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ORIGINAL RESEARCH

Disinfection of Stethoscope and Non-Infrared Thermometer: Practices of Physicians in Ethiopia in the Era of COVID-19

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Background: Stethoscopes and non-infrared thermometers are the customary medical equipment used by the physicians on a daily basis, among various patients. With the rise of potential infections in the healthcare facilities and the transmission nature of the current COVID-19 pandemic, consistent and correct disinfections of these devices after each use should not be pardoned. This study, therefore, aimed to assess the level of stethoscope and non-infrared thermometer disinfection practices among physicians involved in direct patient contact during the COVID-19 pandemic.

Methods: A web-based cross-sectional survey was conducted among physicians working in Ethiopia to assess their practice of stethoscope and non-infrared thermometer disinfection. The online survey was circulated using an anonymous and self-reporting questionnaire via Google form with a consent form appended to it. The developed Google form link was shared with physicians through their email addresses and social media pages. A descriptive summary was computed and presented by tables and figures. Multivariable logistic regression model was used to identify factors associated stethoscope and non-infrared thermometer after every use.

Results: The proportion of stethoscope and non-infrared thermometer disinfections after every use was 13.9% (95% CI: 10.9–17.6) and 20.4% (95% CI: 16.7–24.5), respectively. Taking COVID-19 training (AOR: 2.52; 95% CI: 1.29–4.92) and the availability of stethoscope disinfection materials at the workplace (AOR: 3.03; 95% CI: 1.29–7.10) were significantly increased the odds of stethoscope disinfection after every use. The odds of stethoscope disinfection after every use was significantly decreased for those who reported the use of shared stethoscope (AOR: 0.34; 95% CI: 0.12–0.92).

Conclusion: Only a wee share of the respondents reported that they have disinfected their stethoscopes and non-infrared thermometers after every use – possibly jeopardizing both patients and clinicians safety, particularly during the COVID-19 pandemic.

Keywords: COVID-19, stethoscope, non-infrared thermometer, physicians, disinfection

Introduction

Stethoscopes and non-infrared thermometers are the most customary medical equipment wield by physicians on a daily basis, among various patients. With the rise of potential infections in the healthcare setups, disinfection of this medical equipment's should not be pardoned.[1–4] Spaulding proposed three categories (critical, semi-critical and non-critical) as the basis for selecting the prevention practice or process to use (eg, disinfection) when caring for patients. This classification has stood the test of time and still serves as a good basis for setting priorities for any

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infection prevention program.[5] The guidelines issued by the Center for Disease Control and Prevention (CDC) classify stethoscope and non-infrared thermometer as both non-critical and semi-critical medical devices – depending on the association it has with intact and non-intact skins.[6]

Stethoscopes and non-infrared thermometers are the commonly used medical equipment's to assess the health of patients. In practice, thermometer is used to assess the patients' body temperatures at least twice daily, and the common anatomical sites for measurements are oral, rectal, and axillary temperatures. It is well documented that this medical equipment's can harbor pathogenic microorganisms.[3,7–19] For instance, potential pathogens cultured from stethoscopes include *Pseudomonas aeruginosa*,[3,20] *Clostridium difficile*,[8] methicillin-resistant *Staphylococcus aureus (MRSA)*,[3,10–12] Vancomycin-resistant *enterococci*,[3,15,16] and *Acinetobacter baumannii*.[17] Huang et al reported that highly resistant bacteria, MRSA can potentially linger up to 9 days on stethoscopes.[21] Additionally, a review by Wolfensberger et al found that the diaphragms of the stethoscopes become colonized by bacteria quickly; acquiring more pathogens than any part of the doctors' hands except the fingertips.[22] In many low-income settings, acquiring patients' body temperatures using non-infrared thermometers are still predominant practices, and these devices travel among healthcare workers across the hospital. This entails that non-infrared thermometers are often exposed to body fluids, and travel without proper disinfection may advance the spread of cross-infection.[23–25] Rectal thermometers and reusable oral thermometers may possibly contact with body fluids, hence, wager contaminations, and therefore are unsuitable in this travel fast COVID-19 pandemic situation.

The novelty of COVID-19 pandemic – along with its uncertainties – makes it critical for health authorities to develop appropriate medical equipment and environmental disinfection regulations to keep the safety for both patients and clinicians in the countenance of the current COVID-19 pandemic.[26] The oft-cited Healthcare Infection Control Practices Advisory Committee (HICPAC) and Centers for Disease Control and Prevention (CDC) guidelines, advocating for non-critical medical equipment, such as stethoscopes, should be disinfected once daily or weekly.[6] The above standards might not be reflective on the current danger that a contaminated stethoscope may feasibly jeopardize patients' and physicians' safety – given the survival potential of coronavirus to thrive on different surfaces for an extended period of time.[27] It has been reported that SARS-CoV-2 can survive on steel and plastic surfaces for 72 hours or more.[28] The analyses of 22 studies also reveal that Severe Acute Respiratory Syndrome (SARS) coronavirus, Middle East Respiratory Syndrome (MERS) coronavirus, or endemic human coronaviruses (HCoV) persist on inanimate surfaces like metals, glasses or plastics for up to 9 days.[27] This poses concerns among patients contracting COVID-19 from contaminated stethoscopes and non-infrared thermometers, even if this has not been directly documented yet – at least the theoretical risk of COVID-19 is anticipated to be existing, and just as same as how one cleans his hands regularly, cleaning anything that contacts the patients would be potentially beneficial to their safety – as evidence suggests that human-to-human transmission of novel human coronavirus and were explicated with incubation times, and its spread via droplets, contaminated hands or objects (such as medical equipment's).[29]

