Wolters Kluwer

Medknow

Journal of Patient Safety & Infection Control

Official Journal of **Hospital Infection Society–India**

Volume 7 | Issue 3 | September-December 2019

ISSN 2214-207X

Available online at www.jpsiconline.com

Original Article

Care and maintenance of ocular diagnostic drugs in eye care facilities in 'Ghana'

Samuel Kyei, Michael Quayson-Dadzie[1], Peter Nsiah[2]

Department of Optometry and Vision Science, School of Allied Health Sciences, College of Health and Allied Science, University of Cape Coast, Cape Coast, [1]Eye Clinic, Police Hospital, Accra, Ghana, [2]Optinova Eye Care, Harare, Zimbabwe

Abstract

Background: Diagnostic ophthalmic drugs are very essential in every eye care setting. Contamination of these drugs has a deleterious effect on the eye as they can trigger or worsen a pre-existing ocular disease.

Purpose: The aim of this study was to evaluate how ocular diagnostic drugs are cared for and maintained by eye care practitioners.

Methods: A total of 140 eye care practitioners across the ten regions of Ghana responded and returned the questionnaires. It contained questions on how frequently they checked date of expiry, first date of opening the diagnostic drug bottle, how long the opened diagnostic drug bottles were kept in use before discarding them, adherence to hand hygiene practices prior to instillation of drops among others.

Some 20 of the 60 eye care facilities (from which the participants were drawn) were purposively selected and observed for their adherence to care and maintenance practices with regarding the use of diagnostic agents in a blinded fashion (the practitioners did not know they were they were being observed).

Results: It was realised that most of the practitioners did not adhere strictly to basic care and maintenance (as indicated in the drug insert and the British Pharmaceutical Codex) practices necessary to ensure optimal safety of patients.

Conclusion: Care and maintenance practices were not always adhered to by most of the eye care practitioners despite its implication for patients' safety.

Keywords: Care, eye care practitioners, maintenance, ocular diagnostic drugs

Address for correspondence: Dr. Samuel Kyei, Department of Optometry and Vision Science, School of Allied Health Sciences, College of Health and Allied Science, University of Cape Coast, Cape Coast, PMB, Ghana.
E-mail: skyei@ucc.edu.gh

Received: 13-11-2019 **Revised:** 23-03-2020 **Accepted:** 15-04-2020 **Published:** 18-08-2020

INTRODUCTION

Ocular diagnostic drugs are very essential in execution of some ocular examinations and evaluating certain ocular complaints commonly reported to eye care practitioners.[1] The commonly used ocular diagnostic drugs in basic eye examinations are fluorescein dye, local anaesthetics, miotic and mydriatic/cycloplegic drugs.

Fluorescein dye is indispensable in the detection of corneal disorders such as aberrations, ulcers, contact lens

Access this article online	
Quick Response Code:	Website: www.jpsiconline.com
	DOI: 10.4103/jpsic.jpsic_27_19

How to cite this article: Kyei S, Quayson-Dadzie M, Nsiah P. Care and maintenance of ocular diagnostic drugs in eye care facilities in 'Ghana'. J Patient Saf Infect Control 2019;7:72-7.

overwear syndrome and dry eye syndrome. However, fluorescein ophthalmic solutions have been found to harbour bacteria, possibly due to inherent practices relating to care and maintenance complexities.[2,3]

Local anaesthetics such as proparacaine, benoxinate and tetracaine used in rendering the cornea insensitive are useful in examinations involving surface manipulations such as removal of corneal or conjunctival foreign bodies, tonometry or administering a subconjunctival injection.[2] Since these get into direct contact with compromised cornea, they should be sterile in order to avoid any infections.[4,5]

Mydriatics and/or cycloplegics are useful during cycloplegic refractions and dilated fundus examination. Recent studies have revealed an unacceptable level of contamination of these agents with a potential threat to patients' safety.[6,7]

Possible causes of contaminations could be as a result of poor hygiene on the part of the clinicians or from improper care and maintenance of these drugs. These contaminations may also be due to the fact that most of the diagnostic drugs used in these parts of the world are in multi-use forms.[8,9]

Kyei *et al*.[3] did not only find unacceptably high levels of contamination but detected that the microorganisms were resistant to most of the commercially available antimicrobial medications posing a high risk of severe infection to both the practitioners and patients.[10] The sterility of multi-use eye drops has also been found to be compromised with increased duration of use.[11] However, these studies did not probe sufficiently the causes of these contaminations, especially aspects relating to care and maintenance of these agents in the consulting rooms hence this study.

