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# An Evaluation of Thyroid Patients' Awareness and Knowledge Level in Diwan Health Complex, Muscat

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# ABSTRACT

## Purpose

This study aims evaluating the level of knowledge and awareness among thyroid patients in Diwan Health Complex-Muscat by understanding the practiced knowledge management system and its effect in providing the same.

## Methods

A descriptive study involved conducting a survey covering thyroid patients and their treating physicians. Data collection involved two questionnaires; the first was a telephonic questionnaire conducted on thyroid patients and the second questionnaire was distributed to their treating physicians. The survey involved a number of 150 respondents of thyroid patients whom are being registered and treated in Diwan Health Complex- Muscat during the period of 2016-2020 whereas a number of 11 physicians were included in the survey. Data compiling and interpretation were done out using Excel and SPSS.

## Results

95% of the participated patients had no previous knowledge of thyroid gland & its associated diseases. Post-diagnosis, thyroid diseases' education and awareness is low. 62.22% of thyroid patients have voted that the health complex does not visually display any contents of thyroid diseases, 76% of thyroid patients did not receive any counselling and/or awareness sessions beside their routine appointments and 91.33% of these patients confirmed receiving no printed materials of their diseases.

## Conclusion

In the chosen health complex, thyroid patients' awareness and knowledge were merely subjected to the physician's individual effort which varied from one physician to another. The efforts were controlled by a variety of factors such as the absence of a KM system, absence of IT role, busy clinics, doctor-patient counselling time, non-availability of an Endocrinologists, unavailability of disease educator/counselor and changing treating physicians on every visit. On the organizational level, the health complex spared no visible efforts in educating or raising thyroid patients' awareness nor has a clear structured system of KM in this regard.

Key Words: Thyroid gland, Thyroid Diseases, Knowledge, Awareness, Knowledge Management (KM).

# Chapter One: Introduction

## 1.1 BACKGROUND OF THE STUDY

Thyroid diseases had been noticed moving towards higher peaks for the last few decades. Azadnajafabad et al. (2021) confirmed that the rate of thyroid cancer cases has increased noticeably during the years of 1990-2017 causing a global concern. Despite the witnessed increase, the level of awareness and knowledge among this category of patients is still poor. Many global researchers had unanimously concluded that the causes were mostly contributed to health providers rather than the patients. The lack of awareness programs, physicians' incompetency, poor doctor-patient relationship, nurses' lack of appropriate knowledge and the pharmacists' absence of better involvement were the main reasons that compromised knowledge management implementation. Goel at al. (2017) conducted a cross-sectional study in India aimed evaluating the level of awareness and knowledge among thyroid patients showed that patients possessed wrong believes and were committing incorrect practices related to their disease. According to the study, these actions were attributed to unqualified physicians which led patients seeking false knowledge externally. Another cross-sectional study performed by Khandelwal et al. (2017) in the same country reflected similar findings. Due to low health awareness, patients lacked the basic knowledge of their disease which subsequently led to poor adherence to given treatment.

Thyroid diseases' upsurge is forcing an undeniable focus and care to better aid the public in general and thyroid patients in particular. Thyroid diseases are categorized by Functional and Structural (Brady 2021); each causes different illnesses that comprise the patients' quality of life and in some cases, leading to mortality. Thyroid diseases are more prevailing in women than men (Dunn and Turner 2016). Equipping thyroid patients with adequate knowledge and awareness about their disease and treatment journey will raise their level of understanding and therefore, raise their self-moral, employ a better adherence to treatment and decrease their overwhelms, anxiety and despair. Despite the advancements of treatment in this filed as stated by Himabindhu (2020) and Lane et al. (2020), many of the previously conducted and

published studies revealed a marginal-to-poor level of knowledge and awareness in general public and among thyroid patients as well. These findings were mostly contributed to poor knowledge sharing.

## 1.2 Statement of the Research Problem

The current study aims evaluating the extent of knowledge and awareness level of thyroid patients by assessing three points: patients' previous knowledge about thyroid gland and its associated disease, their level of their knowledge and awareness as in parallel to their treatment and the benefits of IT solutions in improving their needs. Similar points will be investigated among the treating physicians' as well. An understanding of what and how Knowledge Management system is being utilized to raise knowledge and awareness level among these patients in a particular health complex in Muscat called Diwan Health Complex.

## 1.3 Organization's Background

Diwan Health Complex (Image 1) is a medical-based facility falls under the Directorate General of Medical Services (DGMS), Diwan of Royal Court, among other directorates. DGMS was established by the instructions of the late, His Majesty Sultan Qaboos in 1974. DGMS established two clinics, one in Muscat which was called then as the "Palace Clinic" and the second in Salalah governate. The Muscat clinic has evolved over the years and transformed to a health complex. The Health Complex currently comprises of multiple specialties such as GP clinics, ER, Family Medicine, Internal Medicine, X-ray department, VIP clinic, Gynecology, Dermatology, ENT, Physiotherapy, Medical Co-ordination, Ophthalmology and Cardiology (DGTIT 2017).

Image (1) Diwan Health Complex-Image was extracted from the web for illustration purposes only

## 1.4 Aims and Objectives of the Study

### 1.4.1 Research Aims

The current research aims studying the currently used knowledge management system and its effect on the awareness and knowledge level among thyroid patients in the said health complex. This is by identifying any potential gaps and faulty practices, their causes and

impact on these patients and provide thereafter, suitable and applicable recommendations. Moreover, the study aims providing further understanding for patients and doctors for better practices and excel.

### 1.4.2 Research Objectives

As exhibited in figure (1), the author's objectives of carrying out this study are four and summarized by the following points:

- To analyze the currently practiced knowledge management system on thyroid patients.
- The first objective aims shedding a light on what approach of KM is used to educate and raise the awareness level among thyroid patients.

  To examine the knowledge and awareness level among thyroid patients.

  The second objective holds the purpose and importance of carrying out this study. Some chronic and non-chronic diseases had their share of public awareness such as the Breast Cancer and Diabetes Mellitus, yet; despite the high increase of thyroid diseases in Oman and worldwide, a high population are not adequately aware nor properly acknowledged about it.

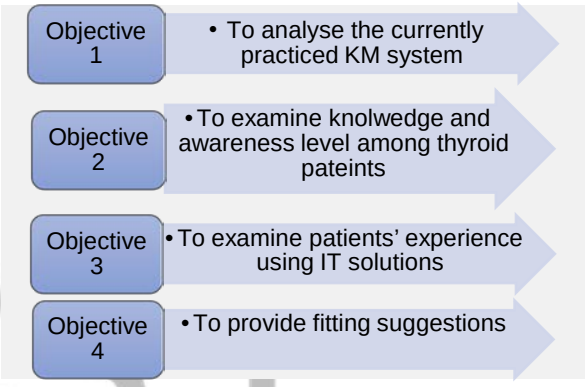



Figure (1)
Objectives of the Study

- To examine patients' experience using IT solutions.

  This objective revolves on identifying the currently used IT mediums/approaches in educating thyroid patients and how patients' experience can be improved using different solutions of information technology. A general discussion of different IT solutions had been given in the literature review; however, the ideal and applicable ones were provided for the medical organization under study.
- To provide appropriate suggestions/recommendations to the entities.

  The last objective involves providing an appropriate analysis and conclusion of any detected gaps or miss-practices that compromise the level of awareness and knowledge of thyroid patients and subsequently provide the fitting recommendations.

## 1.5 RESEARCH QUESTIONS

- How knowledge management as a system, is being carried out on thyroid patients?
- What is the level of knowledge and awareness of thyroid patients in Diwan Health Complex?
- What does the currently exercised KM system lack?

## 1.6 EXPECTED OUTCOMES

- Increase the awareness of thyroid diseases among thyroid patients in Oman.
- A chance where Endocrinologists/Physicians have a better understanding towards the impact of thyroid diseases have on patients' life and how could a good management system eases that impact.

## 1.7 SIGNIFICANCE OF THE STUDY

On the disease level: Thyroid diseases have been categorized by one of the commonest diseases in the world. Despite this fact, Thyroid patients' knowledge and awareness were found to be minor or insufficient. Disease education and awareness leads to early disease detection and treatment. Possessing prior acknowledging and understanding of the disease's related difficulties formulates a solid foundation for patients and their families to walk through the disease's overwhelming stage with steadiness and confidence. The study in hand in its deepest intentions, targets to form an important endeavor in promoting and refining the current practices of knowledge management to this particular group of patients. The study also points to the importance of doctor-patient communication and its crucial role in delivering patients' assurance and support.

On the study level: Until the date of this study's completion, the author could find very limited online published studies of the same topic conducted in the Sultanate. These few studies had selected a specifics area of study. Therefore, the author signifies her study by a rather fuller content, i.e., thyroid diseases and measurement of knowledge and awareness level by selecting governmental health complex for study.

## 1.8 SCOPE OF THE STUDY

- The study covers a specific category of patients; thyroid patients, whom are being treated in Diwan Health Complex-Muscat.

- Data will be collected from patients whose data are available in the currently used Health Information System (HIS) in the above-said health complex. Personnel information will be treated with complete discretion.
- As for the treating physicians, an adequate number of Consultants, Specialists and General Practitioners are intended to be involved in this study.

The study can be also addressed to and benefited from by the public as well. An adequately comprehended knowledge can be generated from this study that would assist them in aiding a relative or a friend facing thyroid disorder and can thereafter, provide the required support.

## 1.9 LIMITATIONS OF THE STUDY

The limitations of this study are few (figure 2), these could be addressed and studied in further future studies.

- The study covers Diwan Health Medical Complex in Muscat governate only. As it has another directorate in Salalah governate, the findings of the current study cannot be generalized to Salalah directorate.
- The study limits its findings on adult patients of thyroid disorders and does not include younger patients (children and adolescents).
- Taking into consideration the set-up and type of the currently studied organization in addition to allocated time for this study, the magnitude of disease coverage was limited to pure thyroid diseases only, i.e., Hypothyroidism and Hyperthyroidism.

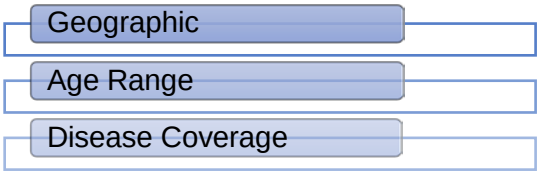



Figure 2: Limitations of the study

## 1.10 STRUCTURE OF THE STUDY

This dissertation's structure is categorized and organized in a sequence manner, each according to allocated chapter to present an easy flow of information demonstration. The first two chapters encompass a general understanding of thyroid gland and all related information followed by a thorough discussion of previous publications concerning similar scope. This is followed by the chapters of Methodology and Project Management. A real life evaluation of the same is conducted to examine the current situation of thyroid patients' level of awareness

and knowledge in a health complex in Muscat. An analysis and interpretation of gathered data is being exhibited in chapter five, to acknowledge any gaps in the currently practiced knowledge system. Recommendations were provided in the last chapter. Figure (3) demonstrates the logical structure of the study's chapters.

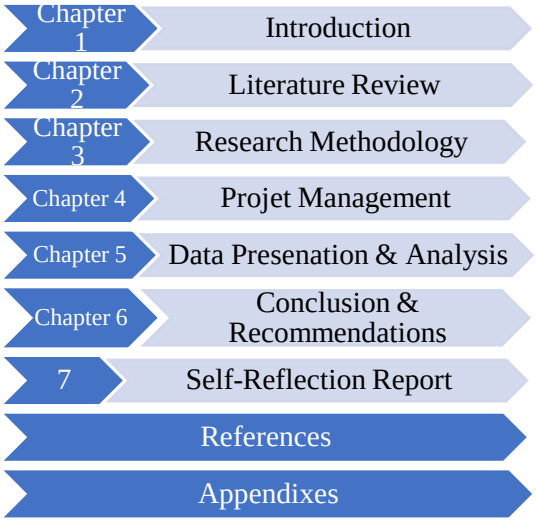



Figure 3: Structure of the Study

### 1.10.1 Literature Review (LR)

To fulfill the desired objectives, the author discussed numerous local and international studies in regard to awareness and knowledge level among thyroid patients. The LR demonstrates previous on-line publications of medical articles, magazines, e-books, journals, medical organizations and hospitals' periodic articles and leaflets. The LR commences with identification of Thyroid gland, its functions, associated disorders and modalities of treatments. The second phase of the LR involves an adequate understanding of Knowledge Management as a discipline, its cycle and how its miss-implementation impacts thyroid patients' awareness level. The third phase of LR explains patients' level of knowledge, awareness and satisfaction of the overall KM in their treating institutes.

### 1.10.2 Research Methodology

In order to execute the purpose of this study, the author sought applying a telephonic questionnaire, as a mean of collecting data from thyroid patients whom are being randomly chosen from the currently used HIS in the said health complex. Telephonic surveys are considered more efficient approach when it comes in saving time, money and validity for

both; the investigator and the respondents. Moreover, the participants' educational level had been taken into consideration. Another structured questionnaire was distributed to the concerned physicians in the chosen health complex.

1.10.3 Project Management

The tasks involved in achieving the study's objectives will be demonstrated by charts/schedules using ProjectLibre software.

1.10.4 Analysis and Findings

For data analysis, the author used Microsoft Excel for data compiling, interpretation and analysis.

1.10.5 Conclusion and Recommendations

Taking into consideration the data findings and interpretations, the author proposed the fitting recommendations that are in favor and of best interest of this category of patients (thyroid patients) in addition to the medical organization.

### 1.11 CHAPTER'S SUMMARY

To precis, this chapter provides an overall view of the followed criteria in fulfilling the requirement of the dissertation's topic.



# CHAPTER 2: LITERATURE REVIEW

### 2.1 INTRODUCTION

This chapter demonstrates in detail three topics which were divided into sub-topics to provide an overall perception of the study in hand. These are:

- Defining Thyroid gland, its functions, related diseases and modalities of treatments.

- Thyroid patients' level of knowledge, awareness and satisfaction.
- Theoretical Framework.

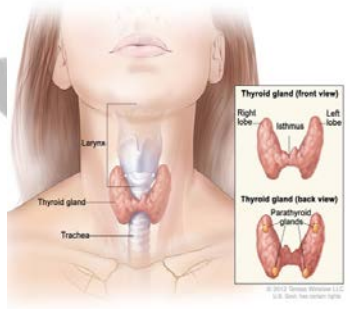
Each of these topics will be divided into sub-topics to provide an overall perception of the main topic.

## 2.2 Thyroid Gland, Its Functions, Related Diseases and Modalities of Treatments

2.2.1 Thyroid Gland:

Thyroid is the chief gland in the human endocrine system (Dev at al. 2016). It takes a shape of a butterfly situated in the human's throat just below the voice box which is known by the "Larynx". Described as a butterfly because it has two wings known by the "Lobes" connected to each other by a small piece identified by the "Isthmus" (Image 2). Even though small in size; about five centimeters and15-20 gms in adults, this gland controls every and each cell of the human's body. Thyroid gland contains multi-numerous vessels for blood flow.