In Ethiopia, physicians habitually carry their stethoscopes around their necks or in their pouches, and on occasions brings them to their homes, as well. While non-infrared thermometer kept in the wards; and in many occasions, they were used by multiple healthcare workers in different patients. These consequently augments the risk of transmission of infections from the hospitals to homes, and vice versa. Up to date, no specific guidelines have been available in the country solely on the disinfection of this medical equipment.[30] To our knowledge, there are no available studies on this aspect that determine the level of physician's stethoscopes and non-infrared thermometer disinfection at the national level. This study, therefore, describes the level of stethoscope and non-infrared thermometer disinfection practices among physicians and determine its associated factors during the COVID-19 pandemic. Further, an attempt was made to identify factors associated with stethoscope and non-infrared thermometer disinfection practices.

Methods

Study Design and Setting

A web-based cross-sectional online survey was conducted in Ethiopia from June 1 to 20, 2020 using Google form with a consent form appended to it. An internet-based survey was utilized due to the current COVID-19 pandemic and the government's strict regulations on face-to-face interviews

in Ethiopia. Ethiopia is located in the horn of Africa. It is one in the world with low medical doctor densities (0.769/10000 population), which is far below the minimum threshold density. The number of physicians increased to 8395 (in the year 2018) from a number of 1936 in 2003. Withal, there are 2528 specialist medical practitioners in Ethiopia.[31] The stethoscope and non-infrared thermometers are the customary tools that physicians use daily in the examination of patients in Ethiopia. Up to date, there is no regulation on the screening for multi-drug resistant bacteria and isolation practices for patients with MDROs. In addition, there is no specific guideline solely for reusable medical equipment processing. In many cases, alcohol-based solutions of iodine and 60–90% alcohols (ethyl or isopropyl) are the commonly used antiseptic solutions for disinfection of reusable medical equipment's including stethoscope and non-infrared thermometers, if they are not visibly soiled. In some cases, healthcare workers in Ethiopia used high-level disinfection (HLD) for non-infrared thermometers if they are contaminated by blood and body fluids.

Study Participants and Eligibility

All medical – doctors, specialist medical practitioners (surgeons, pediatricians, orthopedics, and internist), residents, and interns – who are able to access and utilize at least an Email, Facebook, LinkedIn, Telegram, and by Tweeter, who consented to participate, and those working in healthcare facilities were eligible in the survey. In addition, physicians practicing in Ethiopia at the of data collection were eligible and included in our study. With exceptions, physicians who do not engage in direct contact with patients and those who work in any administrative areas were excluded.

Sample Size Determination

The sample size was determined using Epi Info™ 7.1.1.14 statistical software (Center for Disease Control and Prevention, 2013) using single population proportion formula with the assumption of 95% confidence level, 5% precision, considering the proportion of healthcare workers who had safe stethoscope disinfection (disinfection after every use) was 39.7%,[2] and considering 25% non-response rate. The calculated sample size was (n=460).

Data Collection

An online survey was circulated using an anonymous and self-administered structured questionnaires via Google form with a consent form appended to it. The study participants who were willing to partake in the present survey and could access the Google form link obtain an informed consent sheet as a pre-requirement before proceeding to participate in the actual survey. Explicit information about the aim, scope, and eligibility criteria along with the link was purveyed. The call for participation was dispatched thru Emails, Messenger, Tweeter, LinkedIn, and Telegram. Upon receiving the Google form link, the participants were auto directed to the information about informed consent and their voluntariness to participate. The informed consent and questionnaire was protected by a secured login and privacy policies. The confidentiality of the study participants was safeguarded throughout the data collection.

Instrument

An internet-based, self-administered closed-ended questionnaire was utilized. The online data collection tools were created using the Google Forms provided by Google ™ and were constructed using the English language. The tools consisted of four sections, with a total of 25 questions. The first section was analogous to the participants' socio-demographic characteristics – including age, gender, professional titles, working department, service year, type of healthcare facility, place of residence, and history of COVID-19-related training. The second section comprised six questions relating to stethoscope disinfection practices during COVID-19 pandemic, such as "Have you ever disinfected your stethoscope?", "How often do you disinfect your stethoscope?", "Which stethoscope part you frequently disinfect?", and "Do you disinfect your stethoscope after examining your last patient?" along with questions about reasons for not disinfecting their stethoscopes. The third section of the questionnaire encompassed four questions pertaining to topics about non-infrared thermometer disinfections. Finally, the last section composed of five questions about the physicians' awareness related to stethoscope and non-infrared thermometer disinfections. The data collection tool was tested for internal consistency and the resulting Cronbach's Alpha value of 0.841 was obtained.

