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Pitout JDD, Church DL, Gregson DB, Chow BL, McCracken M, Mulvey M, Laupland KB (2007). Molecular epidemiology of CTXM-producing *Escherichia coli* in the Calgary Health Region: emergence of CTX-M-15-producing isolates. *Antimicrob. Agents Chemother.* 51: 1281-1286.

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Full Length Research Paper

Knowledge, attitudes, and practices of health care workers on Ebola virus disease in Conakry, Guinea: A cross-sectional study

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In the current Ebola virus disease (EVD) outbreak, health care workers (HCWs) are on the frontline of the response. The study aimed to report on the knowledge, attitudes and practices of Conakry HCWs. A cross-sectional survey was done among HCWs from the two national hospitals and at the communal hospitals in Conakry, using a standardized questionnaire. Demographic, knowledge, attitudes and practices data of the respondents were recorded and analyzed. Respondents (n = 525) were mainly physicians (43.0%) or nurses (36.8%). Over 90% of HCWs cited the three major clinical signs of EVD. Only 68% knew the correct concentration of Javel water that is advised for hand washing. This was known by 69.4% of nurses, 59.0% of residents, 69.5% of physicians, 100% of pharmacists and 60.9% of midwives ($P = 0.35$). The EVD transmission risk in the ward was estimated as probable for 70.6% and very probable for 24.0% of HCWs. Eighty-four percent of all respondents estimated their knowledge on EVD insufficient and 97.1% reported that they either need specific training on EVD or enhance their knowledge. This study underlines the low level of knowledge, attitude and perceptions regarding EVD prevention despite the high incidence and mortality of this disease.

Key words: Ebola virus disease, perception, health care workers, Guinea.

INTRODUCTION

Filoviruses that is, Marburg viruses and Ebola viruses, are highly infectious and transmitted from person-to-

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Table 1. Characteristics of health care workers at Conakry.

Characteristics	N= 525	%
Age (mean±SD)	39.3±9.9	-
Men	253	48.2
Profession	-	-
Nurses	193	36.8
Resident	39	7.4
Physician	226	43.0
Pharmacist	3	0.6
Midwife	64	12.2
Hospitals		
Municipal hospitals	-	-
Coléah	47	9.0
Matam	64	12.2
Matoto	50	9.5
Minière	46	8.8
Ratoma	56	10.7
University hospitals	-	-
Donka	111	21.1
IgnaceDeen	151	28.8

person by direct contact with infected body fluids or by contaminated fomites (Bühler et al., 2014). The ongoing Ebola virus disease (EVD) outbreak in West Africa is the largest and most sustained Ebola epidemic recorded to date, with 28,476 probable, confirmed or suspected cases of Ebola virus disease and 11,298 reported deaths mainly in Liberia, Sierra Leone and Guinea as of October 21, 2015 (WHO, 2015; Bausch et al., 2014). The control of the outbreak is expected to last longer than initially planned. The current outbreak, like previous, has been deadly in health care settings with increased risk for health care workers (HCWs) (Benowitz et al., 2014).

The overall mortality rate associated with EVD in the Conakry Ebola treatment center has been reported to be 44% by Barry et al. (Jamieson et al., 2014). They found that 19% of patients hospitalized with laboratory confirmed EVD were HCW. This suggests that HCW are highly exposed to EVD and many of them might be infected during the current outbreak. Because HCWs are on the frontline of the response to the outbreak, their occupational health and safety is critical to achieve the control of the outbreak and to maintain an efficient health care workforce during and even after the crisis (Barry et al., 2014). The aim of this study was to report the knowledge, attitudes and practices (KAP) of HCW about EVD in the Health district of Conakry in Guinea. The study objectives were:

1. To assess the level of knowledge of HCWs on EVD.
2. To evaluate the level of awareness and practices towards EVD.

MATERIALS AND METHODS

Study population

The study population consisted of all HCWs working at the two national hospitals of Donka and IgnaceDeen and the five communal hospitals of Conakry. The following professionals were considered as HCW: Physicians, medical residents, nurses and midwives. Administrative staff was excluded of the survey as HCWs.

Data collection

A semi-structured self-reported questionnaire was developed by the research team through group discussions after an extensive literature review. The draft questionnaire was reviewed by two experts in the fields of infectiology and epidemiology. The questionnaire was validated and pre-tested with 20 individuals to ensure reliability and validity prior to initiating the fieldwork. Some questions were open ended and allowed the respondents the chance to give greater details while others were restricted to a yes or no answer. The questionnaire captured demographic data (age, sex, profession, department at hospital and length of experience), knowledge on the EVD, attitudes and practices regarding EVD. Participants were asked about their perception of contamination in health services, and the risk was scored using Likert scales (Skowronski et al., 2003). The numeric scale was scored from 0 ("no risk") to 10 ("high risk"). The Likert scale included the categories "very improbable," "improbable," "undecided", "probable," and "very probable". The questionnaire was anonymous and the confidentiality for participants was preserved. The study data was collected between September, 1 and October, 31, 2014.

Statistical analysis

The characteristics of the study population were presented using proportions, means (SD). Fischer exact test and the Student T tests were used to compare categorical and quantitative variables. All statistical analyses were performed with SPSS (Statistical Package for Social Sciences, Version 21.0; SPSS, Chicago, IL, USA). All tests were 2-tailed, with a p-value <0.05 considered as being significant.

Ethical approval

Verbal informed consent was obtained from all participants. Ethical approval was obtained from the Faculty of Medicine, University of Conakry, Guinea.

RESULTS

Demographic characteristics

A total of 990 HCWs were contacted and 525 completed the questionnaire corresponding to a response rate of 53.03%. The overall mean age of the participants was 39.3±9.9 years and 48.2% were women. A total of 43.0% were physicians and 36.8% were nurses. Almost half of the respondents (49.9%) were working at the national university hospitals Donka and IgnaceDeen (Table 1). The median duration of their working experience was 8.0

Table 2. Knowledge of Conakry health care workers about the Ebola transmission.