Image (2) Thyroid Gland-Office of Women's Health
(U.S Department of Health & Human Services 2019)




Furthermore, thyroid gland is the largest gland among all endocrine glands, a single soft gland with two lobes on both sides, right and left, rests in the neck. Each lobe takes the shape of a pear and is about 5 cms in length. The lobes mobilize up and down with swallowing and speaking. The gland is larger in women than men and usually weighs between 25-30g (Society for Endocrinology 2018).

Schiera et al. (2021) stated that Thyroid gland encompasses two types of cells:

- Follicular cells: These use the iodine from the blood to make the thyroid gland hormones.
- Parafollicular cells (C Cells): These produce a hormone called Calcitonin which is responsible for controlling the uses of calcium in the human body.

Four small oval-shaped glands located behind the thyroid gland (Image 2), called Parathyroid glands. These are responsible to produce parathyroid hormone which is vital in regulating

Calcium levels in the body. Even small imbalances of calcium can lead to nerve and muscle issues (Harding and Tidy 2020).

2.2.2 Thyroid Functions:

The thyroid gland's job is to produce Thyroid Hormones (THs). These hormones are released into the blood and are being carried out to all tissues of the body as they are responsible for every major function such as the usage of energy (metabolism), heart functions, brain functions, muscle functions and regulating temperature. This stresses the importance of thyroid gland in keeping our body's organs and tissues working just right (Hershman et al. 2020).

The core functionality of the thyroid gland is based on sufficient iodine absorption from our diet. Iodine is absorbed and carried out to the thyroid gland, through the human's body bloodstream, thus, enabling it to release its hormones that are essential for appropriate governess of the whole body metabolism. According to Visser (2018), thyroid gland is responsible for producing and secreting three hormones:

1. Triiodothyronine (T3) – comprises three iodine atoms.
2. Tetraiodothyronine or Thyroxine (T4 ) – comprises four iodine atoms.
3. Calcitonin.



Peeters and Visser (2017) explained that even though the gland produces 20% of T3 and 80% of T4, T3 possess the higher functionality role over the T4. T3 and T4 are made by the follicular cells in the thyroid gland. T4 must be converted to T3 to enable the body using it. The transformation is done by particular enzymes of other tissues such is the kidneys or liver. Any issues disrupting the transformation process will lead to Hypothyroid symptoms (Root Functional Medicine 2019).

Calcitonin hormone at the other hand, is produced by the C-cells, Para-follicular cells. Calcitonin plays an important role in regulating the levels of Calcium and Phosphate which are crucial for the health and maintenance of the body's bones.

Thyroid gland also stores its hormones and releases them when required. Shahid and Sharma (2018) clarified that the requirements are triggered by a small area located in the Pituitary gland in the brain, called the Hypothalamus. Pituitary gland sends a message to the thyroid gland by producing a hormone; thyroid-stimulating hormone (TSH), which is

stimulated by another hormone called Thyrotropin-Releasing hormone (TRH). This acknowledges the thyroid gland of how much hormones are needed to be produced. The magnificence of the complex functionality of both glands understands to operate ideally; when thyroid hormones are low, both TRH and TSH stimulate the gland to produce more hormones. And vice versa, when thyroid hormones are higher than the normal levels, TRH and TSH stimulate the gland to lower its hormones production (Al-Suhaimi and Al-Khater 2019). Hence, any disruption of the pituitary gland's task will affect thyroid gland functions.

2.2.3 Thyroid Diseases:

AlBarzanji et al. (2019) asserted that thyroid diseases are categorized by one of the common endocrine illnesses in the world. It has been noticed that women are riskier than men of having thyroid problems. Morristown-Hamblen Healthcare System (2018) stated that thyroid illnesses can occur for different reasons, however, these illnesses form and aggregate starting by an inflammation which is known by "Thyroiditis". Thyroid gland's diseases are not conditioned by a certain age or gender as they can occur to both genders at any age. However, there are few triggers that can increase the risk of developing thyroid diseases. These involve having a family history of similar problems, having other diseases such as Diabetes Mellitus, Rheumatoid Arthritis, Lupus, & Turner Syndrome, Anxiety, taking highly-dozed iodine medications, women older than 60 years and recurrence -people whom have undergone thyroid diseases or cancers treatments- (Cleveland Clinic 2020).

Tessdale (2016) categorized thyroid diseases as functional which causes Hypothyroidism and Hyperthyroidism and structural; which leads to different cancers, goiters and nodules.

2.2.3.1: Thyroid Functional Diseases:

**Hyperthyroidism**: Hyperthyroidism is a term describes an over-active thyroid gland. In this case, thyroid gland produces extra hormones (T4 and T3) than the body's requirement. Hyperthyroidism condition leads the metabolism to function over the normal rates. Alhawiti et al. (2018) assured that any changes in the thyroid gland activities manifest in almost all the humans' system. Cleveland Clinic (2020) specified the following causatives of Hyperthyroidism:

- Nodules: These can be described as small growths that occur when the thyroid's cells grow in an abnormal way. Thyroid nodules are also known by lumps or swellings. Most of these nodules are benign (non-cancerous) however require periodic surveillance.

Some of these nodules lead to Hyperthyroidism as enlarged nodules forces the thyroid gland to produce extra hormones (NYU Langone Hospitals 2021).

- Thyroiditis: As a term, Thyroiditis refers to a group of inflammation disorders that occur in thyroid gland. The thyroid inflammation leads to hormonal leakage outside the gland which causes Hyperthyroidism in the first stage. With the continuous hormonal leakage, Hypothyroidism (explained in the upcoming section) occurs followed by other types of thyroiditis conditions. Thyroiditis present different types of disorders, each depending on type and classification.
- Excessive Iodine: Fareborther et al. (2019) detected few environmental factors that lead to excessive iodine intake as in consuming overionized salts, dietary supplements containing iodine, iodine-rich animal milks, some seaweeds, water and a combination of all these. Some medications contain excessive iodine too; such as heart medication. High doses of iodine intake precipitate to different thyroid diseases, Hyperthyroidism is one of them.
- Graves' Disease: Bradford (2017) explained that Graves' disease was discovered and named by doctor Robert Graves in 1835. An autoimmune disorder that attacks the thyroid gland and makes the whole gland hyper (overactive). This disease is triggered by the immune system of the human's body which; in normal conditions, protects the body from any harmful invaders such the viruses by releasing antibodies to do the job. Sometimes, the immune system is tricked and mistakenly attacks itself. One of the results is Graves' disease (American Thyroid Association 2017).

Basina (2021) explained that excessive thyroid hormones lead to multiple impairments in the human system. These include mood swings, heat intolerance, sleep disturbance, sweating, increase in bowls' movement (Diarrhea), weight loss (un-intended), abnormalities in heart beats, difficulties in breathing, nervousness (unusual), hands shakiness, inflammations, bulging of the eyes and some skin conditions. These are the general ailments of hyperthyroidism. However, there are further distinguishment in symptoms between men and women. Kandola (2021) elucidated these symptoms as shown in Table (1).

| Women | Men |
|---|---|
| Period irregularities | Enlargement of breast tissue |
| Low libido | |
| Difficulties in conceiving (Pregnancy) | Dysfunction in erectile |
| Health issues for both, mother and fetus (during pregnancy) | Early ejaculation |

| | |
|---|---|
| Raised high pressure & kidney problems (during pregnancy) | Low counts of sperms |
| Extreme hyperthyroidism (Storm) | Low libido |
| Early baby birth | |
| Baby weight (underweight) and heart complications | |

Table (1): Hyperthyroidism Symptoms in Women & Men

**Hypothyroidism**: Hypothyroidism is the contradiction of hyperthyroidism. The thyroid gland in the case does not make sufficient hormones to meet the body's needs. Most researchers observed that hypothyroidism is a commonly wide-spread condition, unfortunately, could be fetal if not detected and treated early. Gaynon (2019) had extensively explained a number of causes that lead to hypothyroidism, major ones are:

- Thyroiditis: These involve group of inflammation disorders such as Hashimoto's Thyroiditis and Postpartum Thyroiditis. Das et al. (2018) and Mcdermott (2020) pointed in their articles that the most common reason of hypothyroidism in adults is Hashimoto's thyroiditis. Hashimoto's disease is an autoimmune condition where the immune system attacks mistakenly, the thyroid gland leading to its destruction and therefore, its ability to produce its hormones. Mincer and Jialal (2020) asserted that women between the age range of 30 to 50 years are more affected by this disease compared to men by a ratio of 10:1. Premawardhana et. al (2017) identified Postpartum Thyroiditis by a thyroid dysfunction that occurs in women in their first year post delivery and in infrequent cases; occurs after a miscarriage. It is common for the thyroid gland to return to its normal functions within 12 or 18 months of the first symptoms occurrence, however, some women may develop permanent complications (Groer and Jevitt 2014).
- Iodine insufficiency and excessiveness: As mentioned earlier, iodine is the impetus functioning factor of thyroid hormones. Its lack and/or excessiveness leads to thyroid hormonal imbalances.
- Doses of thyroid treatment: Incorrect (low) doses of anti-thyroid medication lead to hypothyroidism.
- Non-Functional thyroid gland: In very few cases, thyroid deficiencies (absent/un-developed) occur from birth where infants are born with it. A condition that occurs in 1 of 3000-4000 children (British Thyroid Foundation 2018).

Dew et al. (2018) proved that hypothyroid patients are at higher risks of developing cardiovascular diseases, fractures, dysrhythmias (disturbances in heart rhythm), raised blood pressure levels and affected cognitive functions. Chaker et al. (2017) added fatigue (overall body tiredness), cold intolerance, thick and dry skin, weight gain, change (hoarseness) in voice, muscle cramps, weakness & pain, needling pain in hands and fingers, elevated cholesterol, period irregularities (heavier) in women, slow heart beats, constipation, and slow overall movements, thoughts and speech.

2.2.3.2: Thyroid Structural Diseases:

**Nodules**: Thyroid nodules are an irregular development of thyroid cells that forms a lump in the gland. Nodule is a separate lesion in the thyroid gland. Thyroid nodules' presence in the population is high and common. They can be detected incidentally during a physical examination, when underdoing imaging procedures such as Ultra-Sound, CT (Computed Tomography) scan & MRI (Magnetic Resonance Imaging) and sometime patients themselves can detect a nodule through self-palpation (Tamhane and Gharib 2016). Nodules can present isolated (solitary) or grouped causing multi-nodular goiter (explained below).

Thyroid nodules are classified into two categories; Neoplastic and Non-neoplastic. Shahzad (2018) identified Neoplasm by tissue abnormal growth that occurs as a results of rapid and unregulated cells proliferation. This growth, if persists, becomes a tumor. Neoplasm can be categorized as benign (non-cancerous) or malignant (cancerous). Pemayum (2016) divided both of them in the following manner:

1. Neoplastic (Neoplastic nodules can benign and malignant)
   - Benign: such as Follicular Adenoma (Bailey and Wallwork 2018).
   - Malignant: such as Follicular, Papillary, Primary, Medullary and Anaplastic carcinoma. In addition to thyroid Lymphoma and thyroid metastasis (spread) from other primaries such as lungs.
2. Non-neoplastic nodules:
   - Inflammatory such as: Hashimoto's thyroiditis, Bacterial thyroiditis (acute) and Sub-acute thyroiditis.
   - Hyperplastic: Also known by multi-nodular goiter and Adenomatoid (Wasserman 2020).

**Goiters**: Are an enlargement; growth in size of the thyroid gland (Harris 2021). The first visible symptom of a goiter is swelling (bulge) in the neck. The swelling size ranges from small to very large (Images 3 & 4). Other symptoms involve cough, hoarseness, tightness in the throat, swallowing difficulties and in extreme cases, breathing difficulties (MacGill 2020). MacGill (2020) stated that goiters occur and grow in different types which are:

- Multi-Nodular goiter: A common disease where many nodules grow in the thyroid gland.
- Diffuse goiter: The thyroid gland swells entirely. This type is associated with hyperthyroidism and hypothyroidism.
- Retrosternal goiter: In this case, the goiter grows behind the breastbone and could lead to constriction of the windpipe/esophagus.

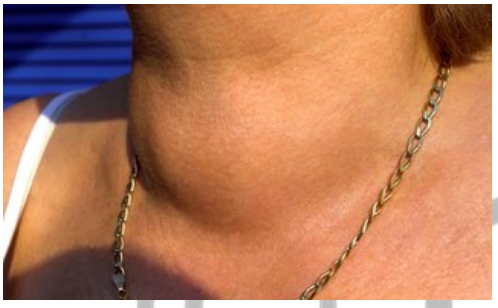


Image (3) *Visible Goiter in the Neck* (NHS Choices 2019)

Image (4) *Symptomatic Goiter* (*The Lecturio Medical Concept Library (2021)*

The most common reason of goiters is attributed to iodine deficiency followed by Hashimoto's Thyroiditis. Other causatives include Graves' disease, Congenital Hypothyroidism and Postpartum Thyroiditis. Hereditary is another contributive factor of goiters. Moreover, other important causatives are nodules or cysts (growths that can be filled fully or partly with fluids or partly solid), which are mostly harmless, however, requires frequent monitoring to ensure their development status (Can and Rehamn 2021). Thyroid cancer is another reason as well. MacGill (2020) added other less common causes such as hormonal changes when females go through in their puberty, pregnancy and menopause. It was also acknowledged that some psychiatric drugs might interfere with thyroid gland function such as "Lithium", excessive iodine and undergoing Radiation therapy as they trigger a thyroid that is swollen.

**Cancers**:

Al-Lawati et al. (2020) stated in their study that thyroid cancer is the most wide-speared endocrine malignancy in the world. It has been ranked as the second common cancer in GCC and second in Omani women. Even though thyroid cancers had been reported approaching high levels for the last four decades, albeit, a percentage of 85% of thyroid

cancer patients are being cured with timed detection and appropriate treatments (Puxeddu et al 2020). Thyroid cancers are those that start in the thyroid gland and begins to grow. Despite the different types of thyroid cancers, most of them are non-aggressive. Compared to men, it has been noted that women are three to four times higher in developing thyroid cancers (Katoh et al. 2015). Most of thyroid cancers types develop from the follicular cells, i.e., Papillary, Follicular and Anaplastic where the Medullary cancer type develop from the parafollicular (C cells). Khosravi et al. (2017) explained the types of thyroid cancers by:

- Papillary cancer: Also called papillary carcinoma/adenocarcinoma. Pambniezhuth et al. (2017) confirmed that this is the commonest form and is in increasing pattern, grows slowly in one or both thyroid lobes, can extend to neck lymph nodes, usually treated by surgery (partial or full removal of thyroid gland) and in some cases; Radioactive Iodine treatment is required.
- Follicular cancer: Also known by follicular carcinoma/adenocarcinoma. The second common thyroid cancer. Follicular can spread to other organs such as bone or lungs. Has a very good prognosis and is similarly treated as Papillary.
- Medullary cancer: Medullary prognosis is not good; however, it is less common. The primary treatment is surgery.
- Anaplastic cancer: Even though it is very uncommon, however, very aggressive. It grows vigorously fast and produces a firm mass in the neck. The American Cancer Society (2019) affirmed that this type spreads fast into the neck as well to other body parts and considered difficult to treat.
- Hurthle cancer: known also by Hurthle cell carcinoma (HCC). Markam (2021) identified this type by a sub-type of the follicular cancer. Even though being very rare, however, categorized to be a very aggressive cancer (Kure and Ohashi 2020).