METHODS

The study was carried out across the then ten regions of Ghana. A cross-sectional survey was employed in this study as this design allowed for the gathering of information from the clinicians in the eye care facilities regarding the care and maintenance of the ocular diagnostic drugs through the use of questionnaires and on-site observation.

This study was carried out across selected 'major' eye care facilities in Ghana. These major eye care facilities were those that had the full complement of staff whose routines require the use of these drugs.

A frame of the eye care facilities in Ghana was drawn from the eye care secretariat, and the major eye facilities were listed and proportionately assigned per region according to the density of facilities. A total of 60 eye care facilities were selected, five facilities from each region except for Greater Accra and Ashanti Regions where 10 were selected due to the density of major eye care facilities in these regions. Some 140 participants out of 180 eye care staff from these selected facilities answered and returned the questionnaire. The questionnaire had two main sections: a section on demographics and another section on care and maintenance practices. The respondents were required to indicate which of the care and maintenance practices they 'always, often, sometimes, rarely and never' performed.

The on-site observations were made by the principal investigator to observe and record the care and maintenance practices relating to diagnostic drugs by the practitioners in real time. This was done by observing and noting the practitioners' adherence to basic care and maintenance practices in the performance of their routines with diagnostic drugs. Observations included how they handled the drugs, hand hygiene practices, where they stored the drugs as well as how they instilled the diagnostic drugs among others.

Ethical consideration

The research was approved by the Research and Ethics Review Board of the University of Cape Coast, (ID: UCCIRB/CHAS/2018/54). The study conformed to the Declaration of Helsinki on the use of human subjects for research.

RESULTS

Demographic characteristics of participants

A total number of 140 eye care practitioners participated in the study. Among the 140 participants, 73 (52.1%) were females and 67 (47.9%) were males. Their ages ranged from 31 to 56 years, with a mean age of 34.48 ± 6.65 (standard deviation [SD]). The modal age was 35 years, and the analysis showed that participants within the age bracket of 25–32 years were 66 (47.1%) and those 33 years and older were 74 (52.9%). Out of the 140 participants, 13 (9.3%) were ophthalmologists, 62 (44.3%) were optometrists and 65 (46.4%) were ophthalmic nurses. Their years of practice ranged from 1 to 20 years, with a mean of 6.45 ± SD: 3.886. Chi-square showed no significant association between participants' demographics and care and maintenance practices of ocular diagnostic drugs ($P > 0.05$).

The care and maintenance of ocular diagnostic drugs in the clinics

Out of the 140 practitioners, checking for expiry dates on drugs was always done by 31 (22.1%). Checking and noting

of the 1st day of opening of bottles to elicit the duration of use was practiced always by 4 (2.9%) of the participants. Checking for leakages of bottles was always done by 27 (19.3%)of them. Among the participants, 37.1% of them always sterilised or washed their hands before opening bottles. Replacing leaked or expired drugs was always done by 30 (21.4%) of them. Placing of cover of bottles over sterile area (hands included) before instilling drop was performed always by 51.4% of the participants. Some 89 (63.6%) of the participants indicated they always ensured the dropper tips did not get into contact with the patients' eye lids or lashes. Another 40.7% indicated they always adhered to storing the bottles in their storage containers and not on their consulting room tables during patients' examination. Furthermore, 5% of the participants always discarded drugs after use on patients with severe infections.

In addition, 82 (58.6%) of the participants always ensured that bottles were properly closed after instillation and 32 (22.9%) always stored the drugs under appropriate stated conditions in leaflet and pharmaceutical codex. Moreover, cleaning of spillages on bottles after the day's work if there was any was done always by 23.6% of the participants [Figures 1-3].