Study Variables and Measurements

Dependent Variables

In the physicians' self-report regarding stethoscope and non-infrared thermometer disinfection practices, respondents were posed to specify their usual practices (during COVID-19 pandemic) by uttering to them "How often do

you disinfect your stethoscope?". Physicians who claimed that they have disinfected their stethoscopes after every use/after contact with patients were coded as "1" and labeled as "disinfection after every use", if otherwise "0". Similarly, physicians who have claimed that they have disinfected non-infrared thermometers after every use were coded as "1", and zero, if otherwise.

Independent Variables

The independent variables include gender, age, years of service, type of healthcare facility, availability of reminders about medical equipment disinfections in their respective working units (eg, poster), availability of disinfectant solutions in their working units, and awareness on stethoscope and non-infrared thermometer disinfections.

Data Analysis

Completed questionnaires were extracted from Google Forms in Excel spreads and were exported to STATA version 14.0 for the analyses. Descriptive statistics were employed to illustrate the data. Multiple binary logistic regression models were used to assess factors associated with the outcome variables (stethoscope and non-infrared thermometer disinfection after every use). All the independent variables were tested for potential multicollinearities before placing them in the multivariable logistic regression models. The multicollinearity effects were assessed with a cut of off point of variation inflation factor (VIF) of greater than ten. Finally, significant variables were discerned based on the adjusted odds ratio (AOR) with 95% Confidence Intervals (CIs), and results were deemed significant if they reflect $p< 0.05$. To scrutinize the accuracy of the final formulated model, the Hosmer–Lemeshow test for the overall goodness of fit was used. Accordingly, the overall goodness of fit was 0.799 and 0.163 for stethoscope and non-infrared thermometer disinfection after every use models, respectively.

Ethical Approval and Considerations

The study was conducted according to the Declaration of Helsinki. Ethical approval was granted by the Institutional Review Board (IRB) at Madda Walabu University Goba Referral Hospital (Ref.NO 01/02/12594). The respondents penned the online questionnaires anonymously, voluntarily, and independently. The privacy and confidentiality of the study participants were also safeguarded throughout the data collection. An information letter was incorporated on the first page of every questionnaire which covered information about the study description, eligibility criteria, voluntary participation, and confidentiality. Also, the contact details of the investigators (name, phone number, email address, and their affiliations) for any inquiry were mounted on the top of the questionnaire. All participants were assumed to only proceed on the survey after reading the consent and acknowledging engagement. Accordingly, electronic informed consent was sought from the study participants as pre-requisites before they are able to annex the survey.

Results

Socio-Demographic Characteristics of the Study Participants

A total of 422 (422/460, response rate of 91.7%) physicians filled the online forms. The study participants composed– 62.8% medical doctors, 33.6% specialist medical practitioners, and 3.6% residents. Of these, 368 (87.20%) were males, 388 (91.94%) are currently working in governmental healthcare facilities, and 238 (56.40%) have less than 3 years of work experience. The mean age of the study participants was 30.13 (± 4.34) years (range: 22–55) and 228 (54.03%) were in the age group of 26–30 (Table 1).

Stethoscope Disinfection Practice

As seen in Table 2, the proportion of stethoscope disinfection after every use was 13.9% (95% CI: 10.9–17.6). A quarter of the physicians delineated that they never disinfected their stethoscopes. Fifty-four percent of them also reported spending only 20 or fewer seconds per stethoscope disinfection. The proportion of the physicians who reported about disinfecting the different parts of the stethoscope variegated as well (diaphragm, 39.51%; diaphragm, tubing, and earpieces, 28.40%; diaphragm and earpieces, 23.77%, earpieces, 7.72%; plastic tubing, 0.62%). Figure 1 exhibits the reported barriers to stethoscope disinfection. More than one-third (35.9%) of the physicians outlined that they cried out for access to stethoscope disinfectants when needed. Factors, such as forgetfulness (29.3%) and negligence (25.2%) were the frequently cited barriers to such. Nevertheless, 378 (89.57%) of respondents believed that stethoscopes necessitated to be disinfected after every use.

Factors Associated with Stethoscope Disinfection After Every Use

The odds ratios for a unit change on each covariate are delineated thru the binary logistic regression model in

Table 1 Socio-Demographic Characteristics of the Study Participants

Variables	Category	n	%
Profession	Medical doctor[a]	265	62.80
	Specialist medical practitioners[b]	142	33.65
	Resident physician	15	3.55
Gender	Male	368	87.20
	Female	54	12.80
Age	20–25	44	10.43
	26–30	228	54.03
	31–35	107	25.36
	36–40	35	8.29
	40+	8	1.90
Service year	1–3	238	56.40
	4–6	97	22.90
	7–9	37	8.77
	10+	50	11.85
Training on COVID-19	Yes	107	25.36
	No	315	74.64
Current working healthcare facility	Governmental	388	91.94
	Private	35	8.06
Department	Surgical	113	26.78
	Outpatient Department (OPD)	106	25.12
	Medical	47	11.14
	Gynecology and Obstetrics Department	37	8.77
	Operation Room (OR)	32	7.58
	Emergency (E-OPD)	31	7.35
	Pediatric Department	29	6.87
	COVID-19 Center	14	3.32
	Intensive Care Unit (ICU)	6	1.42
	Pathology Department	2	0.47
	Radiology Department	2	0.47
	Psychiatric Department	1	0.24
	Orthopedic Department	1	0.24
	Urology Department	1	0.24

Notes: [a]Including medical interns. [b]Surgeons, pediatricians, orthopedics, and internists.