Do you systematically wear gloves during the routine actions such as punctures, installation of catheters, dressings?	Number	%
No in nurses	190	98.4
No in residents	36	92.3
No physicians	218	96.5
Pharmacist	3	100.0
Midwives	59	92.2
Have you received specific training on Ebola virus disease?		
No	152	29.0
Yes	373	71.0
How would you judge your knowledge on the Ebola virus disease?		
insufficient	442	84.2
sufficit	83	15.8
Do you need a continuing training on the Ebola virus disease?		
No	15	2.9
Yes	510	97.1
Do you systematically screen for Ebola virus disease in all the patients received in your department?		
Systematically	432	82.3
Some times	78	14.9
Never*	15	2.8

(0.4 to 36) years.

Knowledge

Nearly 98% of the respondents knew the duration of Ebola incubation. However, only 30.5% of them knew the total number of EVD cases in HCWs that occurred in Guinea from the start of the outbreak to the time of the study. More than 90% of HCWs cited the three major clinical signs of EVD, that is, fever, diarrhea and asthenia. According to the respondents, the diagnosis of EVD is based on clinical signs (24.6%), serology (44.4%), blood culture (1.9%) and polymerase chain reaction (29.2%). When they were asked about the type of treatment, 5% of HCWs reported that the treatment given in the Ebola treatment centers was etiological. For the rest, the treatment was symptomatic. Concerning their knowledge about the transmission of Ebola, the contact with blood fluids was the most cited (82.7%) followed by direct contact with the skin of patients (84.2%) (Table 2). Regarding the knowledge on protection measures, 57.90% (304/525) responders had seen at least once the personal protective equipment against Ebola. Of these, 99.0% (301/304) knew how these equipment must be worn. Sixty-eight percent knew the correct concentration

of Javel water that is advised for hand washing. This was known by 100% of pharmacists, 69.4% of nurses, 69.5% of physicians, 60.9% of midwives and 59.0% of residents ($P = 0.35$) (Table 2).

Attitudes and perception about EVD

Perception of the risk of transmission of Ebola in the medical ward was measured by Likert scale (Table 3). For 70.6% of the respondents, the transmission was probable in the ward, very probable for 24.0%, and improbable for 1%. The results showed that 4.4% were undecided. Five hundred and six HCWs (96.6%) reported not systematically wearing gloves during the routine actions such as punctures, installation of catheters, dressings etc. This was lower in midwives (92.2%) and residents (92.3%) compared nurses (98.4%) ($P = 0.06$). Eleven percent reported having had an exposure to the patient biological fluids. To the question "Have you received specific training on EVD?" 29% responded having received no specific training. Eighty-four percent of all respondents estimated their knowledge on EVD insufficient and 97.1% reported that they either need specific training on EVD or enhance their knowledge. 82.3% of the respondents reported that they systematically

Table 3. Attitudes and preception of Conakry health care workers about the Ebola transmission.

What are the exposures at riskof transmission of Ebola virus disease in health care?	Number = 525	%
Respiratory droplets by coughing or talking	345	65.7
Projection of pathological products on the eyes	159	30.3
Contact with the skin of a patient	442	84.2
Contact with blood fluids of a patient	434	82.7
Prolonged contact with clothing or bedding of a patient	365	69.5
Did you once saw a personal protective equipment against Ebola?		
Yes	304	57.9
Non	221	42.1
Do you systematically wear gloves during the routine actions such as punctures, installation of catheters, dressings?		
No in nurses	190	98.4
No in residents	36	92.3
No in physicians	218	96.5
No in Pharmacist	3	100.0
No in Midwives	59	92.2

*Nurses (n = 5), physicians (n = 9) and pharmacist (n = 1).

screen for EVD in all patients at the time of medical consultation. Screening for EVD in patients was performed sometimes by 14.9% of HCWs and never by 2.8% of them (Table 3).

DISCUSSION

The current Ebola outbreak is the largest EVD outbreak in history (WHO, 2015). It has taken a heavy toll among HCWs, representing nearly 6.2% of all laboratory confirmed Ebola cases in Guinea (MacIntyre et al., 2014; Delamou et al., 2015) and 5.2% in Sierra Leon (Barry et al., 2014; Kilmarx et al., 2014). Recent studies in Guinea Ebola centers treatment, reported that one in five HCWs in Ebola laboratory confirmed and suspected cases (Jamieson et al., 2014; Bah et al., 2015). The present study explored the knowledge, attitudes and perceptions of 525 HCWs from hospitals in Conakry.

The study showed that HCWs in Conakry have good knowledge of some aspects of EVD such as duration of incubation period and EVD clinical signs. However, it pointed out the lack of knowledge about the methods of diagnosis, and the knowledge of the disease. Only around 30% knew that the diagnosis is laboratory based on PCR. The reason for this could be the fact that PCR was not used in Guinea on a routine basis before EVD outbreak. The only laboratories equipped with this exam in Guinea were the Guinean Hemorrhagic Fever laboratory in Donka (supported by the Pasteur Institute of Dakar and France), one provided by the Russian Cooperation and another one by the European Mobile

Lab in Gueckédou.

HCWs are on the frontline of the response, and their occupational health and safety is critical to the control of the outbreak and the maintenance of the health care workforce during the crisis (MacIntyre et al., 2014). A total of 94.7% of HCWs reported that EVD might be transmitted during care. This is reassuring concerning the behaviors that can be expected for avoiding infection in HCWs. However, nearly 18% still were not systematically screening EVD in their patients. That can be related to a lack of knowledge or care for patients with few symptoms.

