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Using Principles of the Disease Interrelationship Model to Enhance Secondary Prevention of Diseases: A Narrative Review

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ABSTRACT The aim of the study was to prove that diseases have a network, which if understood, helps to prevent and/or manage diseases. A comprehensive search of empirical/theoretical literature was conducted between January and June 2020. The study involved original research articles published in English, which focused on prevention of diseases or explain the disease interrelationship model (DIM) and its relationship with secondary prevention of diseases. The study characteristics were examined and categorised according to disease networks, disease prevention concepts and relevance of DIM in disease prevention. The studies were categorised according to the basic framework of DIM, demonstrating the workability of DIM and application of DIM towards disease prevention. The study reveals that no disease is in isolation because diseases belong to a network of infirmities and the prevention of disease at the entry point prevents resultant disease(s). Understanding this network is imperative for effective secondary prevention of disease for ethno-medicine and orthodox medical practice.

INTRODUCTION

The health system is obviously an important aspect of the cultural system of every society. This is why Clarke (2001) cautioned that it is important to be careful when considering the terms, disease, health and illness. This is because most times scholars and medical practitioners treat a particular disease as if it is a single trend of event. To make the picture clearer, Eisenberg (1977) had earlier made a distinction between disease and illness. This idea indicates that disease is endowed with an "objective" quality. Therefore, a disease is not actually a unilateral event. There is always a prognosis for most diseases. In most cases, diseases are not in isolation. There is usually a network among diseases. This network usually strengthens the resistance of the disease agent to the immune system. The strength of this network determines the severity of the consequences of the disease and the difficulty in the prevention and/or management of the disease.

To portray the relationship of diseases, Tang et al. (2016) posited that infection is a disease that could lead to cancer and infertility. Therefore, Tang et al. (2016) explained that the mumps virus attacks the testis, destroying the testicular parenchyma and reducing androgen production, which causes male infertility. Bates et al. (2014) also noted that infertility treatment has a relationship with gestational trophoblastic disease (GTD). In their study at Weston Park Hospital between 1991 and 2001, they observed that patients with previous infertility appeared to be typically those treated for GTD.

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Several studies have also linked infertility treatment with the development of ovarian cancer (Rossing et al. 1994; Mosgaard et al. 1997; Venn 1999). Again, periodontal disease (PD) has been linked as the cause of cardiovascular disease (CVD), diabetes mellitus (DM), cancer and even preterm low-birth weight. The idea that oral disease could impact systemic health is not new (Mawardi et al. 2015). Similarly, Hanson et al. (2017) linked infertility with mental disorder. It was also discovered that the use of infertility drugs could cause breast cancer (Reigstad 2015).

Again, multiple chronic diseases (MCDs) have been reported to be associated with depression. A recent study has shown that there is high association between depression and chronic diseases such as angina, myocardial infarction and stroke (Sale et al. 2008; Seo et al. 2017). A study carried out by Setto et al. (2016) also concluded that being overweight leads to cardiovascular diseases, while diabetes mellitus can result in hypertension. They also linked obesity to diabetes mellitus, which in turn increases the risk of coronary diseases.

From the foregoing, it has been established that most diseases do not stand alone. They could be predisposed by other diseases and they may also lead to secondary disease conditions. However, most studies have been directed at understanding only the comorbidity of diseases with emphasis on how to break the link (Mengfei et al. 2019; Wei-jie et al. 2020; Yue et al. 2020). It has been posited by Nwosu et al. (2019a) that healthcare services mirror the society's cosmology but secondary prevention of diseases has rarely featured in the people's worldview. Similarly, most studies in traditional medicine have not discussed the interrelationship among diseases. This is in spite of the fact that traditional healers sometimes tackle the root of diseases, which prevents further development of the resultant diseases/illnesses (Nwosu 2019a).

Objective

The objective of this paper is to use the framework of the disease interrelationship model (DIM) to enhance the prevention of diseases. The study is also aimed at providing support to the idea that diseases have a network, which makes it difficult to prevent and/or manage them. However, the article is geared towards using the framework of the disease interrelationship model (DIM) to increase the level of secondary prevention of diseases both in traditional and orthodox medicine, thereby improving human health.

METHODOLOGY

The study adopted a narrative review pattern, which is appropriate because the goal was to enhance secondary prevention of diseases through the application of disease interrelationship model (DIM) and to see how the framework of DIM fits into the process. As a result of the fact that DIM is a new concept and there is paucity of thematic review relating DIM to disease prevention, a thematic search of literature was carried out following the Preferred Reporting Items pattern as the leading pointer (Brien et al. 2010). The present study, while applying Arksey and O'Malley's (2005) framework for narrative review process, went through the following stages:

i. Identifying the research problem
ii. Picking out relevant research objectives
iii. Identifying relevant studies
iv. Selecting studies for review
v. Extracting, sorting and arranging resultant data
vi. Collating/discussing the results.