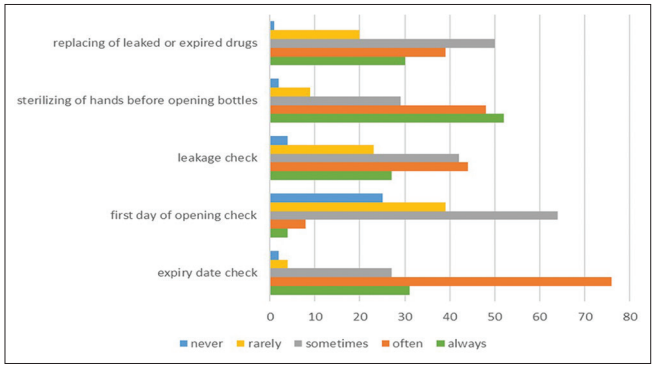

Figure 1: A bar graph showing responses on how participants cared for and maintained drugs before use

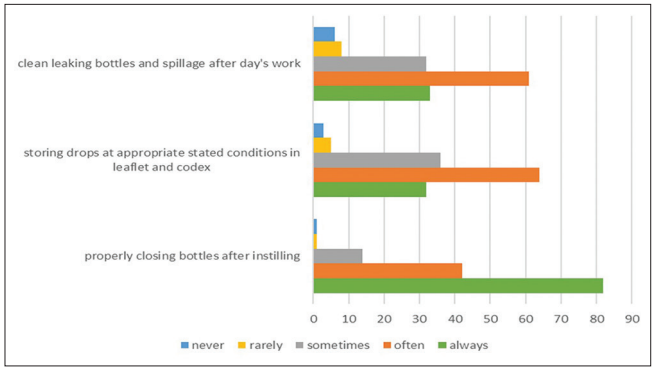

Figure 3: A bar graph showing participants responses on how they cared for and maintained the drugs after use

Possible contributors to contaminations

On visit to some eye care facilities, certain observations were made to find if practitioners adhered to care and maintenance practices that reduce the risk of contamination. In all, 20 eye care facilities were involved: 8 Ghana Health Service (GHS) facilities, 2 Christian Hospital Association of Ghana, (CHAG) facilities, 4 Teaching Hospital and 6 private eye care facilities. The observation made is summarised in Table 1.

Practitioners' adherence to standard practices as stipulated in the British Pharmaceutical Codex

Out of the 140 participants, only 1 (0.7%) always compared the information on the drug leaflet and label about the drug with that of the British Pharmaceutical Codex to evaluate whether they are similar or not and 64 (45.7%) often stored the drugs under appropriate conditions as stated in the pharmaceutical codex [Figure 4].

Furthermore, among the participants, 64 (45.7%) each used the drugs from 15 to 21 days and from 22 to 28 days. However, none of them used the drugs for only a day or for more than 28 days.

DISCUSSION

The demographic parameters indicate the respondents

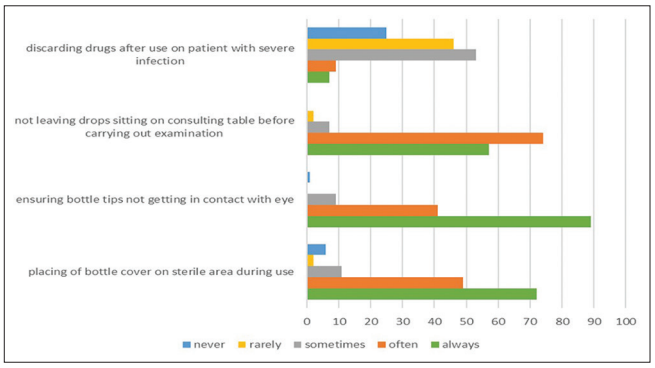

Figure 2: A bar graph showing responses of participants on how they cared for and maintained drugs during use

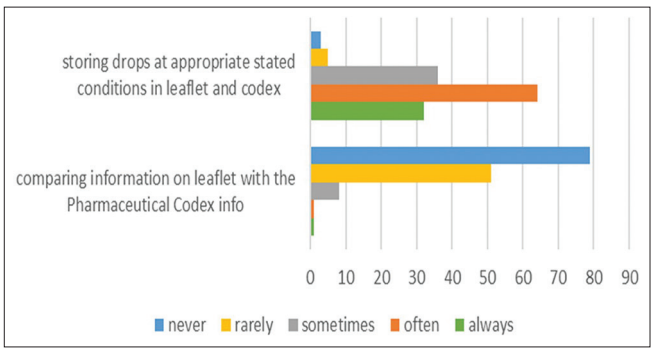

Figure 4: A bar graph showing how frequent participants adhered to the pharmaceutical codex practices