Table 3. On fixed values of the other covariates, young physicians (age ≤ 30) nearly have three times more the odds of disinfection after every use than those of age greater than 30 (adjusted odds ratio [AOR], 2.52; 95% confidence interval [CI]: 1.10–5.78). Those who have had previous COVID-19 training preceding the survey had approximately three times favorable odds of disinfection after every use than those who have none (AOR: 2.52; 95% CI: 1.29–4.92). In addition, the availability of stethoscope disinfectants at the workplace significantly increased the odds of disinfection after every use (AOR: 3.03; 95% CI: 1.29–7.10). Amid the participants, disinfection after every use was significantly greater among resident physicians compared to those of general practitioners (AOR: 4.61; 95% CI: 1.29–16.52). On the contrary, the odds of disinfection after every use were significantly lesser among those who reported using a shared stethoscope (AOR: 0.34; 95% CI: 0.12–0.92).

Non-Infrared Thermometer Disinfection

Three hundred sixty-six respondents, 86.73% concurred that the non-infrared thermometers need to be disinfected after every use, to which 20.37% (95% CI: 16.-78–24.51) reported on disinfecting succeeding every use, and two fifths (40.53%) of physicians sadly reported that they have never disinfected any thermometers (Figure 2). In this study, 141 (33.41%) of the respondents reported that they have disinfected the non-infrared thermometers the last time they used them (Table 4).

Factors Associated with Non-Infrared Thermometer Disinfection After Every Use

In multivariable analyses, the odds of disinfection after every use were significantly higher among female physicians as compared to the males (AOR: 2.21; 95% CI: 1.21–4.36). Among the physicians, the odds of disinfection after every use were significantly higher in resident physicians (AOR: 7.10; 95% CI: 2.30–21.95) than those of general practitioners (Table 5).

Discussion

Upholding to the core values of nonmaleficence, physicians should be more diligent in providing safe domains for their patients. In this study, less than a fifth (13.9%) of the physicians disinfect their stethoscopes after every use, as needed; and a quarter (25.59%) of the respondents uttered that they have never disinfected their stethoscopes. This trend is similar to the antecedent studies done in different countries.[4,32–35] Evidence from the present study showed that the top three reasons for low disinfection practice among physicians in Ethiopia were lack of disinfectant in the work place, forgetfulness, and negligence. Overcoming these barriers through strengthening stethoscope disinfection culture

Table 2 Stethoscopes Disinfection Practices and Physicians Perceptions

Variables	Category	n	%
Stethoscope ownership	Yes/my own	340	80.57
	Yes/shared	82	19.43
How often do you disinfect your stethoscope ?♣	After every use	59	13.98
	Monthly	13	3.08
	Multiple times per day not after every use	26	6.16
	Multiple times per week but not every day	34	8.06
	Never disinfect	108	25.59
	Once a week or less often	42	9.95
	Once or twice a day	29	6.87
	Only after seeing high-risk patients	111	26.30
Disinfected stethoscope after the last patient?	Yes	121	28.67
	No	254	60.19
	I do not remember	47	11.14
Which part/s of the stethoscope do you frequently disinfect? (n=324)	Diaphragm	128	39.51
	Diaphragm, tubing, and earpieces	92	28.40
	Diaphragm and earpieces	77	23.77
	Earpieces	25	7.72
	Plastic tubing	2	0.62
Average duration of stethoscope disinfection (n=273), Mean (SD): 22.76 (± 21.46) Range: (2–120 Second)	<20	142	52.01
	≥ 20	131	47.99
Stethoscopes used on intact skin should be disinfected between each patient?	Yes	70	16.59
	No	352	83.41
As in the case of skin that is not intact (eg, trauma), stethoscopes should be disinfected before use on each patient?	Agree	411	97.39
	Disagree	3	0.71
	Not sure	8	1.90
Do stethoscopes need to be disinfected after every use?	Agree	378	89.57
	Disagree	18	4.27
	Not sure	26	6.16
Stethoscopes can contribute to the transmission of COVID-19 if not disinfected after every use?	Agree	384	91.00
	Disagree	1	0.24
	Not sure	37	8.77
Are there any reminders about medical equipment disinfection in your working unit? (eg poster)	Yes	70	16.59
	No	352	83.41
Do you have a disinfectant solution in your working unit ? (eg alcohol, alcohol-based sanitizer)	Yes	302	71.56
	No	120	28.44
How often are you involved in direct contact with a known case of COVID-19 patient? (n=411)	Daily	91	21.56
	Never/not yet	331	78.44

Note: ♣Practice of disinfection was specific time during the COVID-19 pandemic.

and infection prevention and patient safety initiatives is needed.

