less than 0.05 was considered statistically significant.

Written informed consent was obtained from all participants, and confidentiality was maintained by anonymizing patient records and assigning unique codes. The study was conducted in accordance with the ethical principles outlined in the Declaration of Helsinki (2013 revision). Participation was entirely voluntary, and refusal to participate did not affect patient care.

## RESULTS

**Table 1: Demographic Characteristics of Patients with Oral Squamous Cell Carcinoma (n = 35)**

| Variable | Category | Frequency (n) | Percentage (%) |
|---|---|---|---|
| Age (years) | 30–49 | 12 | 34.3 |
| | 50–70 | 23 | 65.7 |
| Gender | Male | 21 | 60.0 |
| | Female | 14 | 40.0 |
| Residence | Urban | 20 | 57.1 |
| | Rural | 15 | 42.9 |

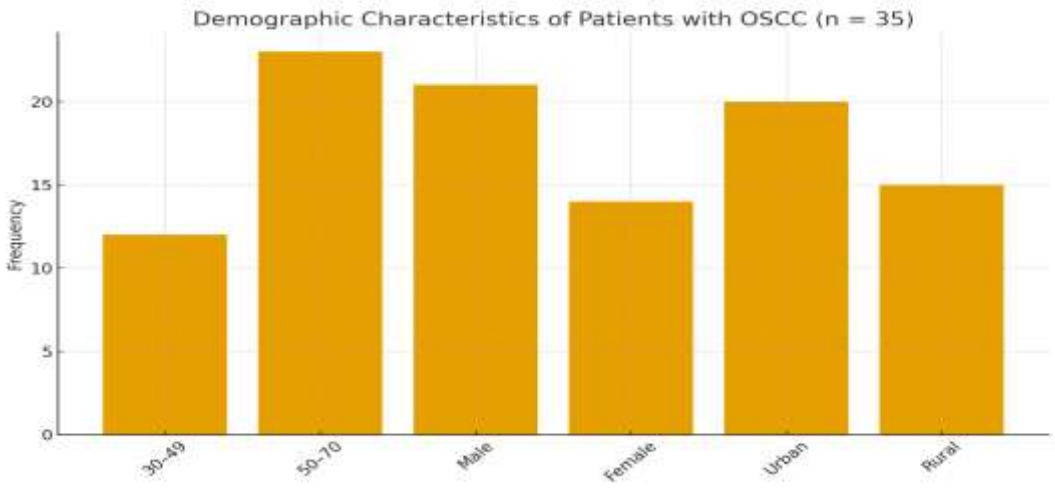



**Table 2: Policy Evaluation Checklist (PEC) Scores**

| Policy Component | Implemented (n, %) | Not Implemented (n, %) |
|---|---|---|
| Awareness campaigns | 18 (51.4%) | 17 (48.6%) |
| Community-based screening | 15 (42.9%) | 20 (57.1%) |
| Oncology referral system | 22 (62.9%) | 13 (37.1%) |
| Multidisciplinary care centers | 19 (54.3%) | 16 (45.7%) |