Table 1: Certain observations made at the selected eye care facilities

Observational themes	Various categories of eye care facility			
	GHS (8 facilities)	Private (6 facilities)	CHAG (2 facilities)	THOSP (4 facilities)
Clinical setting	Two of the facilities were located in rural areas whereas the rest were in urban areas	Three of the facilities were located in rural areas whereas the rest were in urban areas	Both facilities were in urban areas	All four facilities were located in urban areas
	All the facilities had a clean environment both outside and inside the consulting rooms	All the facilities had a clean environment both outside and inside the consulting rooms	All the facilities had a clean environment both outside and inside the consulting rooms	All the facilities had a clean environment both outside and inside the consulting rooms
	All the facilities had a nicely arranged consulting tables with hand sanitisers available	All the facilities had a nicely arranged consulting tables with hand sanitisers available	All the facilities had a nicely arranged consulting tables with hand sanitisers available	All the facilities had a nicely arranged consulting tables with hand sanitisers available
Nature of storage materials	All the facilities except for four had refrigerators for storing some eye drops	Only one facility had refrigerator for storing some eye drops	None of the facilities had refrigerators for storing some eye drops	Only two of the facilities had refrigerators for storing some eye drops
	Of these four, none monitored or measured the refrigerators temperatures	No monitoring of refrigerator temperature was done	None of the facilities had an alternative backup for refrigerator	None monitored or measured the refrigerator temperature
	None of the facilities had an alternative backup for refrigerator	None of the facilities had an alternative backup for refrigerator		Only one of the facilities had an alternative backup power to power the refrigerator in case of a power outage
	Six of the facilities used kidney dishes with no cover while two used round storage bowls with covers	All the facilities used round storage bowls with covers	One of the facilities used kidney dishes with no cover while the other used round storage bowls with covers	Two of the facilities used kidney dishes with no cover while two used round storage bowls with covers
Nature of other materials kept with drugs	Only one facility stored only the diagnostic drugs separately. The other facilities stored the drugs, cotton and cotton swabs together	All the facilities stored the drugs, cotton and cotton swabs together	All the facilities stored the drugs, cotton and cotton swabs together	Only one facility stored only the diagnostic drugs separately. The other facilities stored the drugs, cotton and cotton swabs together
	All materials stored with the drugs were clean	All materials stored with the drugs were clean	All materials stored with the drugs were clean	All materials stored with the drugs were clean
Practitioners' practices	At four of the facilities, the practitioners performed hand rub after every consultation	At all the facilities, the practitioners performed hand rub after every consultation	At all of the facilities, the practitioners performed hand rub after every consultation	At four of the facilities, the practitioners performed hand rub after every consultation
	None of the practitioners at all of the facilities checked the bottle labels for expiry dates	Practitioners at only one of the six facilities checked the bottle labels for expiry dates	None of the practitioners at all of the facilities checked the bottle labels for expiry dates	Practitioners at only two of the facilities checked the bottle labels for expiry dates
	The practitioners at all the facilities left the bottles on the tables and went on to carry out examination before storing the drug	The practitioners at only one the facilities left the bottles on the tables and went on to carry out examination before storing the drug	None of the practitioners at all the facilities left the bottles on the tables and went on to carry out examination before storing the drug	None of the practitioners at all the facilities left the bottles on the tables and went on to carry out examination before storing the drug
	None of the practitioners at all the facilities sterilised their hand before opening bottles	None of the practitioners at all the facilities sterilised their hand before opening bottles	None of the practitioners at all the facilities sterilised their hand before opening bottles	None of the practitioners at all the facilities sterilised their hand before opening bottles

GHS: 'Ghana' Health Service, CHAG: Christian Health Association of 'Ghana',THOSP: Teaching Hospital

included the key frontline eye care staff in their active working life. It included responses from both genders, with an average work experience of 6 years. The background of the study participants provides a fair assessment of the care and maintenance practices of eye care practitioners regarding ocular diagnostic drugs in eye care facilities in Ghana. In order to significantly reduce the rate of contamination of these drugs, these practices must be performed always by eye care practitioners, but this was not the case in all situations.

The expiry date depicts the safe period of use for eye drops, which is obviously affected by the environment, the frequency and the technique of use. Once opened, the shelf life of eye drops are not determined by the decomposition of the active drug but by the risk of microbial contamination. The continuous use of the medications beyond their date of expiry may not only alter the bioavailability but put patients at high risk of contracting infections. It is, therefore, a good practice to check for expiry dates and not use drugs after these specified dates.[12]

Oculovisual complication resulting from contaminated extemporaneously made ophthalmic solutions has been reported and conjunctivitis and keratitis of infectious origin are among the three most common ocular infectious conditions in Sub-Saharan Africa.[13-16] The causative organisms of these ocular infections include *Staphylococcus aureus*, *Chlamydia trachomatis*, *Staphylococcus albus*,