The implementation of the infection control policy resulted in some improvements in the appropriate hand washing practices and use of gloves. However, despite the context of the Ebola outbreak, the proportion of HCWs who reported not systematically using gloves was 96.6%. This proportion was enough for facilitating EVD transmission within HCW and patients. Such behavior is in total contradiction with the infection control guidelines implemented in health care setting by health services authorities. These findings could explain the high incidence of confirmed EVD in HCWs in the current (MacIntyre et al., 2014). The vast majority of documented EVD outbreaks involving hospitals have explained no socomial transmissions by inadequate isolation of facilities, lack of use of gloves and protective clothing by HCWs (Okeke et al., 2014). In 1995 during the Ebola outbreak that occurred in Kikwit, the investigators reported that the high transmission of EVD in health care workers was due to the lack of use of aseptic-nursing techniques during surgical and obstetrical care and patient

care in general, especially during the of EVD cases (Kerstiens and Matthys 1999).

This study showed that the need for training was strong among HCWs. One HCW over three had received no specific training on Ebola and almost all of them estimated their knowledge insufficient.

Conclusion

To the best of the study knowledge, this is the first study on KAP of HCWs in the context of the current Ebola outbreak in Guinea. The study findings underline the low level of knowledge, attitude and perceptions regarding Ebola prevention in Conakry despite the high incidence and mortality of this disease. There is a strong need to intensify prevention measures among HCWs by providing more structured trainings on Infection control and prevention.

LIMITATIONS

The study has several limitations. First, it used self-reported questionnaire to collect data from the participants, who might misreport their behaviors or attitudes. Because of the cross sectional design, the study could not estimate a trend of KAP. Then, it can be expected that the knowledge improved when the duration of the outbreak increased. A repeated survey might provide some changes regarding KAP in these populations. Analysis of KAP taking account of the number of EVD diagnosed in the wards was not done. Only 53% of HCWs accepted to answer the questionnaire. Nevertheless, the study did not if there are differences between participants and those who declined to participate.

Conflict of Interests

The authors have not declared any conflict of interests.

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Full Length Research Paper

The epidemiology of thyroid diseases in the Arab world: A systematic review

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Thyroid gland diseases are a public health problem worldwide. Imbalance in the regulation of thyroid gland hormones can cause many disorders that range from a small goiter to life threatening diseases, such as thyroid cancer. Thyroid dysfunction both hyper and hypothyroidism can affect circulatory system by affecting cardiac output, cardiac contractility, blood pressure, vascular resistance and rhythm disturbance which can further cause heart failure, fibrillation, congestive heart failure and blood pressure. Westernization and nutrition transition in Arab world have increased the burden of adenocarcinomas, including thyroid cancer. This review aims to present the aggregated burden, risk factors and prognosis of various thyroid diseases prevalent in Arab countries. An electronic databases search was conducted using PubMed in addition to searching of accessible local journals in Arab world, using keywords and terms like epidemiology, burden, odds, risks, etc. After applying exclusion and inclusion criteria, 21 articles were selected to include in this review. The review showed that the prevalence of different types of thyroid disease varied between the reported studies in Arab world ranging from 6.18 to 47.34% prevalence of goiter reported by several studies conducted in Arab world, such as Egypt, Algeria and Bahrain with 25.25, 86 and 1.7%, respectively. Gender, dietary factors, iodine deficiency, family history, diabetes and x-ray radiation were reported as risk factors associated with different type of thyroid diseases. The most prevalence of thyroid disease was concluded to be thyroid lesions which varied in different regions of Arab and the burden of thyroid cancer is very high and very common in different Arab region, and further longitudinal studies are still needed to investigate the prognosis and determinants of these thyroid diseases in the Arab world.

Key words: Thyroid disease, prevalence, burden, odds, odds ratio, risk factors.

INTRODUCTION

Thyroid gland is the hormone secreting organ that regulates body metabolism (Skarulis and Stack, 2015).

Imbalance in the regulation of these hormones can cause many disorders that range from a small goiter to life

threatening diseases, such as thyroid cancer (Ratini, 2015). The most common cause of thyroid disorders is iodine deficiency and literature shows that almost one-third of the world's population lives in the area of iodine deficiency (Zimmermann, 2009). Thyroid lesion can be classified into congenital malformations, inflammatory in origin, endocrinal and neoplastic in origin (benign and malignant).

Several previous studies had reported that the most common type of thyroid disease is goiter; simple, diffuse and physiological (Vanderpump, 2005), and hypothyroidism and hyperthyroidism are also the prevalent types of thyroid disease (Vanderpump, 2010). Moreover, thyroid cancer is the fifth most common cancer in women (Jemal et al., 2010) and second most common cancer in Italy (Dal Maso et al., 2011). Hence, the thyroid gland disease is among the most common endocrine cancer, with approximation of 1.0 to 1.5% of all new cancers diagnosed each year in the USA, and its incidence has continuously increased in the last three decades all over the world (IARC Scientific Publications).

Furthermore, thyroid dysfunction both hyper and hypothyroidism can affect circulatory system by affecting cardiac output, cardiac contractility, blood pressure, vascular resistance and rhythm disturbance which can further cause heart failure, fibrillation, congestive heart failure and blood pressure (Klein and Danzi, 2007). It has been reported that changing in life styles in Arab world has led to the emerging of double burden of diseases, including the thyroid related diseases.

The westernization lifestyle and nutrition transition in Arab world have increased the burden of adenocarcinomas, including thyroid cancer (Sawka et al., 2008). Thyroid cancer occupies the number two position among females in Saudi Arab (Sawka et al., 2008). Secondary to westernization and the life-style of Arab countries has changed over the past years and thus the burden of thyroid diseases, specifically cancer, is increasing, which further contributes to the economic crises.

To date and best knowledge of the authors, no systemic review has been conducted in our region to highlight and consolidate the prevailing data on thyroid disease. Thus, this review aims to present the aggregated burden, risk factors and prognosis of various thyroid diseases prevalent in Arab countries.

