

The effects of an educational intervention on the early management of oral lesions in the uMgungundlovu District in KwaZulu-Natal

TA Muslim, S Naidoo

Tufayl Muslim, BDentTher, PGDHE, PGDLaw, MSc, Academic Development Officer: Dentistry, University of KwaZulu-Natal
Sudeshni Naidoo, BDS(Lon), LDSRCS(Eng), MDPH(Lon), DDPHRCs(Eng), MChD (Comm Dent), PhD(SU), DSc
Senior Professor and Principal Specialist

Department of Community Dentistry, Faculty of Dentistry, University of the Western Cape, Tygerberg, Cape Town

E-mail: suenaidoo@uwc.ac.za

Keywords: HIV, oral lesions, primary health care nurses, practices, knowledge

Oral lesions that are associated with human immunodeficiency virus (HIV) infection are often the first clinical signs of an underlying infection. This study aimed to test primary healthcare (PHC) nurses' knowledge and practices before and after an educational intervention on the detection and management of oral diseases, and in particular, those associated with HIV infection. A cross-sectional study was conducted among PHC nurses who were employed in a range of clinical settings within the public sector (hospitals, clinics and nurse training colleges) in urban and rural areas in the uMgungundlovu Health District of KwaZulu-Natal. The convenience sample comprised 121 nurses who completed a self-administered questionnaire, undertook pre-education testing, were provided with educational material and underwent post-education testing. The obtained results showed that most nurses (90%) had received little or no undergraduate or postgraduate training in the examination, diagnosis or treatment of oral lesions. Analysis of the pre-education test results that pertained to the identification of a number of oral lesions revealed a mean correct response rate of 38.5%. Post-education results revealed a statistically significant (p -value $< .0001$) (24%) improvement to 62.4%. The provision of a basic education intervention can have significant effects on knowledge, treatment and referral patterns, and can lead to early diagnosis, treatment and improved quality of life for persons who are infected with HIV.

Peer reviewed. (Submitted: 2012-01-27. Accepted: 2012-07-09.) © SAJEI

South Afr J Epidemiol Infect 2013;28(1):55-60

Introduction

The mouth is often the first site of disease¹ and oral lesions the first features of human immunodeficiency virus (HIV)/acquired immune deficiency syndrome disease (AIDS).²⁻⁸ HIV infection presents a panorama of mucocutaneous manifestations^{1,3} that include fungal, viral and bacterial infections, as well as periodontal diseases, of which any one may be the presenting feature of the disease^{5,8} and may be a predictor of HIV infection in undiagnosed patients. Oral lesions that are identified during examination of asymptomatic at-risk individuals may be consistent with underlying immunosuppression.^{3,6,7} The presence of oral candidiasis, oral hairy leukoplakia (OHL) and Kaposi's sarcoma strongly suggests HIV infection.^{6,9-12}

A recent study in Lesotho reported that 74.4% of patients who were HIV-infected presented with one or more oral mucosal lesions, of which only 30.4% were symptomatic.¹³ Another study in Cape Town, found that 6% of the patients who first complained of oral symptoms were subsequently found to be diagnosed as HIV-positive.³ Oral lesions may cause pain and discomfort and restrict food intake, leading to malnutrition

and immunosuppression.^{14,15} Oral health and nutrition have a synergistic relationship.¹⁵ The magnitude and impact of HIV-associated oral disease on dietary intake and nutritional status is well known.¹⁵ This has serious implications for patients' health, since if left untreated, these oral manifestations can affect the quality of the patient's life. The early diagnosis of oral lesions that are associated with HIV infection, together with early referral and initiation of medical treatment, may lead to prolonged life and improved quality of life for HIV-infected persons.¹⁵ HIV/AIDS treatments have shown considerable success in terms of longevity. The net result of improved HIV/AIDS treatments is reflected in improved quality-adjusted life year and health-related quality of life indices.¹⁵⁻¹⁷