2.2.4 Modalities of Treatment:

Treatment modalities of thyroid diseases had improved over time, depending on the nature and extent of the disease. The diagnostic tools for each disease and its opted treatment are demonstrated in Table (1), however, no single treatment fits every patient (American Thyroid Association 2019, Baidoun et al. 2019, Himabindhu 2020, Ross et al. 2016, U.S. National Library of Medicine 2021, Walsh 2016).

| Disorder | Diagnostic Testing | Modality of Treatment |
|---|---|---|

| | | |
|---|---|---|
| **Hyperthyroidism** | - Symptoms.<br>- Family History.<br>- TSH, T3 & T4 levels.<br>- TSI test (Thyroid Stimulating Immunoglobulin). | - Beta-Blockers.<br>- Anti-thyroid drugs (e.g., Methimazole).<br>- Radioactive Iodine (RAI).<br>- Surgery. |
| **Hypothyroidism** | - Symptoms.<br>- Family History.<br>- TSH, T3 & T4 levels. | Anti-thyroid drugs (e.g., Levothyroxine). |
| **Nodule** | - Imaging: Ultra-sound.<br>- Biopsy: Fine Needle Aspiration (FNA) | - Removal of thyroid, half (Lobectomy) or full (Thyroidectomy). |
| **Goiter** | - Neck examination.<br>- Blood work-out (e.g., thyroid levels, antibodies).<br>- Imaging: Ultra-sound, thyroid scan, CT & MRI.<br>- Biopsy: Fine Needle Aspiration (FNA). | - Surgery.<br>- Radioactive Iodine (RAI).<br>- Anti-thyroid drugs.<br>- Beta-Blockers. |
| **Cancer** | - Signs & symptoms.<br>- TSH, T3, T4, Thyroglobulin, Calcitonin, Carcinoembryonic antigen (CEA) levels.<br>- Imaging tests: Ultra-sound, Radio-iodine scan, Chest-Xray, CT, MRI, PET scan, FNA. | - Removal of thyroid; half (Lobectomy) or full (Thyroidectomy).<br>- Radioactive Iodine.<br>- Chemotherapy.<br>- Hormone medication (life-time). |

Table (2) Diagnostic Tests and Treatment Modalities of Thyroid Diseases.

It is equally important to monitor patients after cancer treatment periodically to ensure no recurrence.

## 2.3 KNOWLEDGE MANAGEMENT OF THYROID PATIENTS

### 2.3.1 Knowledge Management (KM)

In its simplest definition, Knowledge can be described by information, understanding and facts obtained by education or experience. Knowledge cannot be described by a visible or physical matter rather than intellectual (Bolisani and Bratianu 2018). Knowledge is achieved when only new information is processed, utilized and applied. Therefore, Knowledge can be defined by a collection of experience, suitable information and skilled personnel that offers new experiences and integrations to individuals and organizations. In the current dynamic environment, organizations started utilizing different knowledge resources to enhance their

innovativeness and competitiveness. In addition to human resources and capital, knowledge is the current essential element of production (Mohajan 2017).

Knowledge is categorized by two groups: Tacit and Explicit. Tacit knowledge is acquired and possessed from the individual's own experience that might be difficult describing using simple words because of its nature of subjectivity and cognitivism. An example is a sales person who demonstrates outstanding selling skills. On the other hand, Explicit knowledge is easier to be verbalized, therefore easily interpreted, structured, stored and shared (Gamble 2020). Explicit is more of objectivity and technicality in nature. An example is the organization's data, reports, manuals and regulations (Bloomfire 2020).

In order to bring knowledge into practice for tangible results, it ought to be structurally and systematically managed. This is known by Knowledge Management (KM). Various definitions arouse to comprehensively interpret the definition and meaning of KM. These included: the process of organizing the establishment's information in a coordinated and consistent manner, a discipline of achieving the organizations' goals by the usage and reusage of knowledge and a manner by which; organization can generate value using its intellectual assets. Thus, KM can be identified by an intended, systematic and coordinated approach organizations apply by utilizing their technology, labor, processes, skills and structures for the purposes of adding value and innovation of the produced services (Miller 2020).

KM functionality and success is conditioned by a completion of a set of processes known by Knowledge Management Cycle (KMC). This cycle involves an approach in which, information is transformed into knowledge by the steps of capturing, processing and distributing (Mohajan 2016). Different models of KMCs had rose over the years such as the Meyer and Zack model (1999), Karl Wiig model (1993), Bukowitz and William model (2000) and Heising model (2009) (Ceptureanu 2016). Despite the different models, the core processes remain similar. According to Ceptureanu (2016), Karl Wiig's KMC contains four sequential stages as demonstrated by figure (1) and explained by:

- Building Knowledge: phase of acquiring, analyzing, organizing and classifying knowledge.
- Holding Knowledge: phase of storing the acquired and classified knowledge, physically e.g., folders & reports or digitally e.g., database.
- Pooling: phase of accessing and retrieving the required knowledge using the applied means from the stored forms.

- Using Knowledge: phase of the practical usage of knowledge in various organization's activities such as in the provided services, production activities, routine assignments, decision-making and so on.

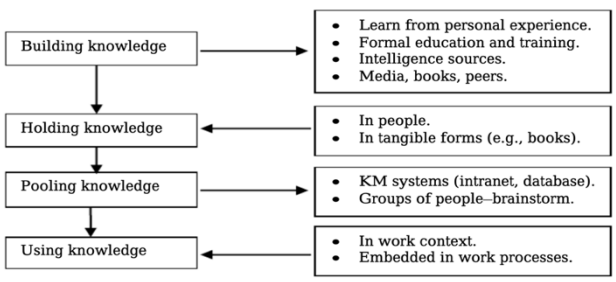



Figure (1) Wiig KMC Model (Mohajan 2016)

2.3.2 KM Benefits to Organizations and Employees:

The dynamic environment of today's business in addition to the continuously transforming processes; organizations were forced to adopt and operate using a knowledge-based approaches (Kordab et al. 2020). The reaped advantages and added values of implementing a successful KM system to organizations and individuals are various (Figure 2). Some are:

i. Sustainability: KM plays major roles concerning multiple aspects in the organization. For instance, the financial aspect as KM is strongly connected to the organizational financial performance. Because of the competitive advantages, a successful organization seeks implementing ideal approaches of KM to increase its profitable performance to up-come other organizations of the same industry (Kavalić et al. 2021). Thus, maintaining its sustainability in the market.

ii. Learning Environment and Cultural Exchange: Valamis (2019) stated that implementing a structured KM forces a learning environment that facilities a continuous learning where capturing knowledge by integrating interior and exterior sources builds a continuous stream of new knowledge. Thus, improving work efficiency and business processes. Moreover, KM system facilitates the usage of a variety of experiences and onboarding ideal expertise for positive organizational outcomes (Saqib et al. 2017). This method supports cultural exchange which should rivet in favors of employees and the organization too.

iii. When it comes to employee's beneficial level, KM ensures easiness and fulfilments for better working environment. These include empowerment; employees are ensured of

making better judgement due to knowledge availability and synchronizing. KM ensures availability of information at the right time and in the right place. Therefore, acting upon a situation or replying to a customer becomes more effective. Likewise, the standardized protocols and procedures involved in KM set an easy guide for employees to follow without the need for brain nor time extra drainage (Agass 2019).


Figure (2) Benefits of KM

In the health sector, the massive need for knowledge and capabilities are always in demand to treat patients individually, each as a unique case (Batra 2020). Healthcare givers are to be continuously trained and prepared for the daily challenges.

Joining the benefits of applying a good KM system in medical facilities and its role in increasing patients' knowledge and awareness, a variety of positive outcomes can rivet in patients' interest and the medical facility as well. Few are explained in the following points:

i. Medication compliance, better life quality and self-management. Following simple protocols such as information toolkits and education programs can provide patients' knowledge and improve their awareness level. This will positively reflect in their medication adherence and enhances their life quality (Seyedin et al. 2015).

ii. Clarifying false conceptions: some of today's patients are "information seekers". These tend to obtain the information they need by a click, e.g., internet and friends. However, the accuracy of sought information/resources remains doubted (Indrasiene et al. 2019). Instead, and through knowledge sharing; health professionals clarify patients' queries and doubts that diminishes any false conceptions and increases their knowledge and awareness consequently.

iii. Better Utilization: Patients whom are provided adequate knowledge and understanding of their diseases and treatment line would not demand additional un-necessary visits/phone calls. This will create a better time utilization for doctors to treat other patients (Relias 2020).

iv. Referrals: A medical facility providing comprehensive knowledge and awareness to their patients will retain their patients. As their satisfaction is ensured; they won't be seeking for external referrals and are likely to stay in the same facility.

v. Attitudes/Behavioral Changes: The outcomes of proper patients' awareness and educational programs reflect positively in their attitudes and behaviors. Their understanding, self-confidence, satisfaction and emotional levels are elevated (Heath 2017). This will clearly show in their lifestyle management, treatment adherence and even in their self-care.

### 2.3.3 KM and Awareness

In parallel to other industries, KM has become a crucial interventive approach in improving health care services. Through and by KM, the possibility of knowledge transfer and development becomes possible and beneficial (Alajmi et al. 2016). Ensuring processes' effectiveness and efficacy demands KM strategies that enables knowledge collection, organization and dissemination using appropriate IT tools. In addition to achieving healthcare excellence and fostering innovation, facilitating and adhering a streamed knowledge flow enables healthcare providers to enhance patient's experience (Haughom 2014).

Being aware of a disease and its symptoms plays an important role in early diagnosis and management. Individuals and societies whom are being continuously acknowledged and educated about diseases are more likely to undertake the necessary precautions and the required medical check-ups. Lack of awareness is highly connected to absence of information, inaccessibility to information or even imprecision of information. These influence people negatively in appreciating the importance of seeking health care or taking preventive measures (Roche 2021).

Mabuza et al. (2015) proved in their study covering 264 hospitalized patients that in-patient awareness (e.g., reasons for admission, associated risks of admission refusal and diagnosis procedures) provided by the physicians through proper communication increases patients' compliance to provided treatment while hospitalized and in the subsequent

visits/consultations. Good communication involves practicing certain principles such as listening, sharing empathy and focusing on patients' verbal and non-verbal behaviours (Ranjan et al. 2015). This reflects the importance of information flow and communication skills administered by the physicians to their patients.

As the health sector is service-based industry, communication is the key of information sharing. Medical organizations seek improving their communication with their staff as well as their patients through the implementation and use of knowledge management (Batra 2020). In order to increase patients' awareness, organizations adopt IT solutions as a process of knowledge sharing as a part of complete KM cycle. After conducting a study on 50 admitted patients in the Cardiac Rehabilitation unit, Federico II University Hospital, Italy, Conte et al. (2021) asserted that the patients' awareness level about the risk factors related to their diseases was low. The reasons were contributed to lack of technological usage and practitioners' training.

Thomas et al. (2017) conducted a study on patients whom had been admitted and discharged for the same pursue and concluded that a percentage of 77% of these patients did not understand their diagnosis and only 27% knew the details of their medications. After implementing a different knowledge sharing mechanism; providing information through leaflets, the awareness level of discharged patients had raised to 100%.

Despite the different levels of severity and chronicity of any health issues, they impact the individuals' wellbeing, social life and even their professional life (EuroMedInfo 2021). These contribute negatively on the individuals' psychological wellbeing. Practitioners sometimes dis-acknowledge and underestimate these effects (Kock et al. 2014). Practitioners' lack of knowledge reflects on their practices towards their patients. Adhering to KM processes of knowledge acquiring (knowledge building) equips health providers with the required knowledge and subsequently improves their ability and skills to provide the needed knowledge and awareness to patients.

When the organization practices a correct knowledge management processes internally, its results pay off externally. Thus, if the organization's structure does not support KM, officials will not be able to manage the organizational knowledge to enhance its performance nor the provided services (Sayyadi 2020).

Medical professionals and healthcare providers can disseminate patients' knowledge and awareness through different means such as investing in and executing awareness campaigns, partnership with other hospitals and health establishments, support and run programs that provide medical screening, education & counselling, publish different materials (magazines, leaflets, newsletter,etc.) and developing websites provides updated information related to diseases, diagnostic check-up and treatment modalities (Heath 2017, IISD 2019, Schelkun 2020).

Awareness lack is not limited to worsening the patients' conditions, it also destroys their lives' quality and deranges the overall health outcomes. Considering the current era of advanced technologies in health industry, awareness lack represents a stigma.

2.3.4 Thyroid Patients' Knowledge, Awareness and Satisfaction Level

Patients' experience involves interacting with their health care provider/system at different levels such as proposed treatment by physicians, nurses' care, pharmacists medicine dispensary and so on. Optimizing a patient-focused experience means understanding and fulfilling patients' needs and expectations (AHQR 2016). Patients' awareness and satisfaction levels are highly connected to patients' experience. Alemu et al. (2021) confirmed that patients' awareness takes place when they are being informed and fully acknowledged about their medical status in addition to the offered treatment solutions. Patients' satisfaction and awareness levels are an important parameters to measure health care quality level (Umoke et al. 2020).

The cross-study of Alotaibe and Almousa (2018) of evaluating the awareness level of thyroid diseases among Riyadh population covering individuals older than 18 years old had showed that 6.6% out of 870 participants did not know what thyroid gland is. As for the rest, they have provided answers reflecting some knowledge about thyroid gland diseases and their symptoms. Alotaibe and Almousa (2018) concluded that health policy makers should consider conducting more effective education sessions as a mean of increasing knowledge among the population. This view was supported by Almuzaini et al. (2019) who conducted an on-line survey on 367 adults in the same country, Saudi Arabia. Their study reflected an insufficient knowledge of thyroid diseases among the participants as the majority of their respondents reflected poor knowledge of the same. Both studies however, had examined knowledge and awareness of the public with no involvement of thyroid patients. It is worth

mentioning that both studies contributed the knowledge deficiencies to the lack of educational programs and awareness campaigns.

Conversely, a qualitative interview study aimed assessing the management of hypothyroidism patients has been carried out by Dew et al. (2018) on health professionals involved general practitioners, pharmacists and nurses. Their study has noted an inadequate knowledge among those health professionals manifested in medications interactions (pharmacists) and the attitude of under-estimation of hypothyroidism management by the general practitioners and nurses. Despite the findings, the limitation of their study is the non-coverage of thyroid specialists and endocrinologists as these are the prime care providers of thyroid patients.