As the person-to-person transmission of novel coronavirus has been outlined in the hospital settings,[36] consistent and correct stethoscope disinfection should be observed after each use on patients.[37–41] Interestingly, technological advancements in the area of single-use aseptic diaphragm barriers provide

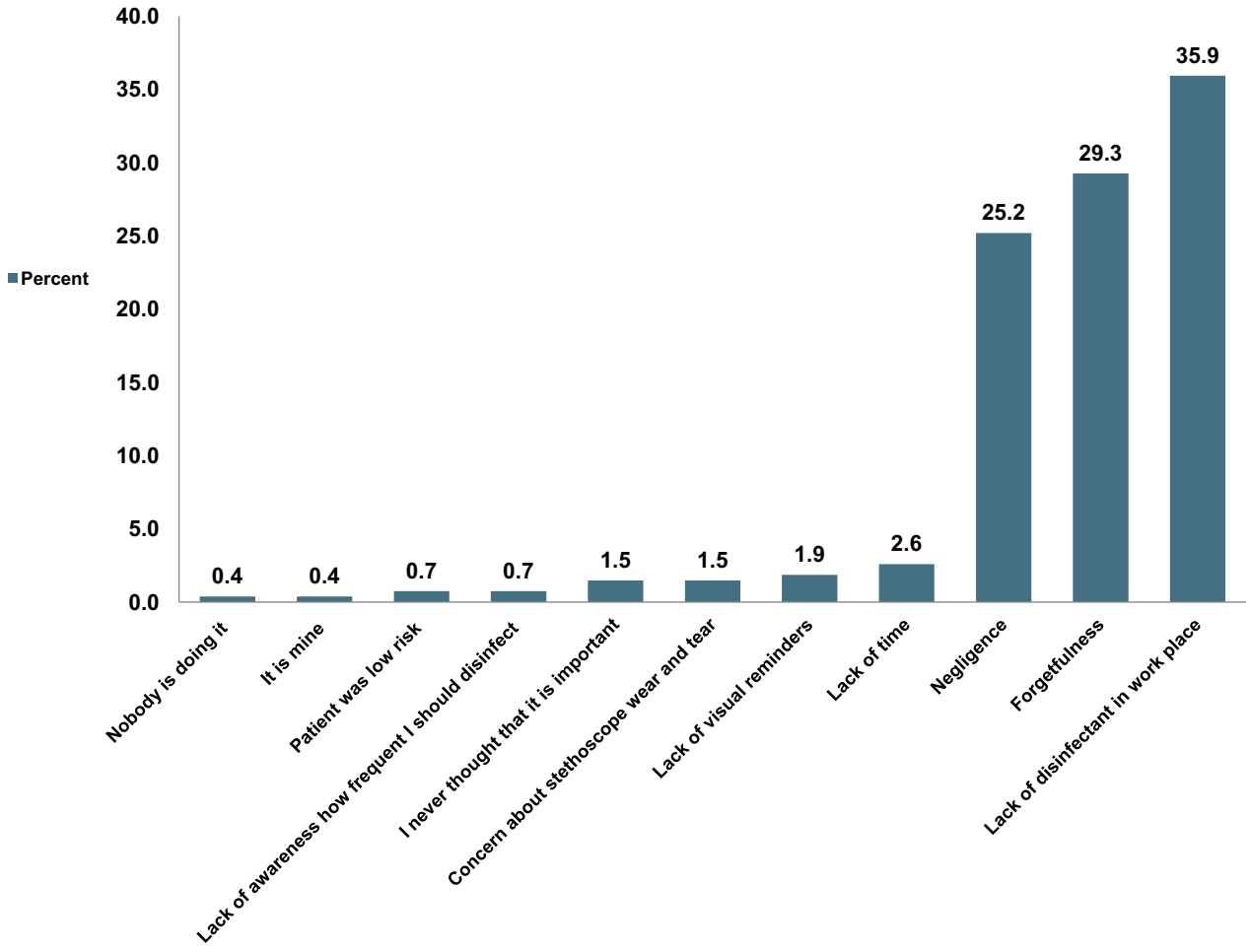

Figure 1 Reported obstacles to stethoscope disinfection among physicians during COVID-19 pandemic in Ethiopia.

a promising result for stethoscope hygiene.[42] Messina et al also propounded the utilization of pocket-held UV-LED devices which would be attached on the stethoscope diaphragms which will provide automatic disinfection of the stethoscope membranes.[43] On the downside, Alali et al connoted that despite the use of alcohol-based cleaner for stethoscope hygiene, physicians were ill-fated in eradicating all pathogenic microorganisms.[44]