Neisseria gonorrhoeae, *Haemophilus influenzae*, *Escherichia coli, Streptococcus pneumoniae*, *Pseudomonas aeruginosa* and filamentous fungi that contaminate ophthalmic solutions.[17,18] The bacteria cultured from ocular tissues are similar to those found on the skin and in the upper respiratory tract. It is possible that the skin of the face is an important source of contamination to the eye. The nose and hands are also potential sources of contamination to the eye mainly due to the proximity of the nose to the eye and hand–eye coordination, respectively. Similarly, the eyes, lids, lashes, conjunctiva, adnexa and hands are all potential sources of contamination for ophthalmic eye drops.[9] *Pseudomonas* species are normally found in soils, water and plants. Resistant strains of these bacteria have been found to be the common contaminants of ophthalmic solutions in clinical setting.[4,6,11,19] Indeed, there have been case reports of severe microbial keratitis as a result of contaminated ocular medications.[20] It is imperative, therefore, that contact of droppers of topical ophthalmic medications with ocular tissues be avoided as much as possible. The observance of proper care and maintenance procedures has a great potential to decrease the tendency for such contaminations. Sterilising hands before opening of bottles and ensuring that the dropper tip does not get into any sort of contact with the patients' skin and eyes are some of the ways of drastically reducing the rate contamination of these eye drops.[21]

Other recommendations suggested to help reduce contamination of opened eye drop containers, include refrigerated storage, recapping the bottles after each use, marking the date when bottles are first opened and discarding containers after they are contaminated by inadvertently touching a patient's lids or lashes. Using new solution bottles is highly recommended as the safest way to go when working with patients with compromised corneas. Discarding of solutions used on patients with contagious anterior segment disease is also highly encouraged.[22,23] In the present study, only 2.9% of the practitioners always marked the 1st day of opening of bottles and only 5% of them always discarded bottles after use on patients with severe infections. These results are alarming as negligence on part of practitioners to always ensure these practices increases the risk of contamination and compromises patients' safety. Storage of drugs under appropriate conditions has also been recommended because this also contributes greatly to reduce the rate of contamination of the drugs.[22] It has been asserted that storing some of the drugs in refrigerator is key in reducing the rate of contamination. In the present study, results revealed that only a small percentage of practitioners [Figure 3] stored the drugs under appropriate stated conditions, while most of the facilities had no refrigerators for storing such drugs.

All of the facilities visited had a clean environment in and otside of the consulting rooms which is good for infection control. However, it was observed that in most of the facilities, the diagnostic drugs were stored with other materials such as cotton and cotton swabs. Although these materials may be clean, it increases the risk of cross-contamination. These materials may easily trap microbes because of their nature and may end up as a source of contaminations. Majority of the practitioners left the drugs on the consulting desks or examination desks and went on with the examination of patients before storing the drugs. This is considered as a poor practice because these drugs left sitting on the desks maybe contaminated with indoor microbes in the surrounding air.

Evidence from the study shows that 22.1% of the practitioners who answered the questionnaire always checked expiry dates on the drugs. However, among the 20 facilities where on-site observations were made, practitioners at only three facilities checked expiry dates before drug usage. A similar scenario was encountered where the results from the questionnaire revealed that 37.1% of the practitioners always observed hand hygiene before opening of bottles, but during observation at the facilities, none of them actually did that. This clearly shows the gap between theory and real practice situation.

Majority of the practitioners used the drugs for 12–28 days before discarding. The efficacy of the drugs opened for 7 months has been observed to remain efficacious as a freshly opened eye drops and a low rate of contamination within the period in a controlled clinical setting.[24] It has, however, been stipulated in the British Pharmaceutical Codex that these drugs should be used for not more than a day. Most of the practitioners in this study never compared the information of the drugs on the leaflet to that of the British Pharmaceutical Codex. Information such as the actual colour of the drugs, their melting and boiling points, storage temperature and duration of use should be checked out in the codex since such factors as discolouration and precipitates may indicate possible contamination of these drugs.

CONCLUSION

It can be concluded that the non-adherence to basic care and maintenance practices by eye care practitioners is a major risk for the observed height of contamination of diagnostic eye drops in eye care facilities in Ghana, and it poses a serious concern for patient safety.

Financial support and sponsorship
Nil.

Conflicts of interest

There are no conflicts of interest.