In the same vein, the cross-sectional study of Goel et al. (2017) performed on 244 OPD (out-patient department) thyroid patients in India confirmed their lack of knowledge in addition to their incorrect practices and wrong beliefs about the disease. Their lack of knowledge was mostly contributed to unqualified physicians in their treatment of hypothyroid patients and patients' pursue of knowledge acquirement through internet. Their study has stressed the importance of patients' education to improve the therapeutic compliance and results. The only limitation of their study was the coverage of one disorder of thyroid diseases, hypothyroidism. The results therefore, may not be generalized to all thyroid patients in the same hospital.



This view was supported by Khanelwal et al. (2017) in their cross-sectional study covering 250 hypothyroid patients in New Delhi. Their study has reflected that the majority of the patients lack the basic knowledge of their disease, possessed false prejudices regarding diet and treatment and had a significant poor treatment adherence. These were contributed to low public health awareness. The one limitation of their study is covering one disorder of thyroid diseases, Hypothyroidism.

McCormick (2015) carried out a more specific study aimed exploring female thyroid patient's treatment experience in addition to the doctor-patient relationship through an on-line chat survey. Her study has pointed out a level of dissatisfaction among the majority of participants in their treatment experience due to cultural differences and improper communication in their doctor-patient relationship. Those remained unsatisfied despite changing from one doctor to another. The key problems of this study lay in the bias of the researcher as she was a thyroid

patient, inadequate number of participants as the study covered only 16 female patients and the covered age range, i.e., less than 35 years old.

Muthukumar and Mohanraj's (2019) study has reflected a contradictive arguments. Their questionnaire survey among 83 adolescents and females in a dental college in India, reflected a percentage of 83% positive awareness about thyroid diseases. These possessed an adequate knowledge and understanding of the effects and risks related to thyroid diseases. The author however, relates the knowledge adequate level among the participants to their education level as they were medical college individuals.

A broader perspective has been adopted by Najeddine et al. (2020) in a survey covering 840 thyroid patients in the US to understand the lacks and the overlooked reasons that led to thyroid patients' negative experiences. The results of their survey had emphasized several reasons ranged from physicians' lack of support, the process of changing doctors due false/improper/late diagnosis and treatment, patients' low adherence to prescribed medications due to their ignorance and lack of knowledge of the same, patients' pursue of information through different websites, family members and friends and the un-updated digital information. There are few limitations of this study, however the most important limitation was the interpretation errors. The respondents' answers were not as anticipated by the researchers and required a lot of cleanup prior usage. Other limitations lay in respondents' bias towards the concerned institution to whom the survey was conducted on behalf and the non-implementation of a proper analysis software such as SPSS, Stata, etc.

In the same path, Rai's et al. (2016) work on assessing knowledge and awareness level in their cross-sectional study covering 250 females aged from 18 to 50 years in India, resulted in patients' knowledge inadequacy of thyroid gland or their related diseases. More than half of those females were presenting thyroid symptoms, however remained unaware of their disease. Their study has failed in addressing male thyroid patients, nevertheless, this could be related to the fact that females are at more risk of developing thyroid diseases.

Serin's et al. (2016) study on evaluating the same was more comprehensive compared to the above explained studies. Their study lasted for a month and covered interviewing 100 patients whose age ranged between 18-75 years and were admitted or an OPD patients in Umraniye Training & Research Hospital-Istanbul. All disease' related characteristics such as disease type and phase, disease treatment, gender, education level and applied food

regimen were involved. Their study has revealed a low level of knowledge and awareness among the participants in regard to their disease and treatment. The researchers contributed this ignorance to lack of physicians' effort in providing the needed awareness and knowledge. This study in particular signifies an undeniable proof of miss-used or improper knowledge sharing in providing the required knowledge and awareness among thyroid patients despite the facility set-up.

In a contrary manner, the cross-sectional study carried out by Treki et al. (2020) covering 288 women aged between 18-66 in two areas of Selangor, Malaysia, in pursue of evaluating the knowledge and awareness levels of thyroid disorders resulted differently. Their study aimed understanding if there was a link between socio-demographic factors and thyroid diseases' knowledge. The data analysis has noted that the majority of women had a good level of knowledge and awareness and their living area has not affected their knowledge level. However, the study was restricted to one influencing factor; socio-geographic, and failed covering the complete intended size sample in both areas.

2.3.5 Enhancing Patients' Experience Using IT Solutions

Taking into thought the results of previously explained studies, it is paramount increasing patients' knowledge and awareness of their diseases as well their treatment modalities. Modernized treatment modalities with no proper knowledge management execution does not serve the purpose. One of knowledge management successful factors is the ability of implementing and using knowledge considering the most appropriate tools and approaches. The taproot mechanism of doing so is by investing the right technology (Simmons and Davis 2019). Choosing and implementing the appropriate Information Technology (IT) solutions will provide the ideal assistance that patients need. Providing the right knowledge in the right time using the correct tools is the core of knowledge management (Shahmarodi et al. 2017). The current innovation of both fields; technology and science, has enabled a variety of patients' care possibilities. Few of them are explained in the following points.

- Health Information System (HIS): Alotaibi and Federico (2017) asserted that in-cooperating a health information technology has its advantages in reducing errors caused by doctors or manual processes, enhancing medical facilities co-ordination and centralizes patient's data for better data tracking.
- Hospital's Website: Pooling Knowledge is one of the fundamental steps in knowledge management. By going virtually, information is being made available to patients.

Establishing a hospital/health institute's website that disseminates medical information of diseases can make patients at ease when seeking answers. In the same line, these websites can be designed to generate and deliver educational programs from which, time and effort are successfully managed for both; physicians and patients. Incorporating e-learning and online concrete information confirms knowledge availability and accuracy, improves information access and enhances patients' satisfaction (HealthTechZone 2018) and (Shahmoradi et al. 2017).

- Telephonic Support: A successful patient's experience involves clarity and a good level of calmness (Gustafsson et al. 2019). Providing these services can be done through telephonic calls in addition to help-lines as they had proved efficacy in increasing patients' satisfaction level and in boosting them to take care of themselves (Veliyathumalil 2017).
- Video Conferencing: A good patient's experience involves providing a personalized feel-like treatment in addition to a faster response. One of the optimal enhancements in health care is video conferencing. Monitoring, knowledge sharing, advice, results' discussion and counselling can be successfully delivered to patients while they are at their homes. Not to mention an important added value, the enhanced doctor-patient relationship (Earon 2017).
- Usage of Deep Learning and Artificial Intelligence (AI): Taking health care services to a higher level, the interference and application of deep learning and artificial intelligence technological advancements in the hospital's processes will lead to a faster and more convenient patient's experience, thus, a better awareness and satisfaction. These technologies can analyze a Computed Tomography (CT) scan for instance, 150 times faster than humans (Majidfar 2017).
- Health Applications: The development in technology has enabled a variety of health services through various applications installed in mobile phones. Mobile devices are an inseparable gadgets to most people. Taking into thought the current pandemic of COVID-19, many treatments and follow-up visits had been cancelled or post-ponded excluding the emergency cases. Even though limited, these applications come in hand. For instance, they measure and monitor glucose (sugar) levels in the blood which are a definite aid for diabetic patients (Earon 2016).

## 2.4 THEORETICAL FRAMEWORK

2.4.1 The Problem:

Until now, patients' knowledge and awareness present a valid cause for study because it still proofs existing hiatus worldwide. The realm of KM and its important role in patients' awareness is sometimes disregarded or miss-practiced by many medical facilities and health professionals as proven in several studies such as (Goldfarb 2021, Khandelwal et al. 2017, Serin et al. 2016).

2.4.2 The Rationale:

Establishing an effective health knowledge and awareness system is the key role in delivering a successful healthcare. Producing highly-qualitied decisions regarding patients' diagnosis, care, support and treatment is entailed with empowered medical professionals, patients and communities with suitable knowledge, skills and tools (Santra 2018). Despite the growth of thyroid diseases and its treatment modalities, a magnitude spectrum of low awareness level among patients still exists worldwide. Many lacunae of this regard were confirmed by many studies such as the one conducted by Kasthuri (2018) where he identified several lacunae including inadequate knowledge, lack of healthcare accessibility, shortages of manpower, lack of educators, affordability (costs) and the lack of accountability. Al-Saadi et al. (2019) had furthermore stressed that the healthcare givers are the most significant criterion, from patients' point of view, in evaluating the quality of given care. Adhering to patients' rights of knowledge and awareness promotes a better relation between the patient and the healthcare giver. The power of patient's education and awareness has a significant role in the quality of delivered care, therefore, increased satisfaction level. Keeping patients' involved in the diagnosis and the line of treatment options enhances their adherence and boosts their self-confidence (Alemu et. al 2021).

Other significant studies had also confirmed that patients' awareness of their disease plays an enormous role in their health conditions. A study carried out in Bangkok-Thailand by Taibanguay et al. (2019) on 120 Rheumatoid Arthritis patients has reflected that patients' education plays a crucial role in their medication adherence. Their study has concluded that providing patients with their disease leaflets, regardless of direct/indirect counselling, can equally improve their adherence. Another supporting quasi-experimental study carried by AO et. al (2020) on 580 Hypertensive patients in Nigeria examining the same has reflected that clinical education is highly linked with patients' medication adherence. Fulfilling the

requirements of awareness and knowledge to patients can positively enhance the health status and vice versa.

Health awareness and knowledge is a collaborative strategy that involves two variables; the medical facility/health provider and adoption of ideal KM approaches by employing suitable IT methods. In addition to transferring knowledge and employing ideal resources, successful medical organizations understand that patients' awareness is crucial in increasing their confident, support and enthusiasm. The two-variables' strategy aims understanding patient's concerns, keeping them informed and is an attempt to change their perspective and behavior to better outcomes (Merck 2018).

Poor health awareness leads to expensive costs that are not adversative sometimes. Martinelli (2017) specified serious diseases and fatalities, decrease in productivity which can lead to turnover, psychological disorders, e.g., Depression and deranged social life among these costs.

Koren (2016) further stressed that patients' comfort and adherence to their medical regimens are connected to the information provided to them. Being insufficiently informed results in non-compliance to given treatment or doctors' advises. Patients should be prepared and adequately informed to better manage their diseases. The benefits of knowledge sharing leads to enhanced self-esteem, increased care satisfaction and decreased anxiety. Patients who clearly understand their diseases and the aims of carrying particular tests or treatment are more likely to have greater outcomes.

Skarbalienė et al. (2019) pointed to the important role communication and interpersonal skills play in delivering a high quality healthcare. Establishing a successful therapeutic plan between the doctor and his patient means establishing a good doctor-patient relationship that involves sharing knowledge, feelings and perceptions in regards to the disease. The psychosocial support is guaranteed in the process as well.

When it comes to medication, patients' knowledge about their medicines are highly connected with health professionals and the organization's system. A facility-based cross-sectional study was carried out by Wogayehu et al. (2020) in Chencha hospital, Ethiopia to assess patients' knowledge of the dispensed medications. Their study has covered 403 patients using observational and face-to-face interview method. The study had confirmed unsatisfactory levels of knowledge among the participants resulted from many factors such

as number of hospital visits, educational level and perception of disease's severity. The study has emphasized that pharmacists need to put these factors into account when dispensing medications. There are few limitations of their study, the major ones are the nature of the study, being a cross-sectional study made it unable of creating the relation between dispensed medications and the independent variables. Another limitation was the usage of exit-interview method in assessing the patients' knowledge which limited assessing complete knowledge of medication usage at their homes.

Saqib et al. (2018) concluded many defaults in that regard in their semi-structured interview study covering 19 patients and 12 healthcare professionals in a teaching hospital in Pakistan. The results of their study had reflected certain lacks presented in doctors' unprofessional behavior, lack of attention and time allocated for patients, lack of special medicines' labelling for the illiterate patients and the daily workload. Their study has confirmed the need for appropriate patients' education in addition to counselling regarding their medications. Despite the findings, the study demonstrated few limitations. The most important one is the major coverage of illiterate participants whom were originated from a poor socio-economic environments.

The above explanation reflects the significance of conducing such study. The faults, malpractices and mis-conceptions in this area are many. The need of establishing and materializing a solid knowledge management system is must to conquer the increasing rates of diseases, increase the therapeutic benefits and upraise the patients' knowledge. Figure (3) reflects the inputs and outputs of patients' awareness and knowledge.

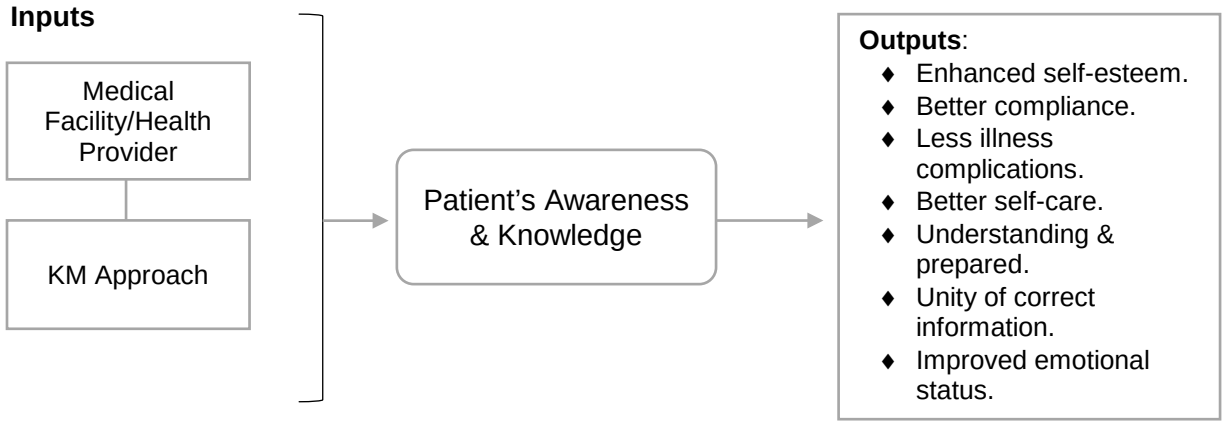



Figure (3) Theoretical Framework of the study

## 2.5 CHAPTER'S SUMMARY

To summarize, thyroid diseases are witnessing a remarkable increase globally. The modalities of treatments are available and manageable in most thyroid diseases. A full patients' involvement, awareness and understanding about their disease are conditioned by proper knowledge providing and perception. Knowledge management success results when an organization is capable of utilizing its knowledge sources and assets effectively and efficiently (Jennex et al. 2014). One of the key steps of a successful knowledge management process implementation is knowledge using. It does not only improve the organization's creativity and performance, but also reaches to customers' awareness and satisfaction (Ahmed and Karim 2019). As the challenges are various in all working fields, the lack of information sharing in healthcare institutes effects different clinical decisions (Alsaqqa 2020). This subsequently effect the quality of services provided to patients. Most of the above discussed studies reflected defects in knowledge using and/or sharing from health providers to the public and patients in particular which have compromised their level of awareness and knowledge. Provided understanding the causatives, appropriate measures can be chosen and implemented to resolve the defects and fill the existing gaps.