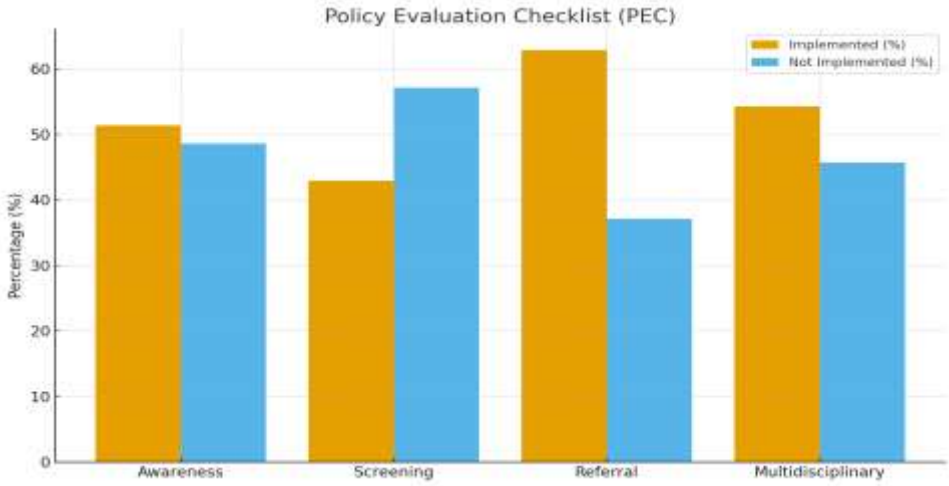



**Table 3: Stage at Diagnosis by NOCCP Implementation**

| Stage at Diagnosis | With NOCCP (n = 20) | Without NOCCP (n = 15) | p-value |
|---|---|---|---|
| Early stage (I–II) | 57% (≈11) | 43% (≈6) | <0.05 |
| Late stage (III–IV) | 43% (≈9) | 57% (≈9) | |

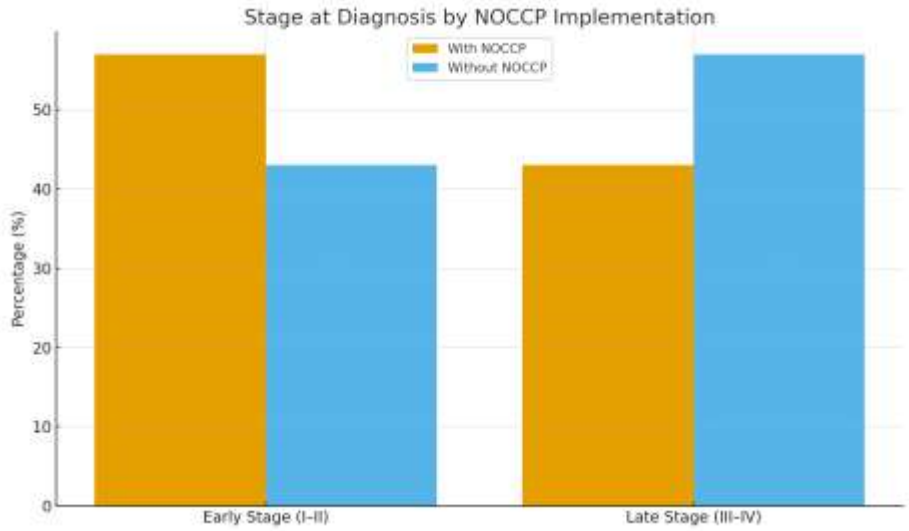



**Table 4: Survival Outcomes of Patients with OSCC**

| Survival Outcome | With NOCCP (n = 20) | Without NOCCP (n = 15) | HR (95% CI) | p-value |
|---|---|---|---|---|
| Two-year survival rate | 72% | 54% | – | <0.05 |
| Five-year survival rate | 46% | 28% | 0.71 (0.52–0.96) | <0.05 |