Often times, dialogues surrounding medical disinfections tend to focus only on critical equipment used for invasive procedures, like gastrointestinal endoscopes. However, essential medical equipment is easily neglected – such as non-infrared thermometers – but these can be prime sources of hospital-acquired infections (HAIs).[45,46] In resource limited settings, including Ethiopia surveillance for body temperatures using non-contact digital thermometers are still shortly supplied, and the use of non-infrared thermometers are withal customary – often assumed sanitary, unless visibly soiled. In this study, only a fifth of the physicians disinfected thermometers after every use, and a significant number of them (40.53%) never disinfected their thermometers at all. This finding has paramount implications in combating COVID-19, as contamination of routinely used devices in the healthcare settings are the possible sources of infections.[27,29] A systematic review on the relationship between shared patient care items and HAIs manifested that potential pathogens and multiple resistant organisms present on noninvasive portable clinical items (NPIs) in routine, non-outbreak conditions – and in a variety of settings affirms the need to improve NPIs decontamination practices.[1]

In multivariable analyses, stethoscope disinfections after every use were significantly associated with the

Table 3 Factors Associated with Stethoscope Disinfection Among Physicians

Variables	Category	Disinfect After Every Use (%)	COR (95% CI)	p-value	AOR (95% CI)
Gender	Male Female	56 (94.9) 3 (5.1)	1 0.32(0.09–1.08)	 0.06	1 0.32(0.09–1.14)
Age	≤30 >30	47 (79.7) 12 (20.3)	2.40(1.23–4.68)* 1	0.01	2.52(1.10–5.78)** 1
Service year	1–3 3+	32 (54.2) 27 (45.8)	1 1.12(0.63–1.92)	 0.72	
Training on COVID-19	Yes No	24 (40.7) 35 (59.3)	2.31(1.30–4.11)* 1	0.004	2.52(1.29–4.92)** 1
Profession	Medical doctor Specialist medical practitioners Resident physician	38 (64.4) 15 (25.4) 6 (10.2)	1 0.70(0.37–1.33) 3.98(1.34–11.82)*	 0.28 0.01	1 0.97(0.41–2.31) 4.61(1.29–16.52)**
Current working healthcare facility	Governmental Private	57 (96.6) 2 (3.4)	2.75(0.64–11.82) 1	0.17	2.24(0.47–10.62) 1
Department	OPD & Emergency Surgical Department & OR Medical Department Gynecology and Obstetrics Department Pediatric Department COVID-19 Center Intensive Care Unit (ICU) and others	17 (28.8) 19 (32.2) 4 (6.8) 6 (10.2) 5 (8.5) 7 (11.9) 1 (1.7)	1 1.06(0.53–2.14) 0.66(0.21–2.06) 1.36(0.49–3.75) 1.47(0.49–4.37) 7.05(2.20–22.61)* 0.59(0.07–4.81)	 0.86 0.47 0.54 0.48 0.001 0.62	1 1.01(0.42–2.46) 0.57(0.17–1.94) 1.27(0.38–4.26) 1.02(0.29–3.52) 3.11(0.84–11.50) 0.32(0.03–3.12)
Ownership of stethoscope	My own Shared	54 (91.5) 5 (8.5)	1 0.34(0.13–0.89)*	 0.02	1 0.34(0.12–0.92)**
Availability of disinfectant in the work place	Yes No	50 (84.7) 9 (15.3)	2.44(1.16–5.14)* 1	0.01	3.03(1.29–7.10)** 1
Are there any reminders about medical equipment disinfection in your working unit? (eg poster)	Yes No	17 (28.8) 42 (71.2)	2.37 (1.25–4.46)* 1	0.008	1.62(0.78–3.36) 1
Stethoscopes used on intact skin should be disinfected between each patient?	Yes No	57 (96.6) 2 (3.4)			
Duration of stethoscope disinfection	<20 seconds ≥ 20 seconds	26 (52.0) 24 (48.0)	0.99(0.54–1.84) 1	0.99	
How often are you involved in direct contact with a known case of COVID-19 patient?	Daily Never/not yet	20 (33.9) 39 (66.1)	2.10(1.16–3.83)* 1	0.01	1.22(0.60–2.47) 1

Notes: Hosmer–Lemeshow = 0.7992; COR, crude odds ratio; AOR, adjusted odds ratio; *p-value < 0.05 (crude); **p-value < 0.05 (adjusted).