METHODOLOGY

An electronic search was conducted using PubMed database during October 2014, in addition to searching of accessible local

journals in Arab world. Inclusion criteria included: articles written in English language, articles describing or investigating the epidemiology, etiology, distribution, prognosis, impact and burden of thyroid diseases in Arab countries and publication date 2014. Consequently, case reports, clinical trials, including the preventive measure and treatment articles about pathological, histological premalignant, and malignant change regarding thyroid cancer were excluded (Figure 1). Then, the search results were reviewed by two authors: the first author and one co-author to identify which articles were relevant to the topic through screening the title and abstract. The search keywords used covered three main categories including thyroid diseases, epidemiological attributes and thyroid diseases geographical location. Boolean (OR/AND) were used to link all the search keywords. The main keys words were "Distribution", "Epidemiology", "Burden", "Incidence", "Pattern", "Diagnosis", "Etiology", "Risk Factors", "Odds", "Odds ratio", "Risk", "Rate", "Prevalence", "Trend", and "Prognosis" with combination of all Arab countries like Algeria, Iraq, Kuwait, Sudan and Yemen (Figure 2). The initial screening of title/abstract of 40 identified articles resulted in excluding 16 articles as they were case reports, clinical trials and treatment based articles. The remaining 24 full text articles were reviewed thoroughly by two reviewers and found 3 further articles related to genetics were excluded. Finally, only 21 articles were included in this review. The flow chart attached is given to highlight the process and sequence of article identification, evaluation and selection (1). The secondary research was performed to check the cross-referencing among the final list of the 21 articles searching for local specialized journals in Arab world, but no additional article was found through secondary search. The review results were classified according to the types of studies that are cross-sectional studies, case control retrospective and prospective studies. The studies that reported prevalence of different thyroid lesions, risk factors and studies conducted solely on thyroid cancer were further differentiated.

RESULTS

Study design

The review results showed different study designs as follows: seven cross-sectional studies were conducted in different Arab regions, including Libya, Saudi Arabia, Egypt, Algeria, Bahrain and Oman (El-Mougi et al., 2004; Ghawil et al., 2011; Henjum et al., 2010; Lamfon, 2008; Moosa et al., 2000; Nouh et al., 2008; Elbualy et al., 1998). The sample size found varied from 99 to 749 subjects except for one study conducted in Oman in which 36000 babies were diagnosed. The study population of these studies comprised of children of school age and adults: five studies were case control with sample size varying from 100 to 313 subjects (Akbar et al., 2006; Memon et al., 2002a, b, 2004, 2010); four of the studies were from Kuwait (Memon et al., 2002a, b, 2004; Memon et al., 2010); and one from Saudi Arab (Akbar et al., 2006),

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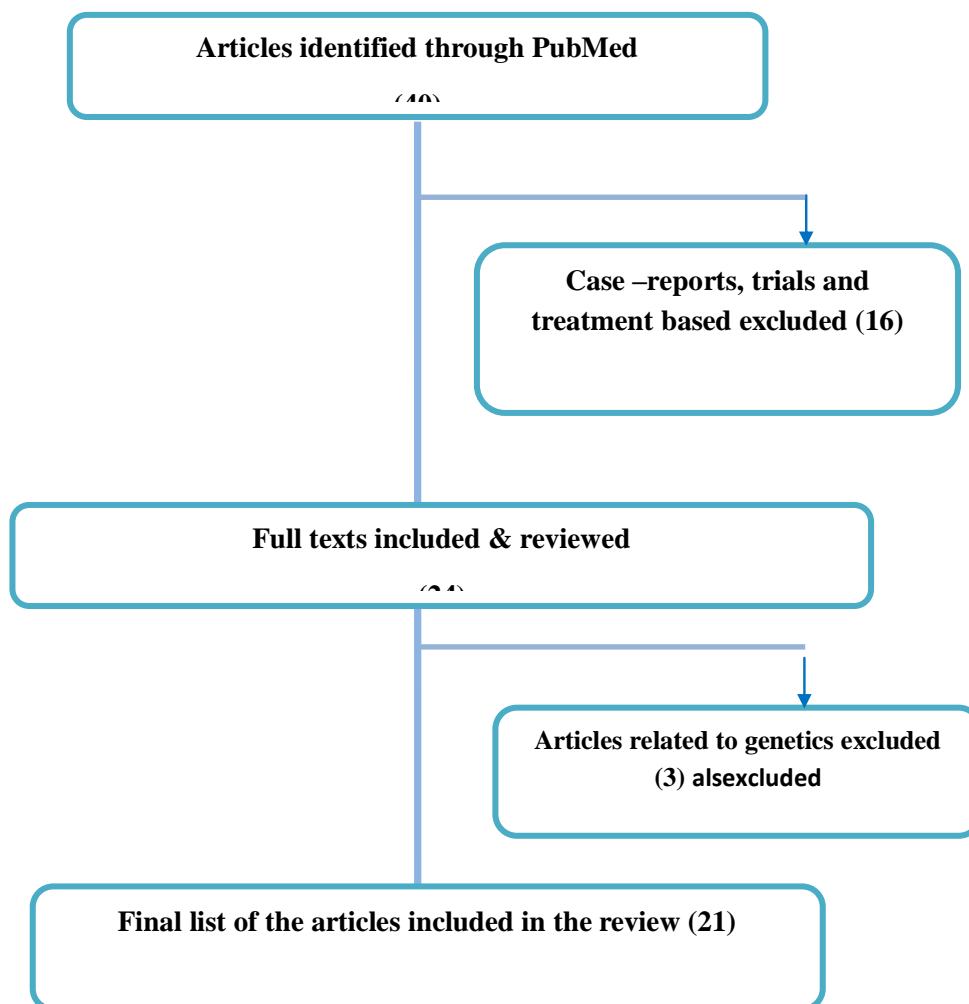


Figure 1. Flow Chart for Systematic Review.

and the study population was recruited from hospitals in Kuwait and Saudi Arab, retrospectively, and eight studies were retrospective; three were from Yemen one from Iraq (Nasheiti, 2005), three from Saudi Arab and one from United Arab Emirate. The sample size was found to vary from 45 to 810 subjects and comprised of children and adults, and all data collected were hospital based. One study conducted in Saudi Arab was prospective (Bahamman et al., 2011) (Table 1).