With the implementation of the District Health System (National Health Act of 2004) in South Africa, patients are being dissuaded from seeking medical treatment at hospitals for minor ailments and non-lifethreatening conditions to local primary healthcare (PHC) clinics where they are managed by PHC nurses.^{16,17} Nursing educators and PHC nurses can play a pivotal role in the early identification, diagnosis and referral of patients who present for treatment as often they

are the patient's first point of contact with the health system. These nurses are ideally positioned to identify persons who are potentially infected with HIV through a simple visual assessment of the mouth. They can refer patients for voluntary counselling and testing (VCT). VCT is an ideal entry point into the health system and has been described as a cornerstone in the prevention of HIV infection. As well as offering care and support services to patients who are identified as being HIV-positive following testing,¹⁸ VCT is a key component of national AIDS prevention programmes in sub-Saharan Africa.¹⁷⁻¹⁹

If patients are diagnosed early in the onset of HIV infection and receive appropriate medical interventions, they could experience a significantly improved quality of life.^{20,21} The nurse must be able to recognise the key features of oral disease and know when to refer patients for a medical and dental opinion.²² Therefore, it is important to integrate oral health assessment and care into the practices of all medical and paramedical healthcare providers.²²

In clinical practice, oral health and hygiene is often not a priority and there may be a lack of oral health assessment protocols.²³ Mouth care is considered to be one of the most basic of nursing activities. However, during the initial patient examination, often scant attention is paid to the oral cavity unless the chief complaint relates to that area. Thus, an excellent opportunity to address the problem is missed.^{23,24} The need for the provision of oral health promotion and education information should be linked to early treatment of patients who are HIV-infected. Nurses' knowledge of oral health problems is often limited²⁴ because of lack of oral health education at the pre-qualification stage. Studies have shown that nurses lack the necessary knowledge to provide oral care²⁵⁻²⁷ and oral care education²⁷ and so may be unable to undertake oral health promotion.

This study sought to assess nurses' knowledge and practices, and to demonstrate that an educational intervention could lead to theoretical knowledge improvement and lead to better practices and improved management of patients who are possibly HIV-infected. In 2010, South Africa had an estimated HIV prevalence rate of 15.4%.²⁰ In the same year, in the uMgungundlovu District, the HIV prevalence rate, as measured by antenatal clinic attendance reports, was 27.7%.²⁸ Geographically, uMgungundlovu is the largest district in the KwaZulu-Natal province. The population of just under one million is served by seven local area authorities through nine hospitals, 12 mobile clinics, 48 fixed clinics and four community health centres.²⁷

Method

A cross-sectional study was conducted among a convenience sample of 121 PHC nurses within the public sector (hospitals, clinics and training colleges) in urban and rural areas in the uMgungundlovu Health District. Ethical approval to carry out the study was obtained from the Senate Research Ethics Committee of the University of the Western Cape. Gatekeeper

permission was obtained from the uMgungundlovu Health District manager, the head of the KwaZulu-Natal College of Nursing and the chief medical officer of the uMgungundlovu (Msunduzi) Municipality. Informed consent was obtained from the respondents. Participants completed self-administered questionnaires, undertook pre-education testing, were provided with educational material (including a handbook),²⁹ and undertook post-education testing. Pre-education and post-education tests were constructed and administered by the researcher and consisted of the respondents being asked to identify oral lesions from 10 sets of photographs. Bias was reduced by administering the test anonymously. The respondents used their own unique codes and by sealing their answer sheets in the provided envelopes. These were only opened by the researcher at the end of the study. The study excluded student nurses and nursing assistants and was not limited to nurses who had undertaken specialised PHC nursing training.