REFERENCES

1. Salmon J, Kanski J, Bowling B. Clinical Ophthalmology – A Systematic Approach. 9th ed. New York, USA: Elsevier; 2019.
2. Meyer D. Essential topical ocular diagnostic drugs for the family practitioner. SA Fam Pract 2004;46:16-8.
3. Kyei S, France D, Asiedu K. Microbial contamination of multiple-use bottles of fluorescein ophthalmic solution. Clin Exp Optom 2018;102:30-4.
4. Kyei S, Appiah E, Ayerakwa AE. Topical ocular anesthetics harbour clinically important microbes. JNOA 2019;21:8-15.
5. Stevens JD, Matheson MM. Survey of the contamination of eyedrops of hospital inpatients and recommendations for the changing of current practice in eyedrop dispensing. Br J Ophthalmol 1992;76:36-8.
6. Kyei S, Appiah E, Ayerakwa EA, Antwi CB, Asiedu K. Microbial safety implications of in-use topical diagnostic ophthalmic medications in eye clinics in Ghana. J Optom 2019;12:263-71.
7. Akiba M, Yoshida L, Akiba J. Microbial contamination of ophthalmic solutions in examination rooms. J Clin Ophthalmol 1996;50:411-4.
8. Geyer O, Bottone EJ, Podos SM, Schumer RA, Asbell PA. Microbial contamination of medications used to treat glaucoma. Br J Ophthalmol 1995;79:376-9.
9. Brudieu E, Duc DL, Masella JJ, Croize J, Valence B, Meylan I, *et al*. Bacterial contamination of multi-dose ocular solutions. A prospective study at the Grenoble Teaching Hospital. Pathol Biol (Paris) 1999;47:1065-70.
10. Fazeli MR, Nejad HB, Mehrgan H. Microbial contamination of preserved ophthalmic drops in outpatient departments: Possibility of an extended period of use. DARU J Pharmaceut Sci 2004;12:151-5.
11. Nentwich MM, Kollmann KH, Meshack J, Ilako DR, Schaller UC. Microbial contamination of multi-use ophthalmic solutions in Kenya. Br J Ophthalmol 2007;91:1265-8.
12. Dawson M. Expiry dates. Aust Prescr 1994;17:46-8.
13. Jeglum EL, Rosenberg SB, Benson WE. Preparation of intravitreal drug doses. Ophthalmic Surg 1981;12:355-9.
14. Whitcher JP, Srinivasan M, Upadhyay MP. Corneal blindness: A global perspective. Bull World Health Organ 2001;79:214-21.
15. Whitcher JP, Srinivasan M, Upadhyay MP. Prevention of corneal ulceration in the developing world. Int Ophthalmol Clin 2002;42:71-7.
16. Upadhyay MP, Srinivasan M, Whitcher JP. Microbial keratitis in the developing world: Does prevention work? Int Ophthalmol Clin 2007;47:17-25.
17. Locather RD, Seegal BC. The bacterial flora of the healthy eye. In: Microbiology of the Eye. St. Louis, MO: C.V. Mosby; 1972. p. 13-23.
18. Leck AK, Thomas PA, Hagan M, Kaliamurthy J, Ackuaku E, John M, *et al*. Aetiology of suppurative corneal ulcers in Ghana and south India, and epidemiology of fungal keratitis. Br J Ophthalmol 2002;86:1211-5.
19. Abbott RL, Abrams MA. Bacterial corneal ulcers. Duanes Clin Ophthalmol 1995;18:1-24.
20. Schein OD, Wasson PJ, Boruchoff SA, Kenyon KR. Microbial keratitis associated with contaminated ocular medications. Am J Ophthalmol 1988;105:361-5.
21. Aslund B, Olson OT, Sandell E. Studies on in-use microbial contamination of eye drops. Acta Pharm Suec 1978;15:389-94.
22. Clark PJ, Ong B, Stanley CB. Contamination of diagnostic ophthalmic solutions in primary eye care settings. Mil Med 1997;162:501-6.
23. Jokl DH, Wormser GP, Nichols NS, Montecalvo MA, Karmen CL. Bacterial contamination of ophthalmic solutions used in an extended care facility. Br J Ophthalmol 2007;91:1308-10.
24. Hanssens JM, Quintana-Giraldo C, Jacques S, El-Zoghbi N, Lampasona V, Langevin C, *et al*. Shelf life and efficacy of diagnostic eye drops. Optom Vis Sci 2018;95:947-52.