The application of the result towards practical use is a necessary final step.

Data Sources

A comprehensive search of empirical as well as theoretical literature was conducted. The search was centred on the relationship among diseases, the nature of disease interrelationship model and prevention of diseases, as well as applicability of DIM towards the secondary prevention of diseases. Journals, theses and academic materials were searched in line with the theme of the study. Only one unpublished PhD thesis was reviewed to provide basis for the understanding of DIM. All the figures used in this study were adopted from the thesis because that is where the disease interrelationship model (DIM) was extensively discussed for the first time.

Original articles that incorporate appropriate study designs were included as long as they met the desired inclusion criteria, which are as follows.

a. They were written and/or published in English
b. They involved relationship among diseases
c. They explain the nature of disease interrelationship model
d. They explain the workability of DIM
e. They discuss disease prevention
f. They explain the applicability of DIM towards secondary prevention of diseases.

Using the quality assessment instrument of Harden et al. (2009), the study evaluated the articles that qualified for inclusion. The possible score range was put at 0-11. It should be noted that Harden et al. (2009) had earlier identified 12 criteria to assess the quality of studies and they rated studies as studies meeting fewer than seven criteria are of low quality, studies scoring between seven and nine are of medium quality, while studies scoring 10 or above are of high quality. However, one of their items which states, "Did the study involve young people in its design and conduct?" was not utilised because it is not relevant to the present review. This reduces the number of criteria to eleven. In the same vein, the present review did not base the criteria for inclusion on quality of the studies but on relevance to the research objective. Therefore, these criteria of quality scores are simply presented as a guide for readers when interpreting individual study results.

A categorisation process was adopted to examine and derive relevant information from the review. All members of the research team drew their independent categorisation results. Later, there was a comparing of reports, adjustments and final agreement on relevant data to be used. Data were categorised according to basic framework of DIM. However, infertility was used to portray the workability of DIM and application of DIM towards disease prevention. This was done to prove how practicable the concept is.

RESULTS AND DISCUSSION

The findings based on the themes that emerged from the data categorisation are presented under the following headings: of the concept of disease interrelationship model (DIM), theuse of infertility to showcase the workability of DIM, and the application of DIM in the prevention of diseases.

The Concept of Disease Interrelationship Model (DIM)

The underlying belief of DIM is that no disease is in isolation. This is because most diseases belong to a network of causal and resultant infirmities (Nwosu 2010). As such, the study of diseases and their aetiology must consider this pathological network and underlying conditions, especially if the interest is on preventive and/or curative measures. The major implication of this model is that if any infectious agent in the network is prevented at the point of entry into the system, the entire network may be truncated leading to prevention of the resultant disease(s).

In his study, Nwosu (2011) pointed out clearly the issue of disease networking. This network of diseases and associated consequences is what he referred to as "Disease Union" (DU). Therefore, it is this network and its expanse that determine the severity and complexity of such disease (see Figs. 1 and 2). In other words, a disease union (DU) is a group of diseases that belongs to the same network in terms of aetiology and consequences. A disease union is named after the disease at the centre of its network. Therefore, it is possible to have an infertility disease union (IDU), AIDS disease union (ADU), diabetes mellitus disease union (DMDU) and so on. This line of thinking is essential in order to isolate disease networks with the aim of disorganising such networks with the resultant effect of achieving and promoting good health. It is essential to adopt the line of DIM because diseases should not be studied for their own reason but with the aim of rescuing their victims from their pangs (Nwosu 2011). This also supports the view of Evans-Pritchard (1962) when he noted that everything in a society especially diseases and their ambient are functionally related to one another.

Using Infertility to Showcase the Workability of DIM

It has been discovered that there are certain diseases that result in illness or create discomfort for the sufferer. In an earlier study, Nwosu (2010) posited that some kinds of diseases could also lead to infertility. Among these are swollen scrotum, worms, epilepsy, cancer, sickle cell disease, diabetes, kidney disease, thyroid disease and

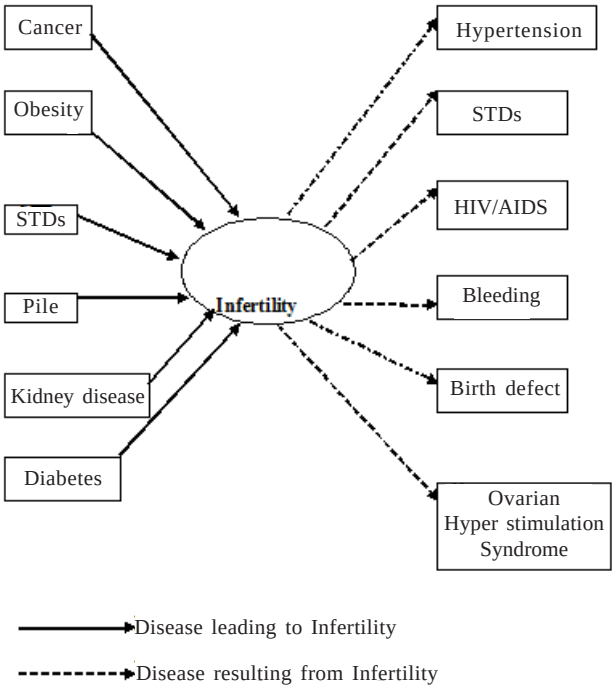

Fig. 1. Disease interrelationship model (dim)
Source: Author - Nwosu (2010)