Information that derived from the questionnaire included nurses' undergraduate and postgraduate training and experience, as well as their knowledge and awareness of oral lesions as predictors of HIV and their association with HIV/AIDS. Statistical analysis was carried out using the statistical software SAS[®] 2004 Version 9.1.1 (Cary, NC SAS Institute, USA). A p-value of < 0.05 was regarded as statistically significant. A simple correlation coefficient (Pearson's correlation coefficient) using the Z-test provided a correlation analysis of selected variables such as experience vs. knowledge. The test results were analysed using a linear model that included the effect of lesion type, and pre-education and post-education test results that defined the period of the evaluations and the interaction between them. Descriptive statistics were calculated and parametric statistics used to analyse the data.

Results

Study sample and profile

Two hundred and sixty-seven nurses at six institutions were approached to participate in the study. One hundred and twenty-one nurses participated (a response rate of 45%). The majority were female (88.4%). The mean age was 41.4 years with a standard deviation of ± 9.83 years. The qualification mix encompassed three nursing qualification levels: the two-year Enrolled Nurse Certificate (13.2%), the 3-4-year Diploma in Nursing (Registered Nurse) (69.4%) and the four-year Degree in Nursing (Professional Nurse) (17.4%). The participants had a mode of 15.5 years of experience as a PHC nurse and a mean of 22.75 years of nursing experience (standard deviation ± 6.32).

Primary healthcare nurses' knowledge, practices and training in oral conditions management and voluntary counselling and testing

The respondents ($n = 121$) reported differing exposure during their undergraduate training in the examination, diagnosis

and treatment of oral conditions. 65.3% reported that they had received a basic overview, 9.9% that they had received in-depth training and 24.8% that they had not received any training. Most (80%) were not trained in VCT, and of the 20% who did receive VCT training, only 10% indicated that this training included the diagnosis and management of oral conditions. More than two thirds (70.2%) of nurses reported that they encountered oral health problems often. Seventy per cent reported that they referred patients for general dental check-ups. Nearly all of them identified the need for an alternate cadre of oral healthcare worker, i.e. a community oral health information worker who could deliver oral health promotion messages to patients while being based in the PHC facility.

Figure 1 reflects nurses' examination practices that related to patients' mouths. Thirty-nine (32.2%) nurses indicated that they always examined patients' mouths. Sixty-five (53.7%) occasionally examined patients' mouths, while 17 (14.1%) acknowledged that they never examined patients' mouths. Of the 104 nurses who either always or occasionally examined patients' mouths, only 59 (57%) were comfortable doing so and 75 (72%) indicated that they would benefit from additional training when assessing the oral cavity. This indicates that additional training could lead to an increase in the number of nurses who examine patients' mouths.

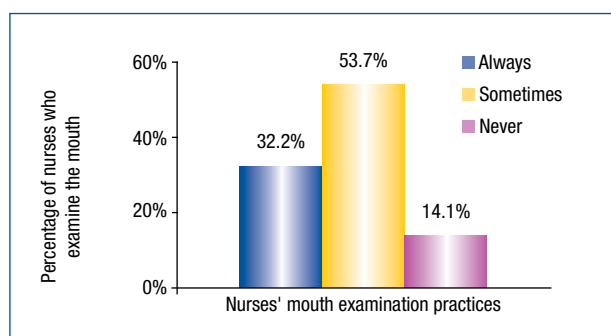


Figure 1: Nurses' mouth examination practices

Results of pre-education and post-education testing

The nurses participated in pre-education and post-education testing. For all of the variables (see Table I) except "dental caries", there was a significant improvement (p -value < 0.05) between the pre-education and post-education test results in the nurses' ability to correctly identify and recognise these conditions.

Correlation of certain variables, using a simple linear correlation coefficient (Pearson's correlation coefficient), was carried out using the Z-test. These correlations are cross-tabulated in Table II. A p -value of < 0.05 was regarded as statistically significant.

No correlation exists between any of the variables as the p -values are not statistically significant. These results reveal that the age, experience and qualifications of PHC nurses had no impact on their referral patterns, nor did a knowledge and awareness of HIV preindicative oral conditions have an impact on their referral patterns.