Prevalence of thyroid lesions

Different thyroid diseases were reported in different studies that include hypothyroid, hyperthyroid and goiter. The prevalence of different types of thyroid disease varied between the studies. The study conducted in 2011 in Libya reported the prevalence of subclinical hypothyroidism as 2.3% (Ghawil et al., 2011), and

prevalence of hypothyroidism was reported as 6.18% in Libya (Nouh et al., 2008) and 47.34% in Saud Arabia (Makkah region) (Lamfon, 2008) and the prevalence of goiter was reported by many studies conducted in Egypt, Algeria and Bahrain (25.25, 86 and 1.7%, respectively) (El-Mougi et al., 2004; Henjum et al., 2010; Moosa et al., 2000).

Risk factors

Different risk factors were identified by different studies included in the review. The prevalence of thyroid diseases reported was found to be more prevalent in females than males. The study conducted in Iraq in 2005 reported that the female to male ratio of congenital primary hypothyroidism was 1.6:1 (Nasheiti, 2005), and studies conducted in Yemen in 2005 and 2004 reported higher prevalence of thyroid cancer in female than in

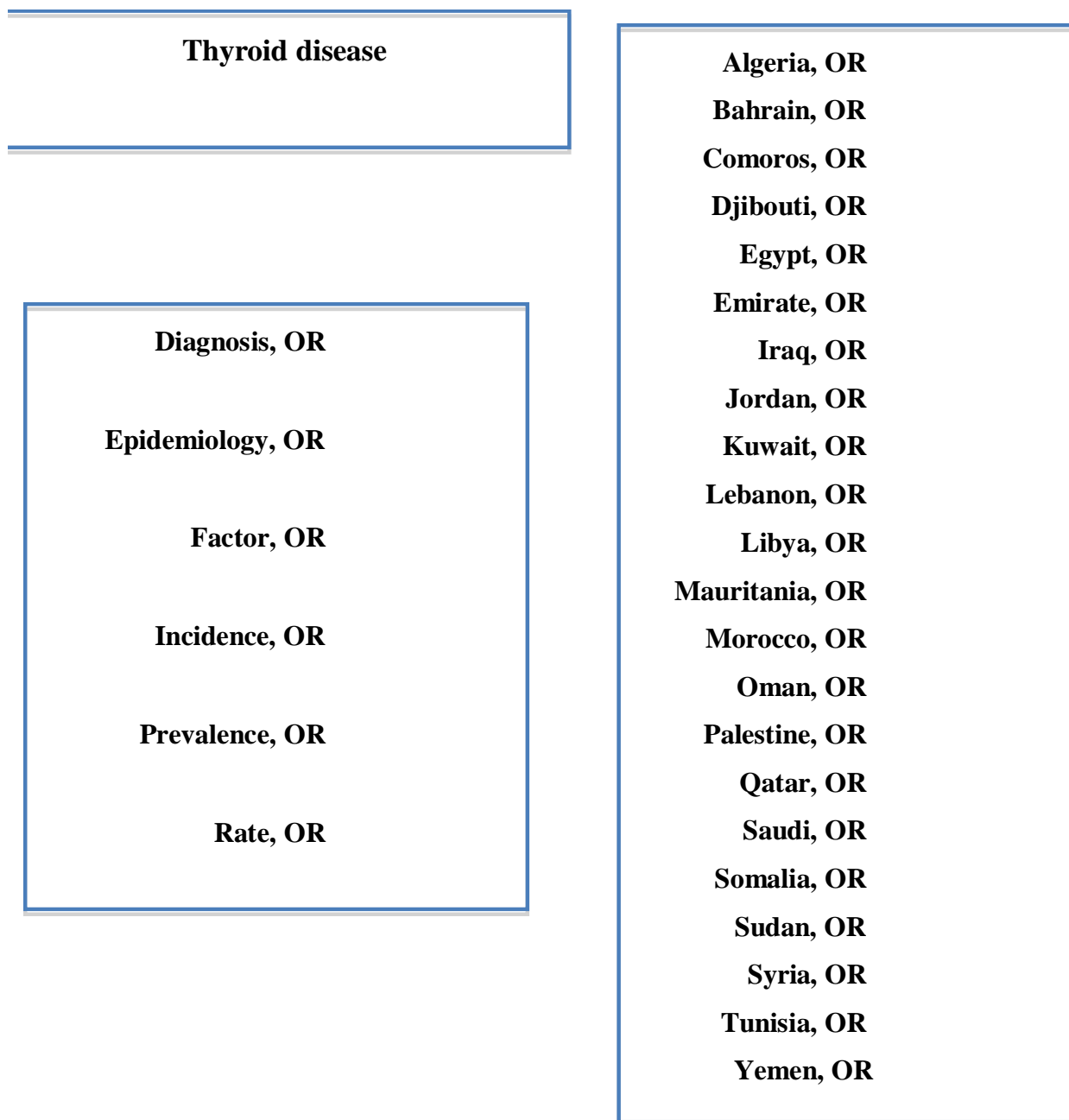


Figure 2. Search strategy: keywords.

males, that is, 90 and 89.7% respectively (Abdumughni et al., 2004; FCPSP, 2005). The bad nutrition and iodine deficiency was reported as risk factors in study conducted in Makkah (Lamfon, 2008), and iodine deficiency in Egypt was also reported in 31.3% of school aged children by estimating urinary concentration of iodine (El-Mougi et al., 2004). A case control study conducted in 2005 in Saudi Arab among diabetic patients reported that 16% of the cases had thyroid dysfunction

(Akbar et al., 2006), and one cohort study reported that the study participant having sleep disorder had high prevalence of subclinical hypothyroidism compared to the newly diagnosed clinical hypothyroidism. One retrospective study conducted in Iraq in 2005 documented that patients with hypothyroidism 89% had congenital hypothyroidism and 60% were from urban areas and more than half had parental consanguinity and family history of hypothyroidism (Nasheiti, 2005) (Table

Table 1. Summary of studies included in the systematic review.