# CHAPTER 3: METHODOLOGY

## 3.1 INTRODUCTION

This chapter provides a comprehensive reflection of the used mechanism of carrying out this study. This section will cover all aspects related to the study type, data sources, sampling techniques, chosen methods of data collection and the statical approaches used for data analysis.

## 3.2 RESEARCH TYPE

The aim of this study is to evaluate the level of awareness and knowledge among thyroid patients whom are being treated at Diwan Health Complex in Muscat. The study is descriptive in nature, sought data from both parties; patients and doctors. The study inhibited a mixed approach of quantitative and qualitative data. The rationale of choosing this approach is the fact of its usefulness in an improved understanding by integrating various ways of reasoning (Daniel 2016). Using this approach has its advantages in understanding and clarifying any discrepancies between the results of both; quantitative and qualitative findings (Wisdom and Creswell 2013). The derived results from using mixed approach consolidate un in-depth method of information examining and explaining.

### 3.3 DATA SOURCES & COLLECTION SPECIFICATIONS

Primary and Secondary data had been employed to achieve the objectives of this study. The primary sources involved a telephonic questionnaire on thyroid patients and a manually distributed questionnaire to the physicians in the chosen health complex-Muscat. The rationale of choosing a telephonic survey for patients has its advantages in reducing interpretation errors that might result due to participants' education levels, obtaining immediate responses, faster method as compared to manual questionnaire distribution and is considered to be an effective cost management method (Suttle 2019). Moreover, considering the current impacts of COVID-19 presented in social distancing as a precautionary measure and decreasing patients' routine follow-up visits in the chosen facility had forced implementing this method. On the other hand, the author preferred the manual distribution approach of physicians' questionnaire due to their number as they were 11 in total. Sufficient time was granted to them considering their clinics' schedule. Both questionnaires were three-sectioned, each encompassed questions of different themes to fulfil the desired objectives.

For patients, the author used one of the most common sampling techniques in participants' selection; the Probability-based sampling. A method that is random as each chosen member represents an equal opportunity of being selected and is also bias-free (CloudResrach 2021) and (Crossman 2020). All physicians concerned in thyroid patients' treatment were involved in the survey.

Taking into thought the overall sample accuracy and error calculation, Martinez-Mesa et al. (2014) and Sciencebuddies (2021) stated that decreasing the percentage of error margin means increasing the sample size. Therefore, to understand the error margin of a sample size, the author applied the formula $1/\sqrt{N}$ where N represents the sample size. Therefore, if an intended sample size is 150, as in this study; the error margin is 0.081 (8.1%). The sample were selected from the registered thyroid patients in the currently used health information system (HIS) in the said medical organization. The author used the parallel convergent design in data collection in which; both surveys were conducted concurrently, data analysis was done separately and results were interpreted by combining both datasets (NSU 2021) and (Piccioli 2019).

The secondary sources had a substantial share in supporting and critically evaluating the author's arguments throughout the study. These involved previous publications in the form of journal articles, e-books, medical periodical papers, dissertations, health organizations,

medical magazines, leaflets and so forth. A clear view of the current study's data sources & collection methods is shown in figure (4).

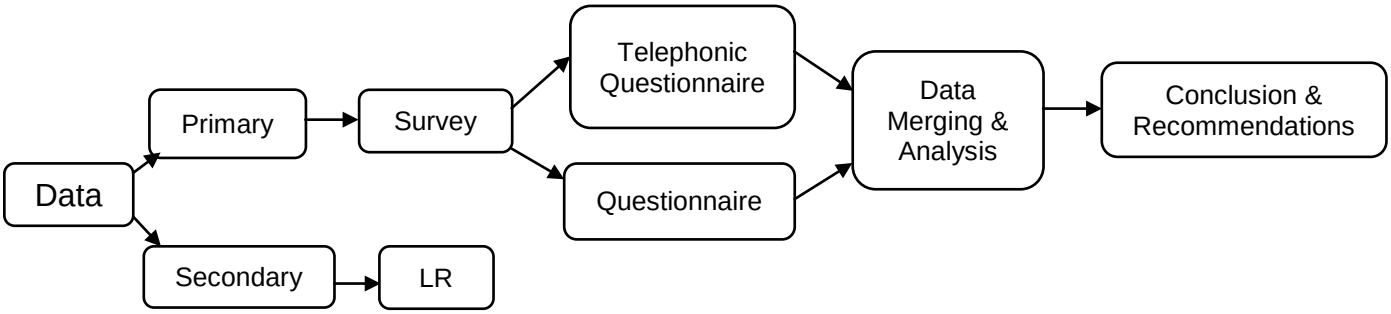



Figure (4) Data sources & collection methods

## 3.4 SAMPLING CHARACTERISTICS:

Thyroid diseases divaricate into several types, considering the given time and capacity; the author has selected covering the following characteristics of thyroid patients.

### 3.4.1 Sample Size:

The author has covered 150 thyroid patients whom were registered and receiving treatment in Diwan Health Complex during the period from 2016 to 2020. These were randomly selected from the currently used health information system (Al Shifa) in Diwan Health Complex. Moreover, a number of 11 physicians had participated in the survey.

### 3.4.2 Inclusive Criteria:

Patients: Omani adult thyroid Patients i.e., 18-54 years old of both genders, participants are of pure thyroid diseases (Hypothyroidism and Hyperthyroidism).
Physicians: All physicians treating thyroid patients in the chosen complex.

### 3.4.3 Exclusive Criteria:

The author has excluded non-Omani thyroid patients and patients associated with mental disorders and malignant (Cancer) thyroid diseases.

## 3.5 VALIDITY & RELIABILITY TESTING

Heale and Twycross (2015) defined Validity and Reliability as notions used to evaluate the quality of a research. Validity relates to the used measure's accuracy where reliability relates to the used measure's consistency (Middleton 2019). Furthermore, Validity is to assess whether the used instrument in a research, has served its role in measuring the

requirements. Reliability on the other hand, also known by “Dependability”, evaluates the measures that are used to gauge precision and consistency of a research (Mohajan 2017) and (Taherdoost 2016).

For Validity testing, the author used Face validity and Content validity. As a term, Face validity refers whether the test (questionnaire, interview, etc.) appears, from the surface, to measure what it intends to (Johnson 2013, McLeod 2013, Oden 2021). The author used the Likert scale to measure the face validity. Both questionnaires involved in this study were subjected to senior staff of different departments in the selected organization, i.e., Research & Planning department, one Senior Specialist in Internal Medicine, medical officials and the assigned Supervisor.

Content validity on the other hand, refers to the degree and extent the test items are being represented. In other meaning, all required contents are being covered in the designed questionnaire to fulfil the intended objectives (Rusticus 2014). Both questionnaires were sectioned into three parts:

1. Demographic information for thyroid patients and Professional information for doctors.
2. Thyroid Patients’ level of knowledge and awareness – from both perspectives (patients & doctors).
3. Enhancing thyroid patients’ knowledge and awareness using appropriate IT solutions - from both perspectives (patients & doctors).



Reliability testing takes place when the test scores are consistent and stable. For a test to be valid, it should be reliable, the essence of making better conclusion and judgement. To ensure reliability of this study, the author used Microsoft Excel and SPSS which are described to be a highly consistent, accurate measures and approved by the concerned college (MEC).

## 3.6 DATA ANALYSIS

Hinshelwood (2018) stated that data analysis is an approach that involves recording, analyzing and presenting data findings for easy interpretation and thereafter, decision-making. As indicated earlier, the study followed a mixed approach to fulfill the pursued objectives. However, before subjecting the data to analysis, the data was checked and reviewed to detect any outliers. The quantitative data was handled using Microsoft Excel and

SPSS whereas the qualitative data was analyzed and interpreted narratively. The collected data was organized and presented graphically to attain easy comprehension.

## 3.7 Legal, Ethical and Social Standards

The key role of this study is fulfilling the desired objectives through the above-described methods. Data collection was obtained from patients and doctors, whom are receiving treatment/working in a governmental medical facility in the Muscat-Sultanate of Oman. The author holds herself full accountability in maintaining the respondents' discretion, non-maleficence, health and dignity. Ethical factors are an important aspect ought to be considered and maintained while conducting a research because dealing and interacting with participants means they are to be respected, un-harmed and protected (Jena 2020: 254). The respondents' participation in this study was willingly without any sort of coercion or persuasion practiced by the author. The author acquired an official consent from the top management of the said organization where a written consent was provided to conduct the required survey for data collection. This was provided after completing a sequence of formalities required by the "Research Ethical Committee" of the same organization. This is to ensure that legal considerations are intact and the data collection process is genuine.

## 3.8 Chapter's Summary

The Methodology chapter reflects a detailed explanation of the most important part of the study. It represents a complete cycle of the methodological details of the study (Jansen and Warren 2020). The cycle involves defining the problem, research's method, data collection techniques, adhering to ethical standards, analyzing collected data through proposed tools/software, data interpretation and providing the discussion and conclusion.

# CHAPTER 4: PROJECT MANAGEMENT

## 4.1 INTRODUCTION

Bahadur (2020) stated that achieving any projects' objectives requires a plan of employing appropriate processes, knowledge, experiences, personnel, skills and methods. This approach is known by Project Management (PM). In this chapter, the author highlights how the study tasks were planned for a successful completion in a timely-manner approach using ProjectLibre software.

## 4.2 WATERFALL PROJECT MANAGEMENT

The author adopted the waterfall project management approach in managing her study, a straightforward method of project management. The phases of the study were sequential where a new phase is commenced after the completion of the previous one (Dillon 2021).

## 4.3 PROJECT'S SCOPE

The author has provided a detailed explanation of the targeted scope in this study (Please refer to Chapter One).



## 4.4 COMMUNICATION PLAN / MEDIUM

A successful project management is highly stipulated with a successful communication between the involved members. Foong (2021) referred that effective communication is vital during the whole projects' cycle, from the beginning until the last phase. Zulch (2014) has further added; communication is crucial in collaborating the important elements of a project, such as time, scope, costs and quality.

Executing the current study (project) was based on a clear and mutual agreement and understanding between the author and the assigned supervisor. A smooth flow of teaching, coaching and knowledge exchange were practiced. Each phase of the study was pre-coordinated and planned to avoid any uncertainties. The plan involved an official virtual meeting on weekly basis though Microsoft-Teams application as a prime method of communicating. However, e-mail exchanging and message texting were practiced as well. The medium of meeting was set virtually due to the inevitable circumstances of COVID-19

pandemic. Each week involved a discussion of the work progress, reviewing, directing and lots of boosting.

## 4.5 PROJECT'S RISK PLAN

Risks come with a verity of effect and are anticipated and inevitable in most projects. Understanding, classifying and treating these risks are crucial for project's completion and success. Eliminating and minimizing the effect of the associated risks are subjected to an effective risk management for each phase of the project (Rahman and Adnan 2020: 167). And so, incorporating ideal mitigation strategies is must to reduce the threats that might halt or endanger the project's process or success (Kivisiaari 2019). Depending on the anticipated and foreseen risks, a set of options and solutions are to be standing ready for immediate execution. Few risks were anticipated in this study and are explained in Table (3) along-with their mitigation plan.

| Risks Anticipated | Probability | Impact | Mitigation Plan |
|---|---|---|---|
| The major risk is the delay or incomplete data collection due to the temporary suspension of work full capacity as a result of COVID-19 measures. | High | High | - Double and speed the effort in allocated time to ensure completion.<br>- Involve trusted personnel in data collection. |
| Humble knowledge in new and/or complex statical analysis/softwares. | Medium | Medium | - Attend the necessary educational lessons in advance, virtually and from statistics professionals for faster comprehension.<br>- If necessary, usage for alternatives without compromising reliability. |
| Delay of weekly meeting with the supervisor. | Low | Medium | - Use other means of communication to maintain a non-stop information/educational flow and tasks' completion/clarification advice.<br>- Subsequent meeting scheduling to compensate the missed meeting, however work process continues. |

Table (3) Mitigation Plans of Associated Risks

## 4.6 PROJECT'S WORK BREAKDOWN STRUCTURE (WBS)

One of the powerful and common tools used in PM; is the Work Breakdown Structure. WBS breaks down the major tasks into sub-tasks in project management, a commonly-followed and implemented technique to ensure productive results (Luijbregts 2020). Every job/work involved in WBS is clearly identified such as labor, costs and time (Burghate 2018:1). The

tasks (chapters) of this study were however; not divided into sub-tasks as each task forms an integral unit that requires a solely and strictly timed-frame approach for completion. Image (5) depicts WBC of the current study.

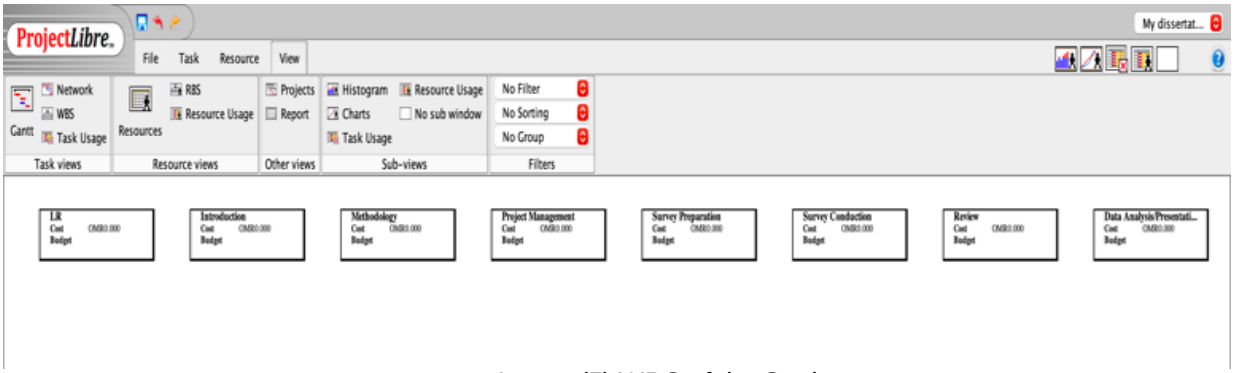
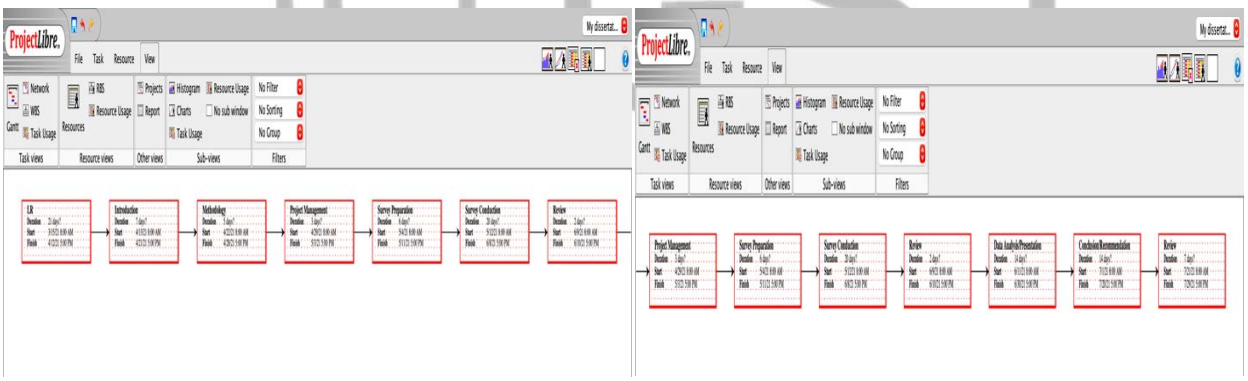



Image (5) WBC of the Study

## 4.7 PROJECT'S NETWORK DIAGRAM

A project network diagram represents a graph depicting all the tasks' activities, their duration, sequence and relationships. It expresses the tasks and events chronology. Moreover, it is a tool that maps the whole work of a project (Sebastian 2021) and (Wrike 2019). Images (6) & (7) exhibit the network diagram of the current project (study).