Discussion

Training in the diagnosis and treatment of oral conditions

In many instances, South African PHC nursing staff serve as substitutes for medical practitioners.^{29,30} It may be argued that they are expected to be competent in the assessment, diagnosis and treatment of patients with training input that is current and relevant. Demand for PHC services has increased because of ageing populations, rising patient expectations and reforms that have shifted care from hospitals to the community.^{29,30} Simultaneously, the supply of doctors is limited. There is increasing pressure to contain costs in these times of economic recession.^{16,31} Numerous studies have reported that nurses lack the necessary oral care knowledge^{24,25,28,31} and sufficient education to render appropriate oral care.^{32,33} These findings are supported by this study. Therefore, it is understandable that

Table I: Results of the pre-education and post-education testing conducted among nurses who participated in the study (n = 121)

Condition, disease or lesion	Pre-education test correct	Post-education test correct	% difference	chi-square	p-value
Oral candidiasis or oral thrush	87 (72%)	108 (89%)	17%	10.91	0.0010
Angular cheilitis	59 (48%)	95 (79%)	31%	22.06	< 0.0001
Parotid gland enlargement	54 (45%)	81 (67%)	23%	11.99	0.0005
Molluscum contagiosum	31 (26%)	81 (67%)	41%	38.88	< 0.0001
Oral hairy leukoplakia	50 (41%)	82 (68%)	27%	16.64	$< .0001$
Herpes simplex	42 (35%)	67 (55%)	20%	10.27	0.0013
Periodontitis	14 (12%)	43 (36%)	24%	17.70	< 0.0001
Kaposi's sarcoma	20 (17%)	48 (40%)	23%	15.25	< 0.0001
Aphthous ulcers	46 (38%)	71 (59%)	21%	10.19	0.0014
Dental caries	62 (51%)	77 (64%)	13%	3.78	0.0518
Mean correct responses (%)	46.5/121 (38.5%)	75.3/121 (62.4%)	24%		< 0.0001

Table II: Cross-tabulation of select variables to reflect the correlation between age, experience and qualifications, and primary healthcare nurses' practices, knowledge and referral patterns

Variable	Other variable	Z-test correlation	p-value
Age	Undergraduate training in examination of oral cavity	-0.03573	0.6972
	Training in VCT	-0.00172	0.9852
	Awareness of HIV preindicative oral conditions	-0.02721	0.8106
	Awareness of oral manifestations of HIV/AIDS	-0.12379	0.2709
	Referral of patients with oral lesions for VCT	-0.12379	0.2709
Experience as a PHC nurse	Training in VCT	-0.03573	0.6972
	Awareness of HIV preindicative oral conditions	0.04671	0.6788
	Awareness of oral manifestations of HIV/AIDS	0.15308	0.1697
	Referral of patients with oral lesions for VCT	-0.18033	0.2720
Qualification	Routine oral examination practices	-0.13863	0.1294
	Treatment and referral of patients with HIV oral lesions to an oral healthcare worker	0.06998	0.1834
	Referral of patients for dental check-ups	-0.02530	0.7830

AIDS: acquired immune deficiency syndrome, HIV: human immunodeficiency virus, PHC: primary healthcare nurse, VCT: voluntary counselling and testing,

14% of the nurses did not undertake an examination of the oral cavity when conducting an overall examination of the patient. This study showed that a large number (85.3%) of the nurses had not received any education on how to render oral health care to patients since qualifying. The rest had not received any education in oral health care at all. There is a crucial lack of training of nursing practitioners in the examination, diagnosis and treatment of oral conditions, at both an undergraduate and postgraduate level. Arguably, this will have a detrimental effect on the holistic treatment of patients.