Author, year, reference	Country	Population	Sample size	Study design	Main findings
Cross-sectional Studies					
Millad (2011)	Libya	Pediatric Department, Tripoli Medical Center	218 TIDM	Cross-sectional	23.4% had TPO-Ab (66.6%=female), 7.9% had TG-Ab and 2.3% had subclinical hypothyroidism
Ali (2008)	Libya	Murzok City	356 Adults	Cross-sectional	Overt hyperthyroidism= 0.84%, subclinical hyperthyroidism = 0.84%, overt hypothyroidism = 1.12%, and subclinical hypothyroidism =6.18%thyroid dysfunction was more common in females higher prevalence of subclinical hypothyroidism 27%=subjects with hypercholesterolemia.
Hawazen (2008)	Makkah	Al-Noor , Hera and King Abdul Aziz hospitals	414 Patients with thyroid diseases	Cross-sectional	196= hypothyroidism, 195=hyperthyroidism. Hypothyroidism: psychic, congenital, diabetes, autoimmune thyroiditis (Hashimoto thyroiditis , Grave disease) and malignant thyroid were in males. Bad nutrition, iodine deficiency, goiter and benign thyroid cancer were increased in females. Hyperthyroidism, iodine deficiency, and benign and malignant thyroid cancer revealed increase in males. Bad nutrition and goiter were increased in females.
El-Mougi (2004)	Egypt	Cairo University children's hospital.	99 School aged children	Cross-sectional	Goiter in 25 children. Median urinary iodine concentration was 70 µg/L. Mild iodine deficiency (50 to 99 µg/L) in 60.6% of the children and moderate to severe deficiency (<50 µg/L) in 31.3%.
Sigrun (2002)	Algeria	4 camps of Algerian desert	421 Children aged 6-14 years	Cross-sectional	The prevalence of goiter based on Tvol-for-BSA was higher (86%) than the prevalence of goitre based on Tvol-for-age (56 %). 84% had UIC above 300 mg/L.
Moosa (2001)	Bahrain	Government school	749 Children aged 8-12 years	Cross-sectional	1.7% had goiter,16.2% had low level of urinary excretion.
Musallam (1998)	Oman	Royal and Khoula Hospital	Diagnosis of 36,000 babies	Cross-sectional	Incidence of congenital hypothyroidism: 1:2200
Case-Control Studies					
Anjum (2010)	Kuwait	KCCC	313 Patients with thyroid cancer,313 matched controls	Case-control	Exposure to dental x-rays was associated with an increased risk of thyroid cancer (OR 2.1, CI: 1.4-3.1) dose-response pattern

Table 1. Cont'd.

Akbar (2005)	Saudi Arab	KAUH	100 Saudi type 2 diabetics and 100 age and sex-matched controls	Case control	Thyroid autoimmunity were detected in 10% diabetics vs. 5% controls (p=0.05). Thyroid dysfunction in 16 and 7% respectively (p=0.03). In GAD65ab-positive diabetics, thyroid autoimmunity: in 27% vs. 4% GAD65ab-negative diabetics (p=0.02) and thyroid dysfunction was reported in 42% and 7% respectively
Memona (2003)	Kuwait	KCCC	313 Case-control pairs of cancer	Case-control	Family history of BTDC= 24.9% cases, 12.8% controls. Risk of TC in individuals who had a mother (OR=2.3; CI:1.1–5.1), sister(s) (OR=2.6; CI:1.3–5.3) or aunt(s) (OR=2.1; CI: 0.9–5.3) with BTDC; Increased risk with an increasing number of affected female relatives (P<0.0001). Individuals aged <35 years, who had an affected first- or second/third-degree relative(s), 3-fold increased risk of the cancer. Family history of TC was reported by 2.9% cases in 13 relatives (OR=3.0; CI:0.811.1).
Memon (2002)	Kuwait	KCCC	313 Case of thyroid cancer control pair	Case-control	12 years of education: 0.6 OR, CI:0.3-0.9. Average age at diagnosis: 34.7 in women, 39 in mal. High consumption of processed fish and chicken were associated with thyroid cancer 2.2 (1.6-3); 1.7 (1.2-2.3)
AnjumMemon (2002)	Kuwait	KCCC	238 Women with cancer and 476 matched controls	Case-Control	12 years of education reduced risk of thyroid cancer (OR 5 0.4; 95% CI: 0.2–0.8; <0.05). Average age at diagnosis 34.7 +/- 11 years. Significant association was found between: age at last pregnancy, parity, last pregnancy at ages >30 years (2.1; CI:1.2-3.8), borne >5 children (OR 1.5; CI: 0.9–2.5)
Retrospective Studies					
Abdulkader (2014)	Saudi Arab	King Fahad Hospital, Madinah	292 Thyroid specimens	Retrospective	Female: Male = 3.70:1. Mean age= 39.7 years. Most common cause of goiter= colloid goiter. Female: Male 4:1. 27.7% had neoplastic tumor. Papillary carcinoma was the commonest malignant tumor accounting for 87.8% of all thyroid malignancies, followed by lymphoma, follicular carcinoma and medullary carcinoma
AlZaher (2008)	UAE	Tawam Hospital	Medical Record of 135 TC patients	Retrospective	58% diagnosed before age 45. Female: Male 2.4:1. Papillary carcinoma: 84%; Multinodular: 63%
Nasheiti (2005)	Iraq	Al-Kadhymia Teaching Hospital College of Medicine, Al-Nahrain University	45 children under 12 years with hypothyroidism	Retrospective	Hashimoto thyroiditis =11.1%. Congenital primary hypothyroidism =88.9%. Of the latter group, 60%= urban area. Female: Male= 1.6:1. Parental consanguinity = 80%. 60.7% had family history of hypothyroidism

Table 1. Cont'd.