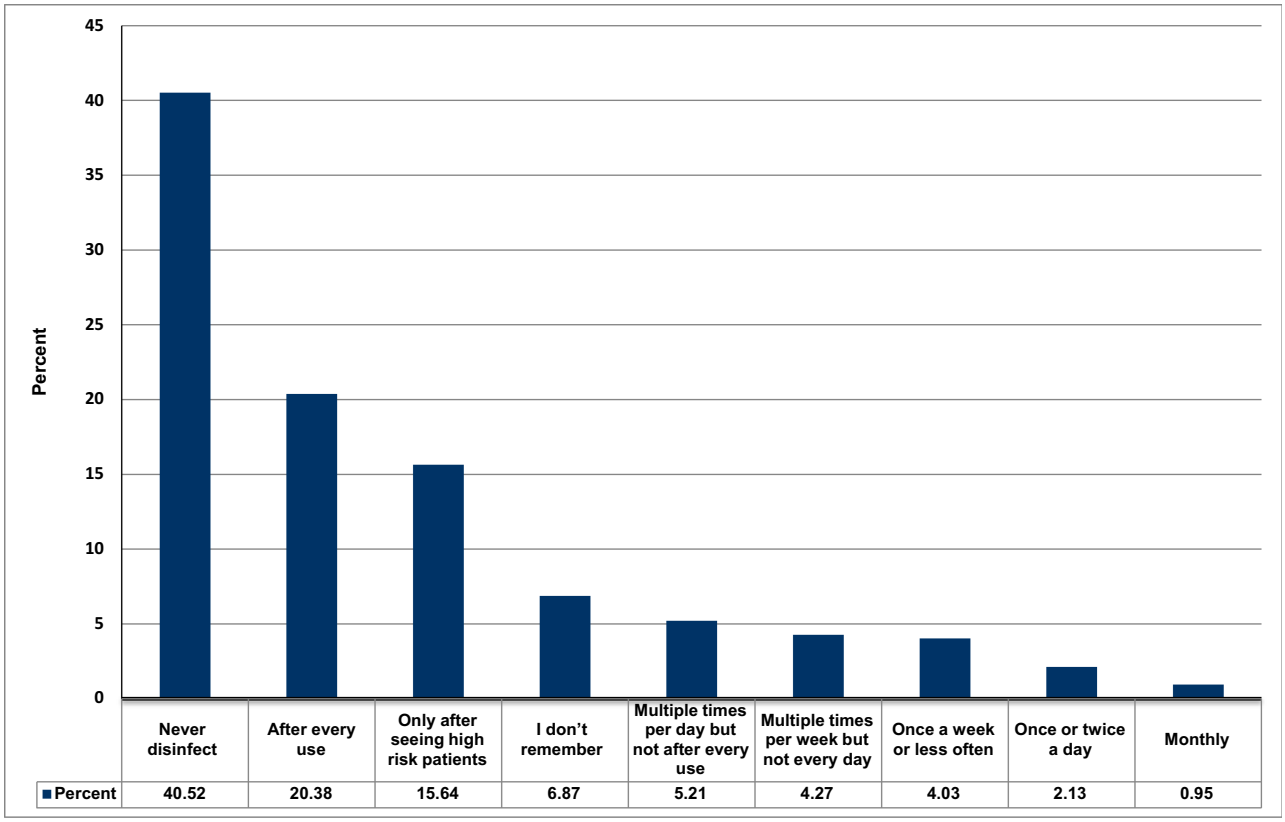

Figure 2 Non-infrared thermometer disinfection practice among physicians during COVID-19 pandemic in Ethiopia.

availability of the disinfectants in the workplaces. Previous studies also identified deficiencies on access to disinfection materials as potential barriers to disinfections after every use.[32] In resource-limited settings, physicians often rely on clinical appraisals using the stethoscope, particularly the assessment of respiratory dysfunctions in COVID-19 positive patients,[33] and eventually, these can cause the contagion of physicians and patients. Considering the communicability of the virus, the use of ultrasound is now recommended by Buonsenso et al as essential in the safe management of the COVID-19 pandemic; après it can allow the concomitant execution of clinical examination and lung imaging at the bedside by the same doctor.[40] However, in resource-limited settings, this may not be applicable. It is, therefore, of utmost importance that ensuring the availability of disinfectant solutions may precede a positive influence on disinfection compliance. Patel et al also argued that, at this point, it is difficult to answer if the stethoscope is a necessary tool or an unnecessary evil during COVID-19 pandemic, but removing it altogether from the care of patients with COVID-19 does not seem practical. And suggested basic guiding principles such as use of personal stethoscopes, use disposable isolation stethoscope and cleaning of stethoscope after patient auscultation with predefined stethoscope cleaning protocols.[47]

In this study, the odds of stethoscope disinfection after every use were significantly reduced among those who reported the use of shared stethoscopes. In our point of view, sharing stethoscopes are detrimental, and may pose risks to physicians. Similar conclusions about the sharing of personal items have been described by WHO.[29] We also believe that, if unavoidably stethoscopes are shared, it is paramount to disinfect the stethoscopes meticulously. Another fact but not of utmost significance, access to disinfectants in the workplaces increase the odds of non-infrared thermometer disinfections after ever use, which is in line with previous studies.[48,49] Lastly, the present study clearly showed that providing trainings are beneficial and significantly increases the odds of disinfection after every use. Hence, public health authorities should focus on