In countries with widespread HIV epidemics, such as South Africa, provider-initiated HIV testing and counselling are recommended to all patients who attend health facilities, regardless of whether they show signs or symptoms of underlying HIV infection, and regardless of their reason for visiting a health facility.³³ The clinical diagnosis of oral diseases that are strongly associated with HIV is relatively straightforward.^{34,35} Oral examination has gained greater importance as studies have shown that in more than 50% of cases, the first sign or symptom of underlying infection occurs in the mouth. Patients of unknown status who present with these lesions are ideal candidates for VCT.³² The ability to provide VCT should not be the exclusive domain of VCT practitioners, but should be an essential component in the armamentarium of every healthcare worker,¹⁴ including dental practitioners.¹⁸ Early detection of HIV infection improves prognosis and reduces transmission.²⁸ This study recommends that all patients, regardless of their chief complaint, have their mouths assessed for the presence of oral lesions that are associated with HIV infection.

Just over two thirds of the nurses only occasionally or never examined the mouth. This presents a missed opportunity to identify oral lesions that may be pathognomonic of HIV/AIDS infection in a country where the prevalence of HIV infection is known to be high. Eighty-seven per cent of the nurses

referred all cases with HIV/AIDS oral manifestations for VCT. This is encouraging as prevention of oral complications and the provision of oral care can avert life-threatening infections and lead to better health and quality of life outcomes for patients.^{21,24,25} With easily diagnosed conditions such as OHL, a simple visual assessment can confirm its presence.²⁴ OHL has been shown to be highly predictive of AIDS since 83% of patients with OHL develop AIDS within the next 31 months.³⁴

Human resources

Africa suffers from the world's most profound crisis in human resources for health. Thirty-six out of 57 African countries face healthcare worker shortages.³¹ It is estimated that in order to provide antiretroviral therapy in a resource-limited setting to 1 000 patients, the staffing requirements should be 1-2 medical doctors, 2-7 nurses, 1-3 pharmacy staff, two counsellors, a community outreach worker, a social worker, a part-time psychologist, a receptionist, a project manager and a data entry clerk.³¹ It can be inferred that if there was early diagnosis, treatment, further prevention of HIV infection and improved quality of life for persons who were HIV-infected, that considerable human resource cost-savings and reallocation of health human resources could be achieved. These economic and human resource reallocation benefits are especially relevant and important in KwaZulu-Natal (the province in which the uMgungundlovu District is situated). The costs and shortages of human health resources are compounded by human resource demands that are made by the emergence of multidrug-resistant and extensively drug-resistant tuberculosis³¹ and the explosion of other chronic diseases.

Oral health education

Nurses' knowledge of oral health is often limited³² because of the absence of education at the pre-qualification stage.²⁶ It is

imperative that nurses have adequate knowledge to be able to provide oral health education and advice to patients when carrying out holistic management of patients. The majority of nurses reported that they provided oral health care education without prompting. This is a positive sign that indicates that patients were receiving optimal health care. It is essential that nurses provide oral health care and advice to patients as good oral health is required in order to eat healthy foods that require chewing for the maintenance of an effective immune system and to regain weight that might have been lost during the course of the progression of the HIV disease.

Pre-education and post-education test results

The test results are significant, except in the case of dental caries, and show diverse responses to the identification of photographs that depicted a variety of oral conditions. The most commonly identified oral lesions in both tests were oral candidiasis, angular cheilitis and parotid gland enlargement, in keeping with results that were obtained in a similar study carried out in Lesotho.¹³ Following basic education, notable improvements were demonstrated in the identification rates of conditions that are highly predictive of HIV/AIDS (OHL, Kaposi's sarcoma and molluscum contagiosum). This clearly indicates that further continuous and sustained education and training in the identification, diagnosis and treatment of oral conditions could be highly beneficial to both nursing practitioners and patients. Such education should constitute a significant element of the curriculum design of basic and postgraduate nursing training courses. This education and training would be particularly beneficial to the nurses in the study who are confronted by a large number of undiagnosed patients who are infected with HIV on a daily basis.