Mansour (2005)	Yemen	Al-Kuwait University Hospital, Al-Thawra Teaching Hospital	810 Surgical operated goiter cases	Retrospective	90%= females. DTC was found in 21% cases, including 86.4% females and 13.6% males. 60% of the cases were in the age group of 21-40 years. Papillary carcinoma was the most common type of DTC (164 cases, 96.5%).
Yasser (2004)	Yemen	Kuwait University Hospital, Sana'a, Yemen	97 TC cases	Retrospective	Patients with TC comprise 17.7% of goiter patients. Females = 89.7% (n=87) and males =10.3% (n=10). The average age of diagnosis = 38.4 years. Among patients with goiter, the carcinoma was higher in the males 37.9% patients aged >47 25.8%, patients with enlarged lymph nodes 9.3% and patients with recurrent disease after being operated for a benign disease 8.2%. 90% = Highland areas. Clinical finding: Multinodular swelling (43.3%). Common symptom: Hoarseness (17.5%). Papillary carcinoma= 93.8% of the cases. Common procedure: Sub- total thyroidectomy (39%).
Faiza (2004)	Saudi Arab	King Abdul Aziz University Hospital	45 TC patients	Retrospective	37.5% patients had histopathology confirmed diagnosis, 82.2% cases of papillary carcinoma. Males: Female's ratio is 1.1:1, 66.7 had nodular mortality rate: 2-.2
Khalid (2003)	Yemen	Kuwait University Hospital	667 Patients with goiter	Retrospective	Females =92.5%, mean age = 35.2±11.58 years, 93%= highland. Clinical finding: Multinodular (44.9%). Common symptom = dyspnoea (20.5%). Common histopathological finding= nodular, colloid goiter (62.8%). Common procedure: Subtotal thyroidectomy. Common postoperative complication =hypocalcaemia
Saeed (1993)	Saudi Arab	Asir Central Hospital	361 Thyroid Specimen	Retrospective	Mean age: 35.9. Female to Male: 4.5:1 68.3%: Multinodular goiter, adenoma thyroid malignancy: 13%. Papillary carcinoma: 65.9%
Prospective Study					
Salman (2011)	Saudi Arab	Sleep Disorder Center	347 Patients having sleep disorder (271 with OSA, 76 Non OSA)	Cohort	Among OSA: prevalence of newly diagnosed hypothyroidism: 0.4%, newly diagnosed subclinical hypothyroidism: 11.1%. Non-OSA patients, the prevalence of newly diagnosed clinical hypothyroidism: 1.4%, and newly diagnosed subclinical hypothyroidism: 4%.

KCCC: Kuwait Cancer Control Centre; BTD: Benign thyroid disease; TC: thyroid cancer; OR: odds ratio; CI 95%, confidence interval; CH: congenital hypothyroid; TSH: thyroid stimulating hormone; NAFLD: non alcoholic fatty liver; MU/L: milli-unit per liter; GAD65ab: glutamic acid decarboxylase; KAUH: King Abdulaziz University Hospital; DTC: differentiated thyroid cancer; T1DM: type 1 diabetes mellitus; TPO-Ab: anti-microsomal peroxidase antibodies; TG-Ab, antithyroglobulin antibodies.

1).

Thyroid cancer

The nine studies included in this review had reported risk factors and clinical findings of thyroid cancer. Study conducted in 2010 in Kuwait reported dose-response relationship between dental x-ray and thyroid cancer (Memon et al., 2010). Another study from Kuwait conducted in 2003 reported association between family history of benign thyroid disease and thyroid cancer (Memon et al., 2004). Case control study conducted in 2002 in Kuwait reported that in female factors, such as age at last pregnancy, parity, pregnancy at age of 30 and above was associated with the increased risk of thyroid cancer (Memon et al., 2002). The papillary carcinoma was more prevalent in Yemen in 2005 and 2004 than any other types of cancer (96.5 and 93.8%, respectively). Both studies concluded that proportion of cancer was higher in female than male (Abdumughni et al., 2004; FCPSP, 2005). Likewise, study conducted in Saudi Arab and UAE also reported high proportion of cancer in female than male and the prevalence of papillary carcinoma is higher than the other types of cancer (Abu-Eshy et al, 1995, Albasri et al, 2014, Al Zahir et al 2008, Qari, 2004) (Table 1).

DISCUSSION

Our review has covered wide variety of thyroid diseases, including hypothyroid and hyperthyroid, goiter, subclinical thyroid, congenital hypothyroid, hashimoto thyroid disease and thyroid cancer.

The prevalence reported and study sample size varied from one study to another study. The prevalence of subclinical hypothyroidism was reported as 2.3 times in adult population of Libya (Ghawil et al., 2011) compared with study conducted in Colorado documented that the prevalence of subclinical hypothyroid in the general population ranged between 4 and 10% (Canaris et al., 2000). So, our review suggested that the prevalence in Arab region is comparatively low. This could be due to the small sample size that has been used in the study. Prevalence of hypothyroidism was reported as 6.18% in Libya and 47.34% in Saudi Arabia (Lamfon, 2008; Nouh et al., 2008) showing the prevalence is much higher than the prevalence reported in the study conducted in Scotland of 0.135% prevalence in people of age less than 22 years (Hunter et al., 2000). The possible explanation of the high prevalence in study conducted in Saudi Arabia could be because of the reasons and risk factors mentioned in the study that the iodine deficiency and bad nutrition. Furthermore, the sample size and variation in participants' characteristics could have

resulted in different prevalence of thyroid lesions.