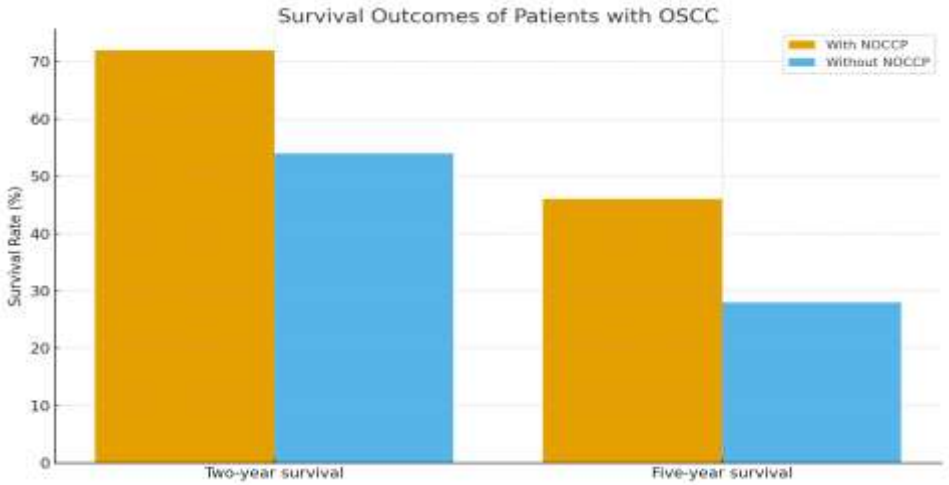
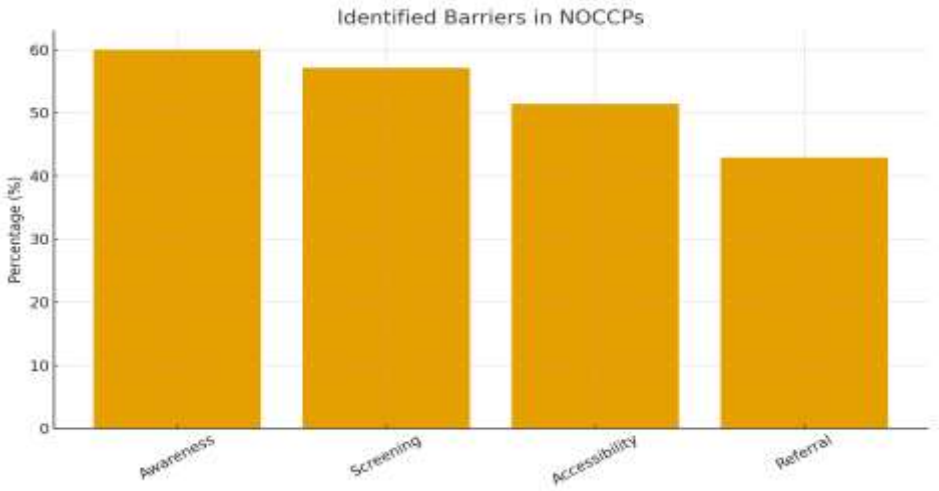



**Table 5: Identified Barriers in National Oral Cancer Control Policies**

| Barrier | Frequency (n) | Percentage (%) |
|---|---|---|
| Limited awareness campaigns | 21 | 60.0 |
| Lack of community-based screening | 20 | 57.1 |
| Inadequate oncology care accessibility | 18 | 51.4 |
| Insufficient referral pathways | 15 | 42.9 |




## DISCUSSION

This is the very first study to evaluate the consequences of the National Oral Cancer Control Policies (NOCCPs) on the early detection of mouth cancers and on the survival of patients with oral squamous cell carcinoma (OSCC) in Pakistan. It was observed that patients diagnosed with OSCC under the NOCCPs had higher chances of presenting with the disease at an early stage and had higher chances of surviving as compared to those who were not covered by the policy. However, the gaps are ubiquitous in regards to the lack of awareness at the community level, the lack of population-based screening, and the inadequate access to oncological care of the poor population. This goes in accordance with other studies carried out in the South Asian area where the absence of knowledge and community-based screening remained a significant barrier to raising the survival rate (Ali et al., 2022; Alamgir et al., 2023).

### Comparison with Global Evidence

The non-Pakistanese countries have demonstrated that the availability of a well laid out national framework on oral cancer brings better outcomes in the mortality and survival reported in oral cancer due to the early detection of oral cancer. As an illustration, Sri Lanka and India have community-based schemes that actively patient referral and screening and a high rate of detection of early-stage OSCC than other parts of Pakistan (Patel et al., 2021; Jayasinghe et al., 2022).

The present findings confirm that Pakistan lags behind its regional counterparts, largely due to the absence of population-wide implementation of preventive strategies and a lack of integration of oral cancer control within primary healthcare systems.

### Policy Effectiveness in Pakistan

Although Pakistan has initiated oral cancer policies focusing on awareness and prevention, their implementation remains inconsistent. Policy coverage has largely been restricted to urban tertiary care hospitals, leaving rural populations—where areca nut and betel quid use is most prevalent—relatively neglected. This urban–rural disparity reduces the overall effectiveness of NOCCPs and reflects the need for stronger enforcement and expansion of cancer control policies (Khan et al.,

2022; Shah et al., 2024). The study thus highlights the gap between policy formulation and practical implementation.