Table 4 Physicians' Non-Infrared Thermometer Disinfection Practice in Ethiopia

Variables	Category	Frequency	Percent
How often do you disinfect non-infrared thermometer?	Never disinfect	171	40.52
	After every use	86	20.38
	Only after seeing high risk patients	66	15.64
	I do not remember	29	6.87
	Multiple times per day but not after every use	22	5.21
	Multiple times per week but not every day	18	4.27
	Once a week or less often	17	4.03
	Once or twice a day	9	2.13
	Monthly	4	0.95
Have you disinfected the non-infrared thermometer for the last time you used?	Yes	141	33.41
	No	204	48.34
	I do not remember	77	18.25
The non-infrared thermometer needs to be disinfected after every use?	Agree	366	86.73
	Disagree	13	3.08
	Not sure	43	10.19
Non-Infrared thermometer can contribute to the transmission of COVID-19 if not disinfected after every use?	Agree	384	91.00
	Disagree	1	0.24
	Not sure	37	8.77

improving the awareness level of physicians through on-job trainings and expand reusable medical equipment culture in every healthcare setting. Additionally, achieving and assuring availability of personal stethoscopes for every physician in the era of COVID-19 must receive the highest priority. The Federal Ministry of Health (FMoH) of Ethiopia should works towards the improvement of stethoscope hygiene culture in the country, along with intervention that are proven to be effective in stethoscope cleaning, including barriers, caps, and UV lights.

Limitations

This study has a number of limitations. First, recall bias may have affected our results. Second, external validation survey responses regarding direct observation on the physician's disinfection practices were not executed. Third, the potential for social desirability biases among survey respondents are present, although the low reported stethoscope and non-infrared thermometer disinfections after ever use suggest that responses may not reflect the physicians' actual behaviors. Fourth, the cross-sectional nature of the survey does not allow the cause-and-effect relationship between the dependent and independent variables. Fifth, we our study did not assess questions, such as how the non-infrared thermometers are stored, what proportion of these thermometers are used for oral, rectal, axillary temperature measurement, and the type cleaning practices physicians employed based on site of used. And finally, this study should be generalizable for the physicians working in the healthcare facilities of this country.

Conclusions

In summary, less than a fifth of the physicians disinfected their stethoscopes after every use, and a significant number of respondents reported that they have never disinfected their non-infrared thermometers. This study has reflected disturbing inadequate disinfection practices among physicians, whereby patient safety is of germane priority in the era of COVID-19. In this regard, physicians should be exigent and more vigilant in disinfecting these commonly used medical devices. Furthermore, this study provides empirical evidence on the association between the availability of disinfectants in the working units, and stethoscope disinfection after every use. With respect, measures should be taken by health authorities in upraising the current practices of disinfection through implementations of simple interventions, such as provisions of training

Table 5 Factors Associated with Non-Infrared Thermometer Disinfection

Variables	Category	Disinfect After Every Use (%)	COR (95% CI)	p-value	AOR (95% CI)
Gender	Male Female	69 (80.2) 17(19.8)	1 1.99(1.06–3.74)*	 0.03	1 2.21(1.12–4.36)**
Age	≤30 >30	55 (63.9) 31 (36.1)	0.97(0.59–1.59) 1	0.49	1.29(0.69–2.39) 1
Service year	1–3 3+	43 (50.0) 43 (50.0)	1 1.38(0.86–2.22)	 0.18	1 1.13(0.64–2.01)
Training on COVID-19	Yes No	27 (31.4) 59 (68.6)	1.46(0.87–2.46) 1	0.15	1.59(0.90–2.81)
Profession	Medical doctor Specialist medical practitioners Resident physician	44 (51.2) 34 (39.5) 8 (9.3)	1 1.58(0.95–2.61) 5.74(1.97–16.64)*	 0.07 0.001	1 1.60(0.86–2.99) 7.10(2.30–21.95)**
Current working healthcare facility	Governmental Private	74 (86.1) 12 (13.9)	0.43(0.20–0.91)* 1	0.02	0.48(0.22–1.08) 1
Department	OPD & Emergency Surgical Department & OR Medical Department Gynecology and Obstetrics Department Pediatric Department COVID-19 Center Intensive Care Unit (ICU) and others	27 (31.4) 23 (26.7) 14 (16.3) 6 (6.9) 8 (9.3) 6 (6.9) 2 (2.3)	1 0.76(0.41–1.41) 1.72(0.81–3.67) 0.79(0.29–2.08) 1.55(0.62–3.88) 3.05(0.97–9.54) 0.74(0.15–3.54)	 0.39 0.15 0.63 0.38 0.06 0.71	
Availability of disinfectants in the workplace	Yes No	70 (81.4) 16 (18.6)	2.96(1.08–3.54)* 1	0.02	1.67(0.88–3.16) 1
Are there any reminders about medical equipment disinfection in your working unit? (eg poster)	Yes No	21 (24.4) 65 (75.6)	1.89 (1.06–3.37)* 1	0.03	1.78(0.95–3.32) 1
How often are you involved in direct contact with a known case of COVID-19 patient?	Daily Never/not yet/	20 (23.3) 66 (76.7)	1.13(0.64–1.98) 1	0.66	0.95(0.51–1.76) 1

Notes: Hosmer–Lemeshow = 0.1631; COR, crude odds ratio; AOR, adjusted odds ratio; *p-value < 0.05 (crude); **p-value < 0.05 (adjusted).

and securing constant and available disinfection supplies.

Abbreviations

AOR, adjusted odds ratio; CI, confidence interval; COVID-19, coronavirus disease; WHO, World Health Organization; COR, crudes odds ratio.

Data Sharing Statement

Data are available from the corresponding author upon a reasonable request.

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Author Contributions

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