This study review showed that the prevalence of goiter was in studies conducted in Egypt, Algeria and Bahrain (25.25, 86 and 1.7%, respectively) (El-Mougi et al., 2004; Henjum et al., 2010; Moosa et al., 2000). The possible explanation for the high goiter in the study of Algeria was due to high intake of iodine, and the result is line with a study conducted in 1998 among the Saharawi refugees that showed a prevalence of 28% for goiter (Pezzano et al., 1998). Some recent studies showed higher prevalence as the recent one had used ultrasound. The study conducted in past years in Oman and Saudi Arab showed 10 and 30% goiter of grades 1 and 2, respectively (Al Nuaim, 1995; Oman Ministry of Health, 1995). This high prevalence of goiter in Arab world is in agreement with the high prevalence encountered in countries, such as in Turkey, where goiter prevalence ranged from 5 to 56%, indicating severe to moderate iodine deficiency (Erdoğan et al., 2002). However, the variation in the prevalence of different thyroid lesions in Arab world could be because the study methods, including different sample size, participant characteristics, source of recruitment of participants, and different tools, were used to identify the burden and different underline causes, such as high intake of iodine and bad nutrition.

The thyroid cancer was found prevalent in Arab region in this review similar to the study finding from India where the thyroid cancer was found to be one of the five most common cancer in India (Kalyani et al., 2010); whereas in Iranian population, thyroid cancer is the 7th most common cancer in females with an overall 5-year survival rate of 88% (Khayamzadeh et al., 2011). Moreover, in a study spanned over 25 years about the incidence of common cancers in Hong Kong, a number of cancers including thyroid cancers were found to be on an increase throughout the study period (Xie et al., 2012). Likewise, a study from Nepal on head and neck carcinomas reported that the most common site of primary lesion was larynx, followed by the thyroid (Lasrado et al., 2012).

The different studies included in this review have commented on the risk factors, clinical presentation and symptoms of thyroid cancer. Female predominance can be seen in our review and the common type of cancer was reported as papillary carcinoma. These findings are in agreement with the findings of study conducted in Iran over the period of 2000 to 2010 (Sokouti et al., 2013). The thyroid diseases as reported in this review are all multi-factorial. For example, as reported in the study of Kuwait that age at last pregnancy, parity, last pregnancy at ages >30 years were all associated with thyroid cancer. These finding are in agreement with what was mentioned in study done in Iran that TG-Ab and TPO-Ab were identified more frequently in women with recurrent abortions (Iravani et al., 2008). A study conducted in Kuwait in 2003 reported the association between benign

thyroid disease and thyroid cancer (Memon et al., 2004). This findings are inconsistent with the study among Iribarren et al. (2001) which included 196 incident cases of thyroid cancer, and reported an approximately 2-fold increased risk with a family history of thyroid disease (Relative Risk (RR) = 2.2; 95% CI: 1.2–4.1) (Iribarren et al., 2001). In addition, Helene et al., from a case-control study reported that seventeen cases (5.0%) and 2 controls (0.6%) reported at least one first degree in relation with thyroid cancer thus suggesting that genetic factors are important for thyroid cancer. Pal et al. (2001) showed that irrespective of the type of disease, the male to female ratio is higher for female having any type of thyroid disease. These findings are consistent with studies conducted in different countries. For example, the study conducted in Norway in 2000 concluded that the prevalence of former diagnosed hyperthyroidism was 2.5% in females and 0.6% in males, hypothyroidism 4.8 and 0.9%, and goiter 2.9 and 0.4% respectively. In both sexes, the prevalence increased with age (Bjoro, 2000).

Another interesting finding in this review is that the study conducted in Kuwait reported the association of Dental X-rays with thyroid cancer. These findings are consistent with the findings from number of previous studies, including a case-control study conducted in Sweden reporting the association of dental x-rays with thyroid cancer. A cross-sectional study also reported this association (Hallquist and Näsman, 2001), and cohort study conducted in USA also reported that x-ray workers had more risk of developing cancer than the other specialties (Zabel et al., 2006).

The limitations of this review includes limiting our search for articles in English, however, most if not all, studies by research institutes and universities are in English in the Arab world. Some articles might have been missed because different databases, like KoreaMed and Embase, were not search into but local journals were reviewed to include all the study related to the Saudi Arab. Publication bias, which is the tendency for publishing manuscripts positive findings, is a potential limitation of all systematic reviews including our review. Limitations of this systematic review also derive from limitations of the individual studies included. Most of the studies conducted in Saudi Arabia were cross-sectional and retrospective with very few follow-up studies that aim to know the prognosis, burden and consequences of these conditions on the society and healthcare services. On the other hand, the strength of this review to the best of our knowledge is the first review that highlights the burden of thyroid diseases in Arab world. Secondly, this review has included considerate amount of studies from many geographical territory of Arab, including Saudi Arab, Jordan, Yemen, Algeria, Kuwait, Egypt, etc. This study includes all the diseases that have been studied in Arab region such as hypothyroidism and hyperthyroidism, goiter, Hashimoto's disease, Graves' disease and thyroid

cancer. The review has, to the best of its ability, consolidated the epidemiology, including prevalence of different types of thyroid diseases, the risk factors and clinical features of different thyroid diseases including thyroid cancer. Different study designs, such as cross-sectional, retrospectives and case-controls were included to highlight the true burden of the disease.

Conclusion

Prevalence of thyroid varied in different regions of Arab and the burden of thyroid cancer is very high and very common in different Arab region. Risk factors, such as female gender, bad nutrition, and diabetes and x-ray radiations were highlighted in the studies. Identified risk factors are potentially modifiable, emphasizing the importance of public health programs that are aimed at tackling such determinants. Future longitudinal studies are needed to investigate the prognosis and determinants of this condition in the Arab world. This study recommended early detection and prevention of disease at primary level by educating the population should be practiced.

Conflict of Interests

Authors have no conflict of interests and the work was not supported or funded by any drug company.

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