Images (6&7) Network Diagram of the Study

## 4.8 PROJECT'S GANNT CHART

No matter how sized a project is, Gantt Charts play a massive role in simplifying their tasks. As stated by the Association for Project Management (2021), Gannt Charts provide a visual presentation of the entire project, displays all phases of the project and their timelines, show the relationships between activities with their dependencies and identifying the critical paths as well (O'Loughlin 2016). Images (8&9) exhibit the tasks involved in the current project (study) and the time frame for their completion.

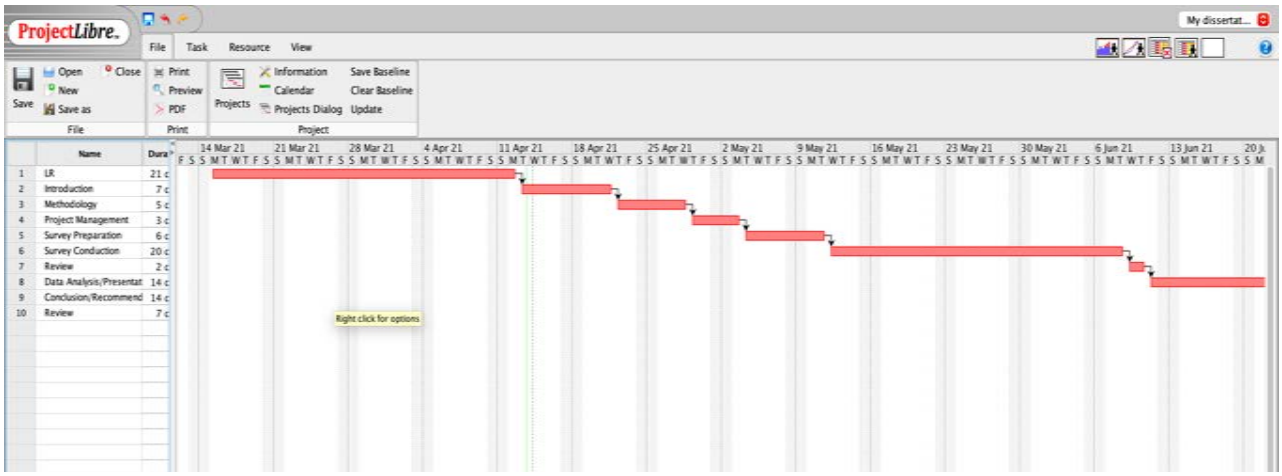



Image (8) Gantt Chart of the Study

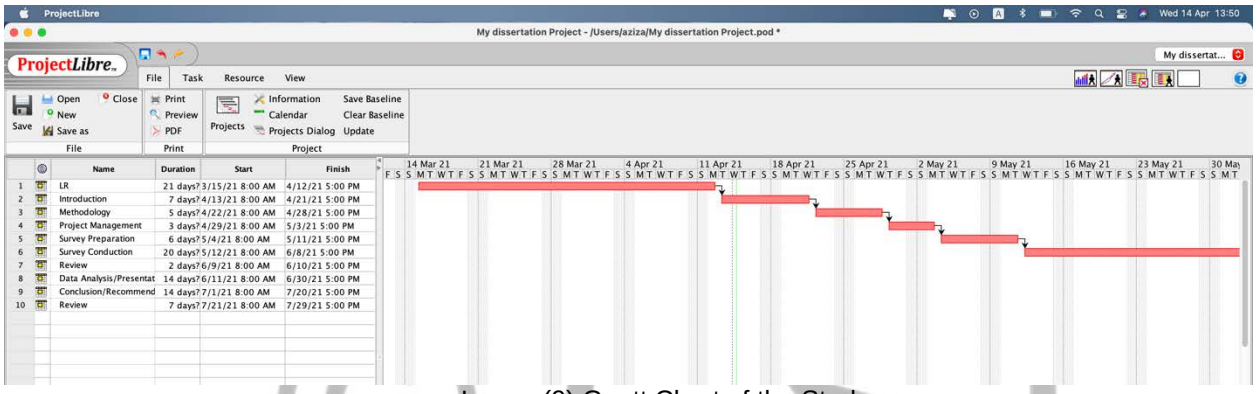



Image (9) Gantt Chart of the Study

## 4.9 CHAPTER'S SUMMARY

Employing good project management has its advantages in saving time & money, distinguishing appropriate communication methods, making enhanced decisions and iterates organizational and individuals' success. This chapter has presented a clear channel of the employed processes for a successful project completion.

# CHAPTER 5: DATA PRESENTATION & ANALYSIS

## 5.1 INTRODUCTION

Chapter Five provides a comprehended presentation of the collected data followed by a detailed analysis using a sectioned approach. The chapter contains three sections where

each section presents an explanation of it as a segment. The sections are: Data Specification, Data Presentation and Data Analysis.

## 5.2 DATA SPECIFICATION

Raw data was collected by conducting two structured questionnaires containing different themes of questions; Multiple-choices, Likert, Open-ended, Rating, Ranking, Dichotomous and Linear Numeric. Questions' design of both questionnaires was done considering the desired objectives. The focality of both questionnaires is understanding the level of awareness and knowledge of thyroid patients in Diwan Health Complex considering the implemented KM system. Patients' data was collected telephonically and physicians'' data was collected through a distributed questionnaire. Reasons for each approach were referred-to and explained in Chapter Three, section 3.3. Proper understanding and clarification of the involved questions was provided to the participants to avoid ambiguousness. A total number of 150 patients and a total number of 11 physicians had participated in this survey.

## 5.3 DATA PRESENTATION

The author demonstrates in the following paragraphs the analytical approaches in the sequence of Cronbach's Alpha (α), Correlation (r), T-Test, ANOVA and Histogram for both datasets. The first demonstration covers patients' data and the second demonstration covers physicians' data.



### 5.3.1 Reliability Testing (Cronbach's Alpha) - Patients' Data

Cronbach's Alpha (α) is a computed statical measure that is commonly used to gauge the reliability or consistency of a set of testing items/questions that are being constructed for a project. Hence, Cronbach's Alpha is a method of measuring the strength of data consistency (Taber 2018). Cronbach's Alpha range falls between 0 to 1.0, and the closer range to 1.0 is a good indicator of reliability (Mohamad et al. 2015).

In spite of its popularity in statical analysis, there are very few constraints that affect its result. It was found that Alpha assumes that every test item should measure the same trait because different number of tested items affect the value of Alpha (Barbera et al. 2020). Therefore, and as the questionnaires in hand aimed testing different items; the author has measured their reliability separately as demonstrated below.

#### 5.3.1.1 Reliability for Knowledge & Awareness

| Reliability Statistics | | |
|---|---|---|
| Cronbach's Alpha | Cronbach's Alpha Based on Standardized Items | N of Items |
| .942 | .956 | 6 |

Table (4) Cronbach's Alpha of Knowledge & Management – Patients' Data

Interpretation

Table (4) represents the Cronbach's Alpha value of Knowledge & Awareness. The table shows that the Cronbach's Alpha value is 0.942 which is in the range of 0.90 – 1.00. Hence, an excellent consistency. Therefore, the results of Knowledge & Awareness are highly reliable.

5.3.1.2 Reliability for Information Technology (IT) Solutions

| Reliability Statistics | | |
|---|---|---|
| Cronbach's Alpha | Cronbach's Alpha Based on Standardized Items | N of Items |
| .840 | .835 | 3 |

Table (5) Cronbach's Alpha of IT Solutions – Patients' Data

Interpretation

Table (5) represents the Cronbach's Alpha value of use of Information Technology (IT) Solutions. The table shows that the Cronbach's Alpha value is 0.840 which reflects good and accepted consistency. Thus, the results of Information Technology (IT) Solutions are reliable.

5.3.2 T-Test

T-Test is an inferential statical test that is used when comparing two sets of groups and their meaning (Bevans 2020). Moreover, T-test is one approach that is used for hypothesis testing.

In order to calculate T-test, three elements are required; the mean, standard deviation and the number of values for each item/group (Kim 2015).

Independent sample T-Test was carried out according to the following steps.

Step 1: Null and alternative hypothesis

$$H_o: mean\ age\ of\ male = mean\ age\ of\ female = \mu_m = \mu_f$$
$$H_1: mean\ age\ of\ male \neq mean\ age\ of\ female = \mu_m \neq \mu_f$$

Step 2: level of significance

$$\alpha = 0.05$$

Step 3: Critical Value

$$t_c = \pm 1.9761$$

Step 4: Test Statistics

| Group Statistics | | | | | |
|---|---|---|---|---|---|
| | Gender | N | Mean | Std. Deviation | Std. Error Mean |
| What is your age? | Male | 65 | 26.9692 | 4.77614 | .59241 |
| | Female | 85 | 41.3059 | 5.13861 | .55736 |

Table (6) Group Statistics Test – Patients' Data

The standard deviation of male and female are not same which means that the variance is also not same (Table 6). So, we do not assume equal variance.

| Independent Samples Test | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | Levene's Test for Equality of Variances | | t-test for Equality of Means | | | | | | |
| | | | | | | | | | 95% Confidence Interval of the Difference | |
| | | F | Sig. | t | df | Sig. (2-tailed) | Mean Difference | Std. Error Difference | Lower | Upper |
| What is your age? | Equal variances assumed | 1.049 | .308 | -17.454 | 148 | .000 | -14.33665 | .82140 | -15.95983 | -12.71347 |

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Equal variances not assumed | | | -17.626 | 142.424 | .000 | -14.33665 | .81339 | -15.94452 | -12.72878 |

Table (7) T-Test – Patients' Data

Table (7) shows that the calculated t value is -17.454 and the significance value is 0.000.

Step 5: Conclusion

As the calculated t value is -17.454 and lies in the critical region, Ho is rejected. The significance value is 0.000 which indicates that H1 is accepted, and Ho is rejected. So, we conclude that the average age of male and female is not the same. i.e., $\mu_m \neq \mu_f$

### 5.3.3 Correlation (r)

Correlation is a statical approach of measuring the extent/degree of a relationship between two or more variables. Corraltion assist in understanding how strong is a relationship between the variables in addition to their directions. Correlation coeffieinct is scaled between -1 and +1 (Schober et al. 2018).

**Correlations**

| | | What is your age? | Education |
|---|---|---|---|
| What is your age? | Pearson Correlation | 1 | .828** |
| | Sig. (2-tailed) | | .000 |
| | N | 150 | 150 |
| Education | Pearson Correlation | .828** | 1 |
| | Sig. (2-tailed) | .000 | |
| | N | 150 | 150 |

**. Correlation is significant at the 0.01 level (2-tailed).

Table (8) Correlation Between Age & Education – patients' Data

Table (8) represents a correlation between the age and education. The correlation value is 0.828. This value shows that there is a high positive relationship between the age of the patients and their education. That is, when the age increases then education also increase and vice versa.

**Correlations**

| | | What is your age? | Information Technology (IT) Solutions |
|---|---|---|---|
| What is your age? | Pearson Correlation | 1 | .668** |
| | Sig. (2-tailed) | | .000 |
| | N | 150 | 150 |
| Information Technology (IT) Solutions | Pearson Correlation | .668** | 1 |
| | Sig. (2-tailed) | .000 | |
| | N | 150 | 150 |
| **. Correlation is significant at the 0.01 level (2-tailed). | | | |

Table (9) Correlation Between Age & IT Solutions – Patients' Data

As shown in Table (9), the correlation value between the age and Information Technology (IT) Solutions is 0.888. This value shows that there is a positive relationship between the age of the patients and Information Technology (IT) Solutions. That is, when the age increases then the knowledge of Information Technology (IT) Solutions increases and vice versa.

### 5.3.4 ANOVA

ANOVA is a statical abbreviation stands for Analysis of Variance. A simple yet powerful method to understand if there is a difference between the means of two or more independent groups. There are two types of ANOVA: one-way; which involves one independent variable and two-way; which involves two independent variables (Qualtrics 2021), (Siddique 2020), (Smalheiser 2017).

ANOVA has been employed for the below following the explained steps.

Step 1: Null and alternative hypothesis

$$H_o: mean\ age\ of\ student = mean\ age\ of\ unemployed = mean\ age\ of\ self\ employed = mean\ age\ of\ governmental = mean\ age\ of\ private\ company$$
$$i.e., \mu_s = \mu_u = \mu_e = \mu_g = \mu_p$$
$$H_1: mean\ age\ of\ student \neq mean\ age\ of\ unemployed \neq mean\ age\ of\ self\ employed \neq mean\ age\ of\ governmental \neq mean\ age\ of\ private\ company$$
$$i.e., \mu_s \neq \mu_u \neq \mu_e \neq \mu_g \neq \mu_p$$

Step 2: level of significance

$$\alpha = 0.05$$

Step 3: Critical Value

$$F_c = 2.434$$

Step 4: Test Statistics

| ANOVA | | | | | |
|---|---|---|---|---|---|
| What is your age? | | | | | |
| | Sum of Squares | df | Mean Square | F | Sig. |
| Between Groups | 8283.285 | 4 | 2070.821 | 101.257 | .000 |
| Within Groups | 2965.408 | 145 | 20.451 | | |
| Total | 11248.693 | 149 | | | |

Table (10) ANOVA– Patients' Data

Step 5: Conclusion

Table (10) shows that the calculated F value is 101.257 which is greater than the critical value. Therefore, Ho is rejected. In addition, the significance value is 0.000 which indicates that H1 is accepted and Ho is rejected. So, we conclude that $\mu_s \neq \mu_u \neq \mu_e \neq \mu_g \neq \mu_p$

### 5.3.5 Histogram

Histogram is a graphical illustration used in statistics to demonstrate the distribution of data values. The vertical axis shows the frequency and the horizontal axis shows the range of data values (Chen 2021).