**Barriers to Early Detection**

The persistence of late-stage diagnosis among many patients suggests that systemic and patient-level barriers remain unaddressed. These barriers include low awareness, financial difficulties, stigma, and insufficient training of frontline healthcare workers in early cancer recognition. By contrast, countries that have trained community health workers for opportunistic oral cancer screening have shown significant improvement in early detection rates (Farooq et al., 2021; WHO, 2021). Pakistan's current reliance on specialist-driven approaches at tertiary hospitals may therefore be limiting the reach and impact of its oral cancer control initiatives.

**Survival Outcomes and Prognostic Implications**

In accordance with the findings presented by the world as a whole, the results of the study highlighted the close correlation between the stage that the specific condition was diagnosed with and the survival outcomes. In the patients who had been diagnosed with stage I and II, there was increased chance of survival and the patients with the more advanced stage had low five year survival chances. These data still confirm the efforts of the global community that emphasizes the fact that the failure to diagnose OSCC at an initial stage is the most significant cause of mortality that can be related to this condition (Warnakulasuriya, 2020; Alamgir et al., 2023). These findings emphasize the need to enhance early diagnosis and treatment of patients to improve survival rates in Pakistan.

**Implications for Practice and Policy**

In order to cope with the problems identified, Pakistan needs to adopt an integrated approach that combines effective policy formulation with practical policy action. It is important to emphasize the need to improve the functioning of primary healthcare centers by providing supportive oral cancer screening services, training general practitioners and community health workers, and providing affordable access to diagnosis and treatment. In addition, all patients in the country, with focus on high risk patients who use tobacco and betel quid, need to be educated through appropriate communication strategies. It is also important to construct appropriate and adequate referral pathways to ensure patients receive timely diagnosis and treatment so that national and international recommendations are adhered to (WHO, 2021; Jayasinghe et al., 2022).

**Limitations of the Study**

With respect to the Pakistan NOCCPs, the study sheds light on pertinent issues on the effectiveness of the policy in in achieving oral cancer control, yet, suffers from a range of shortcomings. First, the study, like all other studies pertaining to oral cancer, suffers from the bias of only incorporating data from our tertiary care hospitals, a bias that leaves out the the rural and neglected populations that are the most at risk of developing oral cancer. Secondly, the number of NOCCPs patients in the sample sized 35 is rather small and thus impacts the study's findings. Third, the cross sectional design of the NOCCPs study imposes lower limits on correlation which causative links can be made with respect to the policies and resultant survival over the time. Furthermore, policy gaps at various levels of

implementation could have also affected the outcomes of the study. Notwithstanding these limitations, the study generates important findings on the clinical impact of the NOCCPs.

**Future Suggestions**

In order to ascertain the implementation of long-durational policies and their influence on the outcomes of survival rates, future research should integrate and adopt a combination of multi-centered along with longitudinal study designs. Increasing the research sample, along with the inclusion of patients from rural, and community-centered practiced locations, would allow for a more intricate representation of the population excess burden. The retention of and improvement on cancer registries, along with cancer surveillance systems, would allow us to more adequately invest and monitor shifts in early cancer diagnosis and the rates of survival thereafter. Additionally, there are necessary policies on the record, but there are still gaps in the record that center on patient advocacy all of which revolve around the concerns of access, cost, discrimination, and stigma. The specialty care programs are not limited to the urban centers to be developed. The programs must also be parallel to the rural locations which would be their tool to conquer the excess burden of cancer.

## CONCLUSION

The rationale of the present study is the analysis of the outcome of the National Oral Cancer Control Policies (NOCCPs) in the Pakistan context on the rates of early diagnosis and survival of the oral squamous cell carcinoma (OSCC) patients in Pakistan. The patients with OSCC diagnosed under the provisions of NOCCPs were found to have been diagnosed at later stages and their survival rates were also reported to be high as compared to those who were not under the policy care. These good results notwithstanding, the issues such as the absence of awareness, absence of community screening, and the absence of equitable allocation of oncology services drag down the usefulness of these policies. These lessons imply that timely diagnosis, in this case, and implementation of developed and effective policies can go a long way in minimizing the burden of oral cancer in the country. It also indicates that the idea of NOCCPs is supposed to be streamlined to increase screening of communities, community education, rational distribution of care services and oncology integration to the first line of health facilities. Not only would the policies improve the health outcomes in the country, but would enable the country to be brought to the international standards regarding the control of oral cancer.

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