Conclusion

This study sought to assess nurses' knowledge and practices and to prove that an educational intervention could lead to short-term theoretical knowledge improvement, better treatment and referral practices and the improved management of patients who are potentially infected with HIV. This study demonstrates that diagnosis by PHC workers might have an economic significance, such as lower treatment costs. The early identification of oral lesions that are strongly associated with HIV infection could result in the provision of early testing, diagnosis and treatment interventions and lead to an improved prognosis for patients who are HIV-infected. Other benefits include prolonged life and reduced pain and suffering from opportunistic diseases, early behavioural changes, a decrease in the HIV opportunistic disease burden and an improvement in the quality of life of individuals who are HIV-infected.^{21,24}

Recommendations

The need for improved education and training at a basic and postgraduate level in oral health and in the early identification, treatment and referral of oral manifestations is clearly

highlighted. The provision of a basic oral health education intervention produced statistically significant improvements in nurses' knowledge of the oral manifestations of HIV. Such education should be beneficial to all nurses in their holistic management of patients who present for treatment at PHC facilities. All patients should undergo an examination of the mouth as a matter of routine assessment when attending a PHC facility with any type of complaint, or when receiving treatment.

Conflict of interest

The authors declare no conflict of interest.

Declaration

No funding or grants were received in the development of this manuscript.

References

- Hodgson TA, Greenspan D, Greenspan JS. Oral lesions of HIV disease and HAART in industrialized countries. *Lancet*. 2006;657(9554):2811-2819.
- Shiboski CH, Patton LL, Webster-Cyraiye JY, et al. The Oral HIV/AIDS Research Alliance, Subcommittee of the AIDS Clinical Trial Group. Updated case definitions of oral disease endpoints. *J Oral Pathol Med*. 2009;38(6):481-488.
- Arendorf TM, Bredekamp B, Cloete CA, Sauer G. Oral manifestations of HIV infection in 600 South African patients. *J Oral Pathol Med*. 1998;27(4):176-179.
- Ferreira S, Noce C, Silva A Jnr, et al. Prevalence of oral manifestations of HIV infection in Rio de Janeiro, Brazil from 1988 to 2004. *AIDS Patient Care STDs*. 2007;21(10):724-731.
- Fauci AS, Clifford-Lane H. Human immunodeficiency virus (HIV) disease: AIDS and related disorders. In: Braunwald E, Hauser SL, Fauci AS, et al, editors. *Harrison's principles of internal medicine*. 15th ed. New York: McGraw-Hill, 2001; p. 852-912.
- Ageblusi GA, Wright AA. Oral lesions as indicators of HIV infection among routine dental patients in Lagos, Nigeria. *Oral Dis*. 2005;11(6):370-373.
- Greenspan D, Greenspan JS. Oral manifestations of HIV infection. *AIDS Clin Care*. 1997;9(4):29-33.
- Boyle S. Assessing mouth care. *Nurs Times* 1992;88(15):44-46.
- Greenspan JS, Greenspan D. The epidemiology of the oral lesions of HIV infection in the developed world. *Oral Dis*. 2002;8 Suppl 2:34-39.
- Shiboski CH, Cohen M, Weber KB, et al. Factors associated with use of dental services among HIV-infected and high-risk uninfected women. *J Am Dent Assoc*. 2004;136(9):1242-1255.
- Klein RS, Harris CA, Small CB, et al. Diagnosis in high-risk patients: the initial manifestations of AIDS. *N Engl J Med*. 1984;311(6):354-358.
- Lewis H, Mistry M, Rudolph MJ, et al. Oral health practices of traditional healers in Zonkizizwe and Dube. *Journal Dental Research*. 2001;80(4):1363.
- Nasir EF. Determination of oral health knowledge, attitudes and behaviour among nursing staff in Lesotho. Unpublished master's thesis. Tygerberg: University of the Western Cape; 2001.
- Moon HS, Jung JY, Horowitz AM, Paik DI. Korean dental hygienists' knowledge and their opinions about aetiology and prevention of dental caries. *Community Dent Oral Epidemiol*. 1998;26(5):296-302.
- Naidoo S, Myburgh N. Nutrition, oral health and the young child. *Matern Child Nutr*. 2007;3(4):312-321.
- Shetty K. Oral opportunistic infections in HIV-positive individuals: review and role of mucosal immunity. *AIDS Patient Care STDs*. 2004;18(8):443-456.
- Robberstad B, Olsen JA. The health-related quality of life of people living with HIV/AIDS in sub-Saharan Africa. *Journal of Cost Eff Resour Alloc*. 2010;3(21):737-742.
- Irungu TK, Varkey P, Cha S, Patterson JM. HIV VCT in Nakuru, Kenya: findings from a community survey. *HIV Med*. 2008;9(2):111-117.
- Wringe A, Isingo R, Urassa M. Uptake of HIV VCT services in rural Tanzania: implications for effective HIV prevention and equitable access to treatment. *Trop Med Int Health*. 2008;13(3):319-327.
- AIDS epidemic update. UNAIDS [homepage on the Internet]. c2010. Available from: www.data.unaids.org/pub/Report/2009/jc1700_epi_update_2009_en.pdf
- Sheiham A. Oral health, general health and quality of life. *Bull World Health Organ*. 2005;83(9):644-645.
- Shetty K. Oral opportunistic infections in HIV-positive individuals: review and role of mucosal immunity. *AIDS Patient Care STDs*. 2004;18(8):443-456.