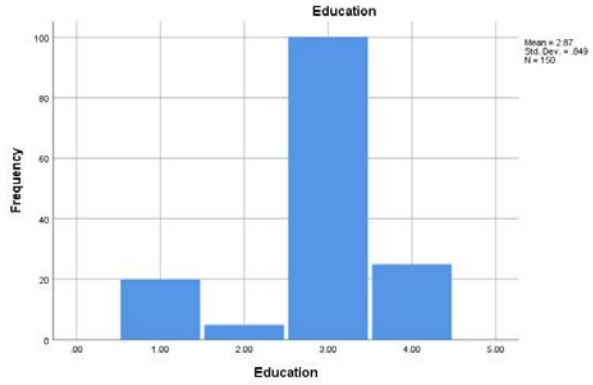



Diagram (1) Histogram of Patients' Education

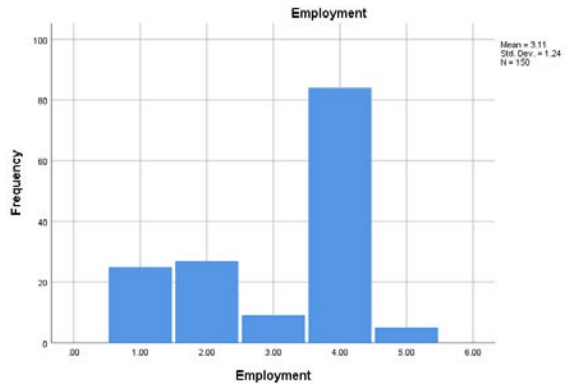



Diagram (2) Histogram of Patients' Employment

The histogram in diagram (1) shows that the mean of the education is 2.87 and its deviation from the mean is 0.849. This means that most of the education of the patients was Bachelor. The histogram in diagram (2) shows that the mean of the employment is 3.11 and its deviation from the mean is 1.24. It means that most of the patients have governmental job.

### 5.3.6 Reliability Testing (Cronbach's Alpha) – Physicians' Data

#### 5.3.6.1 Reliability of the Practiced KM Approaches

| Reliability Statistics | | |
|---|---|---|
| Cronbach's Alpha | Cronbach's Alpha Based on Standardized Items | N of Items |
| .888 | .932 | 16 |

Table (11) Cronbach's Alpha of KM Approaches – Physicians' Data

Interpretation

Table (11) represents the Cronbach's Alpha value of use of the Practiced Knowledge Management (KM) Approaches. The table shows that the Cronbach's Alpha value is 0.888 which is in the range of 0.80 – 0.90, this indicates a good consistency and therefore, the results of the Practiced Knowledge Management (KM) Approaches are highly reliable.

5.3.6.2 Using Technology in Knowledge Management Practices

| Reliability Statistics | | |
|---|---|---|
| Cronbach's Alpha | Cronbach's Alpha Based on Standardized Items | N of Items |
| .806 | .852 | 2 |

Table (12) Cronbach's Alpha Usage of IT in KM Practices – Physicians' Data

Interpretation

Table (12) represents the Cronbach's Alpha value of Using Technology in Knowledge Management practices. The table shows that the Cronbach's Alpha value is 0.806 which is in the range of 0.80 – 0.90. It therefore, reflects good and acceptable consistency. Thus, the results of Using Technology in Knowledge Management practices are reliable.

5.3.7 T-Test

One sample T-Test is been calculated following the below steps.

Step 1: Null and alternative hypothesis

$$H_o: The\ averege\ year\ of\ service\ is\ 10\ years = \mu_s = 10$$
$$H_1: The\ averege\ year\ of\ service\ is\ not\ 10\ years = \mu_s \neq 10$$

Step 2: level of significance

$$\alpha = 0.05$$

Step 3: Critical Value

$$t_c = \pm 2.2281$$

Step 4: Test Statistics

| One-Sample Statistics | | | | |
|---|---|---|---|---|
| | N | Mean | Std. Deviation | Std. Error Mean |
| Yrs. of service | 11 | 10.00 | 8.854 | 2.670 |

Table (13) One-Sample Statistics – Physicians' Data

| One-Sample Test | | | | | | |
|---|---|---|---|---|---|---|
| | Test Value = 10 | | | | | |
| | t | df | Sig. (2-tailed) | Mean Difference | 95% Confidence Interval of the Difference | |
| | | | | | Lower | Upper |
| Yrs. of service | .000 | 10 | 1.000 | .000 | -5.95 | 5.95 |

Table (14) One-Sample T-Test – Physicians' Data

The calculated t value in Table (14) is 0.000 which lies in the acceptable region; therefore, Ho is accepted. Also, the significance value is 1.000 which indicates that Ho is accepted, and H1 is rejected. So, we conclude that $The\ averege\ year\ of\ service\ is\ 10\ years\ i.e.,\ \mu_s = 10$

5.3.8 Correlation (r)

| Correlations | | | |
|---|---|---|---|
| | | knowledge sharing in this organization | thyroid patients' awareness in this organization |
| knowledge sharing in this organization | Pearson Correlation | 1 | .755** |
| | Sig. (2-tailed) | | .007 |
| | N | 11 | 11 |
| thyroid patients' awareness in this organization | Pearson Correlation | .755** | 1 |
| | Sig. (2-tailed) | .007 | |
| | N | 11 | 11 |
| **. Correlation is significant at the 0.01 level (2-tailed). | | | |

Table (15) Correlation Between Knowledge Sharing and Thyroid Patients' Awareness – Physicians' Data

As demonstrated in Table (15), the correlation value between knowledge sharing in the organization and thyroid patients' awareness is 0.755. It means that there is a high positive significance relationship between knowledge sharing in this organization and thyroid patients' awareness in this organization. It means that more the knowledge sharing in the organization more the thyroid patient's awareness in the organization.

5.3.9 ANOVA

ANOVA has been calculated for the below example following the explained steps.

Step 1: Null and alternative hypothesis

$$H_o: averege\ years\ experience\ of\ specialist = averege\ years\ experience\ of\ general\ pratctioner = averege\ years\ experience\ of\ endocrinology = averege\ years\ experience\ of\ senior\ medical\ officer = averege\ years\ experience\ of\ consultant$$
$$i.e., \mu_s = \mu_g = \mu_e = \mu_m = \mu_c$$
$$H_1: averege\ yeras\ experience\ of\ specialist \neq averege\ years\ experience\ of\ general\ pratctioner \neq averege\ years\ experience\ of\ endocrinology \neq averege\ years\ experience\ of\ senior\ medical\ officer \neq averege\ years\ experience\ of\ consultant$$
$$i.e., \mu_s \neq \mu_g \neq \mu_e \neq \mu_m \neq \mu_c$$

Step 2: level of significance

$$\alpha = 0.05$$

Step 3: Critical Value

$$F_c = 4.534$$

Step 4: Test Statistics

**ANOVA**

Yrs. of service

| | Sum of Squares | df | Mean Square | F | Sig. |
|---|---|---|---|---|---|
| Between Groups | 128.133 | 4 | 32.033 | .293 | .873 |
| Within Groups | 655.867 | 6 | 109.311 | | |
| Total | 784.000 | 10 | | | |

Table (16) ANOVA – Physicians' Data

Step 5: Conclusion

The calculated F value in Table (16) is 0.293 which is less than the critical value so, Ho is accepted. Also, the significance value is 0.873 which indicates that Ho is accepted, and H1 is rejected. So, we conclude that $\mu_s = \mu_g = \mu_e = \mu_m = \mu_c$

5.3.10 Histogram

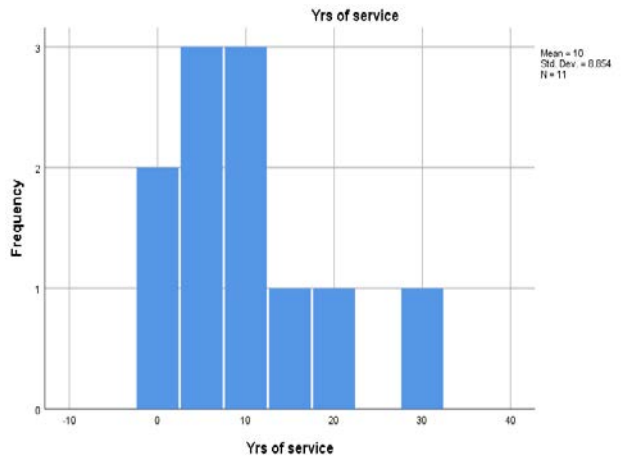



Diagram (3) Histogram of Physicians' Years of Service

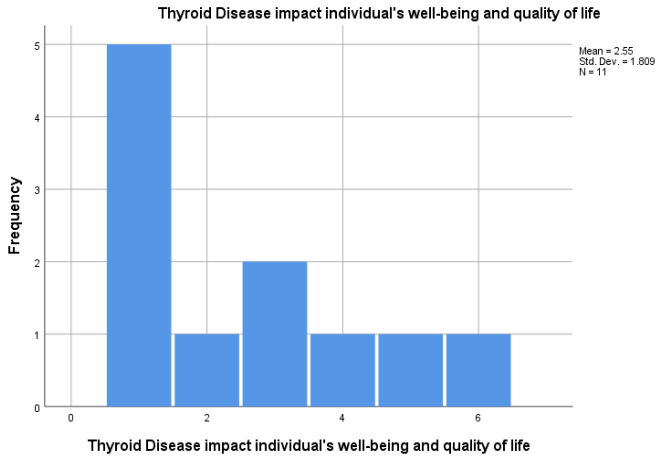


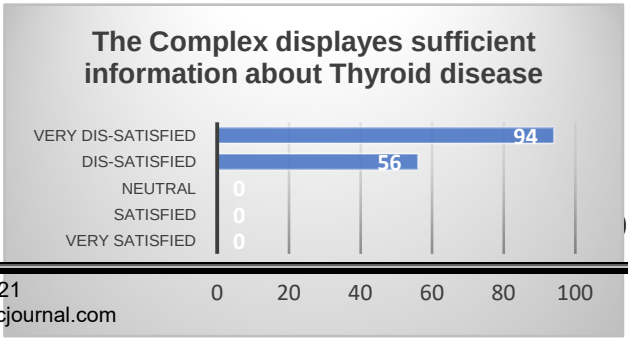

Diagram (4) Histogram of Imapct of Thyroid Disease on Quality of Life

The histogram in diagram (3) shows that the mean of years of service is 10 and its deviation from the mean is 8.854. This means that most of the doctors are 10 years of service experience. The histogram in diagram (4) shows that the mean of Thyroid diseases has a great impact on the individual's well-being and quality of life is 2.55 and its deviation from the mean is 1.809. This means that most of the respondents have totally agreed for this statement.

The following demonstration reflects the organization's employment of IT solutions in raising the level of knowledge and awareness among thyroid patients that are being treated in it. The demonstration is carried out using Excel tables and graphs.

Question 12: The complex displays sufficient information about thyroid diseases.

| Category | Freq. | % | Valid % | Cumulative % |
|---|---|---|---|---|



| | | | | |
|---|---|---|---|---|
| Very Satisfied | 0 | 0 | 0 | 0 |
| Satisfied | 0 | 0 | 0 | 0 |
| Neutral | 0 | 0 | 0 | 0 |
| Dis-satisfied | 56 | 37.33 | 37.33 | 37.33 |
| Very Dis-satisfied | 94 | 62.66 | 62.66 | 100% |
| Total | 150 | 100% | 100% | |

Table (17) Calculation of Data-Question 12.

Diagram (5) Demonstration of Data-Question 12

Question 13: I am given printed materials (leaflets) about my disease.

| Category | Freq. | % | Valid % | Cumulative % |
|---|---|---|---|---|
| Very Satisfied | 0 | 0 | 0 | 0 |
| Satisfied | 3 | 2 | 2 | 2 |
| Neutral | 10 | 6.666 | 6.666 | 8.666 |
| Dis-satisfied | 0 | 0 | 0 | 8.666 |
| Very Dis-satisfied | 137 | 91.333 | 91.333 | 100% |
| Total | 150 | 100% | 100% | |

Table (18) Calculation of Data-Question 13

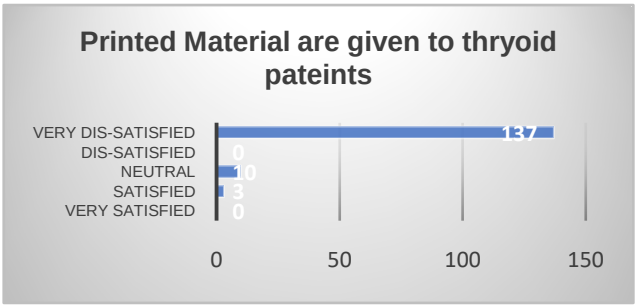



Diagram (6) Demonstration of Calculated Data-Question 13

Questions 12 and 13 were set to have an understanding whether knowledge is being shared and made available for thyroid patients using IT mediums such as visual or readable. The results were highly negative for both questions as all participants have strongly disagreed on receiving any printed material related to thyroid diseases. A percentage of 62.66 have denied the presence of any visual mediums and a percentage of 37.33 have strongly disagreed for the same. Refer to Tables (17 & 18) and Diagrams (5 & 6).

Question 14: Additional counselling/awareness are provided as a part of my treatment.

| Category | Freq. | % | Valid % | Cumulative % |
|---|---|---|---|---|
| Very Satisfied | 0 | 0 | 0 | 0 |
| Satisfied | 4 | 2.666 | 2.666 | 2.666 |
| Neutral | 9 | 6 | 6 | 6.666 |
| Dis-satisfied | 22 | 14.666 | 14.666 | 21.666 |
| Very Dis-satisfied | 115 | 76.666 | 76.666 | 100% |
| Total | 150 | 100% | 100% | |

Table (19) Calculation of Data-Question 14

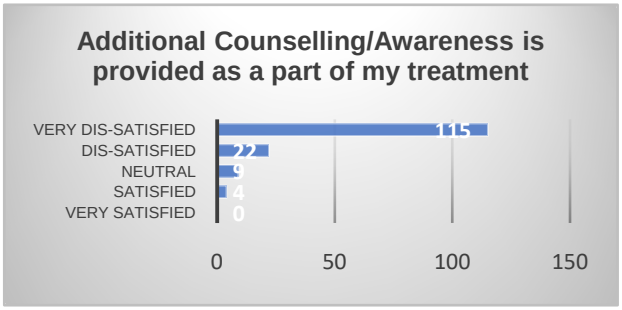



Diagram (7) Demonstration of Calculated Data-Question 14

Table (19) and diagram (7) represent the feedback of receiving additional awareness and counselling sessions. As evident, the feedback is negative as most of the participants agreed

on receiving no additional sessions of counselling or awareness other than their doctors' visits.

## 5.4 DATA ANALYSIS:

Taking into consideration the objectives of this study in their sequence order; the collected, interpreted and apprehended data from the participants can by analyzed by the following.

The overall concluded understanding was highly indicative of low awareness and education level allotted by the organization to thyroid patients. The interpreted data proved that the provided knowledge and awareness was purely subjected to individual efforts. Going into further details, thyroid treating physicians' questionnaire had reflected the following :

a. There is no clear knowledge management system in managing thyroid patients' education and awareness. There were no written nor distributed protocols or approaches signifies a presence of any sort of KM system. The delivered efforts in educating and raising thyroid patients' awareness were purely a result of departmental decisions that are set by the head of the department or individual judgment. A finding that conforms the result of Serin's et al. (2016) study, the absence or improper implementation of KM affect the whole system.
b. Thyroid patients are being seen and treated by different doctors in every visit. These doctors vary from General Practitioners, Family physicians, Internists, Resident Endocrinologists and so forth. This causes some disorientation in patients' treatment as every physician have his/her different approach in treatment management. This corresponds the study findings obtained by Goel et al. (2017).
c. The absence of Endocrinologists developed many failures, the most recognized one is the clinic continuously busy schedules. The clinic's busy schedule prohibits the sufficient time to provide detailed explanation to thyroid patients about their disease, medication and tests. This forces some physicians to prescribe patients' medications, in some visits, without actually seeing the patients and post-ponding their evaluation until the next visit. The next scheduled visits are of no less than 3-4 months. This practice compelled patients to seek information about their disease and medication externally, e.g., internet and friends of same disease.
d. In-spite one patient is being managed by different physicians, the internal communication and collaboration between these physicians is poor. Some physicians do not discuss patients' cases to unify the best line of treatment.

e. It appears that the health complex had overlooked utilizing any sort of IT mediums as a mean of sharing knowledge and awareness. Collected data reflected no presence of medical printed materials, e.g., brochures, leaflets, booklets nor visuals such as in the currently available screens in regard to thyroid diseases. Nevertheless, the complex paid other diseases a good level of attention such as Diabetes Mellitus, Breast Cancer and Eye diseases.
f. 27% of the participated physicians pointed that language forms an obstacle in their communication with the patients. A conclusion that partly conforms McCormick's (2015) study. Language can consolidate a barrier for proper knowledge and awareness dissemination.
g. All the above, in addition to the absence of thyroid disease educator/counselor and the complete involvement of pharmacists, led to illogical myths and misconceptions believed and practiced by some patients. One has requested Uranium as a part of his treatment !. Some did not know correct time to take prescribed medication. These findings support the ones concluded by Khanelwal et al. (2015) in their study.

Taking the rudder to patients' questionnaire, 98% of patients had unanimously given similar feedback in the open-ended questions. The feedback can be described by the following points.

a. The top concern was the continuous change of their treating physician in almost every visit. It was discomforting to some patients and frustrating to others as the management and communication of each physician differs. These were also annoyed by the fact of combining their appointments with other specialists such as Diabetes Mellitus and Hypertension. This resulted in longer waiting time, less time with the physician and long-gaped appointments. The collected data from the treating physicians showed no current availability of an Endocrinologist.
b. The detailed explanation of thyroid level readings, e.g., TFT, were not being detailed by some doctors, thus, patients were unaware of the correct and optimal levels for their conditions nor they understood the need of lowering/raising their doses.
c. The majority of the participants had emphasized their need of an educator or a counselor who can clarify their doubts, positively impacts their self-esteem, provide emotional assurance and grant necessary support. This was accompanied by their

need of a Dietitian who can aid them in their diet suiting their type of disease. It was found that the health complex employs a dietitian, however, not for thyroid patients.

d. Medicine management was an issue for the minority of the patients. The incomplete medicine management (explanation) by the treating physicians and/or the pharmacists made patients unaware of the correct time for full medicine absorption. As a result, hormone levels require longer time reaching optimal status and patients are compelled to suffer from their symptoms for longer periods as well.

e. The employment of IT solutions in disseminating knowledge and awareness level among thyroid patients reflected no usage of manual nor electronic means. Both questionnaires confirmed the absence of telecommunication applications, educatory prints, leaflets, brochures, booklets, posters, visuals, website, regular telephonic support, periodic lectures or workshops. Knowledge sharing is utterly deranged when it comes to IT employment. The lack of educational and awareness programs affects the patients' knowledge as also concluded by Alotaibe and Almousa (2018) and Almuzaini et al. (2019).

f. The effects of COVID-19 pandemic had impacted thyroid patients negatively as concising the workforce limited the periodic medical tests, visits and support. Early diagnosed and/or the unstable cases of thyroid conditions were forced to bear their symptoms for long periods. Similar to elsewhere, medical attention was prioritized to emergency and urgent cases.

# CHAPTER 6: CONCLUSION & RECOMMENDATIONS

## 6.1 Conclusion:

This research aimed understanding and evaluating the level of awareness and knowledge among thyroid patients in Diwan Health Complex-Muscat by fulfilling four objectives, these were:

- To analyze the currently practiced KM system,
- To examine the knowledge and awareness level of thyroid patients,
- To examine patients' experience using IT solutions, and,
- To Provide the fitting suggestions

A decent understanding was obtained from the performed questionnaire, thus, fulfilled the desired objectives.

To start with and as an overall view, Table (20) and Diagram (8) express the needs of thyroid patients whereas Table (21) and Diagram (9) express the physicians' views and recommendations.

| Patients' Needs | Frequncy |
|---|---|
| Treatment with same Phycisian | 145 |
| Thyroid Specialist | 140 |
| Appointments' Management | 132 |
| Provide awareness about the disease | 144 |
| Usage of IT Applications | 147 |
| Psychological Counselling/Educator | 98 |
| Dietitian | 85 |
| Regular Tests | 148 |
| Medication Education | 9 |

Table (20) Thyroid Patients' Needs

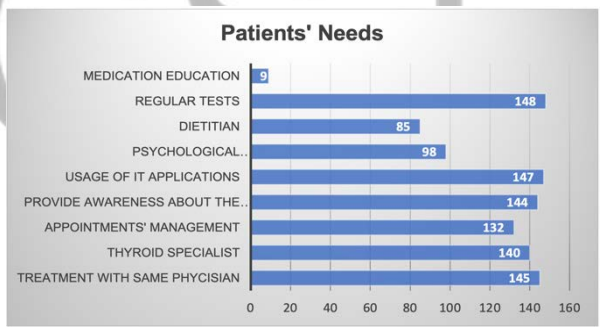



Diagram (8) Graphical Demonstration of Table (20)

| Physicians' Views/Recommendations | Frequncy |
|---|---|
| Provide Group Lectures/Discussions | 2 |
| Busy Clinics/Lack of time | 6 |
| Low Knowledge Sharing | 5 |
| Lack of Deparmental Assistance | 1 |
| Disease and Medicine Education/Awareness | 9 |
| Langauage and Communications Barriers | 3 |
| Better IT Emplyoment | 9 |
| No Clear KM Approaches | 7 |

Table (21) Physician's Views/Recommendations

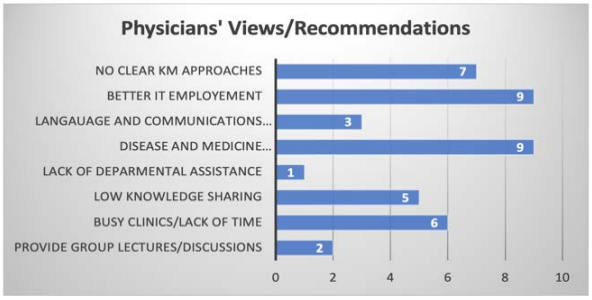



Diagram (9) Graphical Demonstration of Table (21)

From the above-demonstrated tables and diagrams, the author concludes the following:

a. Knowledge Management System: The organization obtains and operates one of the

prime health information system (HIS) that is been used in most of the big governmental hospitals in the Sultanate. The system's main function however, is automating patients' data. When it comes to identifying a structured and operative KM system in managing thyroid patients per say; there was no clear KM system identified or acknowledged identified by the participated physicians. As previously stated, Sayyadi (2020) concluded that if the organization does not operative on a clear KM system, it will not be able to manage its knowledge, thus, effecting the provided services and its performance.

b. Furthermore, as physicians are the main medical tool manager of their patients, howbeit, they are not the sole responsible for other roles. Thyroid patients require, at least at the first stages of their disease, an adequate educating and counselling in terms of disease facts and myths, expectations, emotional assurance, medications and Dietitian's plan. This is not being provided in the current time, knowledge sharing is impacted.
c. Thyroid patients' knowledge and awareness. The survey confirmed that the majority of participated patients had no previous knowledge about thyroid diseases, which does not formulate a big issue compared to their lack of awareness and knowledge after being medically diagnosed. Patients related their lack of knowledge and awareness to certain causatives such as the busy clinics, insufficient patient allocated time, un-availablity of disease counselor/educator, long-term follow-up visits'/tests' scheduling, changing physicians and lack of IT employment.
d. Furthermore, when it comes to Disease Management, there are few challenges in managing specialty diseases by General Practitioners (GPs). Not all thyroid cases can be evaluated and monitored by GPs, i.e., Planning for pregnancy, persistence of symptoms despite treatment, Hyperthyroidism disorders, Secondary Hypothyroidism, thyroid eye and thyroid cancers. GPs may be at more ease treating Hypothyroidism because it is the least complicated disorder, however, the above cases require an Endocrinologist (Rayburn 2020) and Orenstein (2018). As evident in the current organization, shifting thyroid cases between one doctor to another, who may have not undergone appropriate training, is not the ideal approach of managing them and does not serve the role of raising their knowledge and awareness.
e. Information Technology (IT) employment: it is concluded that no medium of information technology was employed in the said health complex that would facilitate

disease education or awareness. Specific knowledge sharing approaches were urged by thyroid patients and recommended by their treating physicians. These included organizing visual and audial patients' educational and awareness workshops/sessions/Smart TV short videos, employment of telecommunication applications and distribution of manuals.

### 6.2 Recommendations

Based on the reached conclusion, the most logical and appropriate recommendations involve:

a. To start with, the organization may benefit from establishing a structured KM system that is to be deployed and operated by the concerned personnel in the organization. This will streamline the processes for the beneficial of patients and the health providers as well.
b. As both groups complained of busy clinics, long waiting time, inadequate patient allocated time, patients shifting from one physician to another in every visit, different lines of treatment and the absence of a thyroid specialists (Endocrinologists); the most ideal and radical solution is hiring sufficient number of Endocrinologists. This will eliminate most of patients' needs and reduces the extra burden of other physicians. Another solution to improve the internal collaboration and communication and subsequently best line of patients' treatment, is establishing a cohesive thyroid medical team.
c. When it comes to thyroid patients' education and awareness, patients' time can be easily utilized by providing education and awareness. During patients' wait; the usage of different information technology amenities works as a perfect educator. Smart displays for instance, can be used to deploy educational videos about thyroid patients' diseases, modalities of treatment, medication details and so forth. Similar outcomes can be achieved by distributing disease's manuals/leaflets/brochures and so on. In addition to raising patients' awareness, this will also help in reducing their frustration that might result from the long waiting period.
d. Better patients' involvement: improving patients' experiences mean easy and quick access to their medical care. Thyroid patients and physicians agreed on the usage of virtual technologies such as Mobile Health applications, website pages, SMS to grant patients' access to their medical files, e.g., Laboratory tests, medications. Not only

quick service is granted; time is cut short, knowledge is provided, patients' engagement in their self-care is improved as well. This solution is considered an optimal one taking into consideration the current pandemic of COVID-19 as unnecessary visits should be limited however patients' engagement in their health care is not.

e. Having a complete line of treatment means providing comprehensive medical solutions. As the majority of thyroid patients tremble emotionally and physically (Shahid and Sharma 2021) and (St.Luke'sHealth 2020) as Hypothyroidism and Hyperthyroidism may cause disorders such as anxiety, mood swings and depression (Stasiolek 2015), assurance and guidance are inevitable. As the organization does not have thyroid disease counselor, it may benefit from conducting periodic open sessions/days by hosting external counselors to provide the necessary educational and awareness lectures.

f. Nurses' Role: Nurses are considered the foundation and engine of any healthcare facility. They operate a significant role in promoting health and wellness (Bagley 2021). For the said organization, thyroid patients' education can be done by involving nurses. Nurses can be trained to cover the minor roles, howbeit significant, that aid thyroid patients'. For example, they can teach thyroid patients' about their medication interaction with other medicines, how to create a daily routine to preserve balanced hormone readings and acknowledge them about the ideal gap between other medications or supplements they are using.

g. In spite of the above recommended solutions fitting the currently concluded issues effecting thyroid patients' level of knowledge and awareness in this health complex, the author stresses the necessity of conducting a future research covering the management departments (Middle & Top management) of the health complex aims studying the employed knowledge management system and processes. The currently documented issues reflect some ? failures, ? improper implementation, ? non-observance or even absence of clear KM system.

## 6.3 CHAPTER'S SUMMARY

This research aimed assessing the level of knowledge and awareness of thyroid patients in one of the health complexes in Muscat. This was planned to be achieved and understood by answering two questions: how knowledge management as a system; is being carried out on

this category of patients and what does the currently exercised knowledge management system lack? The author used the Randomly-based sampling technique in patients' selection where all involved physicians in treating thyroid patients in the chosen complex were included in the survey. A telephonic questionnaire was carried on 150 thyroid patients and the second questionnaire was distributed to 11 physicians. Collected data was interpreted using Microsoft Excel and SPSS. The required analytical approaches were carried out, i.e., Reliability Testing (Cronbach's Alpha), T-Test, Anova, Correlation and Histogram.

The overall results of the patients' interpreted data reflect no previous knowledge about thyroid gland nor its associated diseases. Few of the participated females were having symptoms of thyroid diseases and were unaware of it. Post treatment, thyroid patients complained of several issues effecting their awareness and satisfaction such as the absence of Endocrinologists, changing physicians in every visit, the absence of thyroid diseases' & medication counselling and education, cipher usage of information technology support and uneasy appointment management system. On the other hand, the participated physicians pointed out some significant issues the compromised thyroid patients' knowledge and awareness. These included busy clinics' schedule, insufficient patients' counselling time, language & communication barriers, absence of information technology role and the lack of clear KM system. The findings are very much similar to the previous conducted studies in this regard by other researchers. Referring to the explained knowledge management cycle model; Wiig's Model, the findings does not seem to reflect any sort of process related to a structured nor implemented KM system in this category of patients.

The bottom line, the organization may raise thyroid patients' educational, awareness and satisfaction level by employing dramatical changes in the sense of structuring a proper knowledge management system.

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