23. Ssali A, Butler LM, Kabatesi D, et al. Traditional healers for HIV/AIDS prevention and family planning, Kiboga District, Uganda: evaluation of a program to improve practices. *AIDS Behav.* 2005;9(4):485-493.
24. Yengopal V, Naidoo S. Do oral lesions associated with HIV affect quality of life? *Oral Surg Oral Med Oral Pathol Oral Radiol Endod.* 2008;106(1):66-73.
25. Chidzonga MM. HIV/AIDS orofacial lesions in 156 Zimbabwean patients at referral oral and maxillofacial surgical clinics. *Oral Dis.* 2003;9(6):317-322.
26. Longhurst RM. A cross-sectional study of oral healthcare instructions given to nurses during their basic training. *Br Dent J.* 1998;184(9):453-457.
27. White R. Nurse assessment of oral health: a review of practice and education. *Br J Nurs.* 2000;9(5):260-266.
28. Operational plan for comprehensive HIV and AIDS care, management and treatment, South Africa. Department of Health [homepage on the Internet]. c2010. Available from: www.info.gov.za/otherdocs/2003/aidsoperationalplan.pdf
29. Naidoo S. Common oral lesions in children and adults with HIV/AIDS: visual reference for health care workers. Stellenbosch: Department of Community Dentistry, University of Stellenbosch; 2001.
30. Laurant M, Reeves D, Hermens R, et al. Substitution of doctors by nurses in primary care. [Cochrane review]. In: *The Cochrane Library*, Issue 4, 2004. Oxford: Update Software.
31. Hirschhorn LR, Ogudan L, Fullem A, et al. Estimating health workforce needs for antiretroviral therapy in resource-limited settings. *Hum Resour Health.* 2006;4:1.
32. Adams R. Qualified nurses lack adequate knowledge related to oral health, resulting in inadequate oral care of patients on medical wards. *Journal Adv Nurs.* 1996;24(3):552-560.
33. Orr N, Patient D. Stigma beliefs cause behaviour. *AIDS Bull.* 2004;13(1):10-14.
34. Cleary SM, Slade GD, McIntyre MI. Claims on health care: a decision-making framework for equity, with application to treatment for HIV/AIDS in South Africa. *Health Policy Plan.* 2011;26(6):467-470.
35. Robinson PG, Challacombe SJ, Sheiham A. Oral examination: a screening tool for HIV infection. *Sex Transm Infect.* 1998;74(5):345-348.