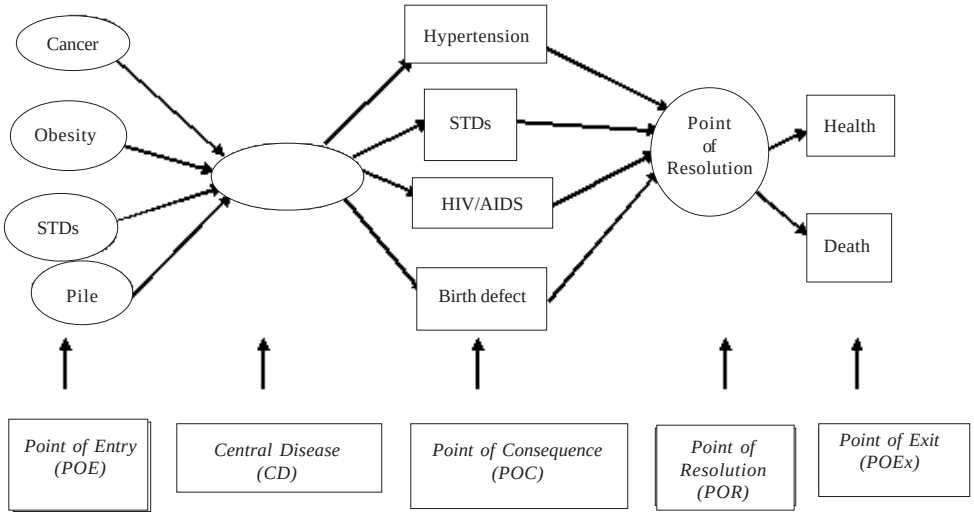

Fig. 2. Infertility Disease Union (IDU)
Source: Author - Nwosu (2010)

dysentery/pile. It was found that swollen scrotum often leads to the blocking or displacement of the ductus deferens within the scrotum and this weakens the ejaculatory duct in male. The implication is that low quantity of sperm is usually transported in minor cases or erection of the penis is zero in severe cases (Campana et al. 2005).

The same study by Nwosu (2010) also revealed that dysentery/pile and worms tend to sap the strength in men. Under such state, no man can perform sexual functions effectively. Even when the man attempts it, the result may be low quantity of sperm or slow transportation of the sperm. In other words, the chances of such a man fertilising the female ovum are quite narrow.

On the other hand, the treatment of certain diseases may hinder fertility. For instance, some drugs used in the management and treatment of epilepsy, cancer, diabetes, thyroid and kidney diseases (whether by traditional or orthodox healers) do affect the fertility of both men and women. These facts have resulted in the belief that most diseases have a network, which is the centre point of the disease interrelationship model (Nwosu 2011).

The model is graphically shown in Figure 1. The model (DIM) portrays diseases that can lead to infertility and those that could result from it.

From Figure 1, it can be seen that in each disease network, there is always a central (underlying condition) disease and in this case it is infertility, and so the network can be named Infertility Disease Union (IDU). This can be further explained through Figure 2.

Figure 2 shows that the central disease (CD) is infertility and diseases at the point of entry (POE) are cancer, obesity, STDs and pile. The point of consequences (POC) is reached when the central disease results into other diseases such as hypertension, STDs, HIV/AIDS and birth defect. Sometimes the central disease, in this case infertility, may result in one of these diseases. At other times, the resultant diseases may be multiple. Usually, it is at this point of consequence that the sufferer reacts forcefully and then one arrives at the point of resolution. This point of resolution or treatment could result in either the return of good health or death in the end and this is the point of exit. In other words, the victim either gets well or dies at the end. Note that infertility does not on its own lead to HIV/STDs but certain sexual behaviour of infertile couples is what leads to HIV/STDs. Such behaviour includes indiscriminate sex and a surrogate marriage (Nwosu et al. 2019b).

Here, infertility is used to portray the idea of DIM. However, other diseases could be used to demonstrate the workings of disease interrelationship model (DIM) and disease union. Therefore, the major implication of DIM is that if any disease in the network is checked at the point of entry into the network, the entire system will be truncated leading to prevention of the resultant disease(s).

DIM suggests that a disease is like a tree whose roots are those diseases that lead to it and it also produces fruits (those diseases that result from it). Therefore, to prevent this tree (disease) from producing such fruits is to destroy the roots and surely the tree will dry up and produce no such lethal results.

Application of Disease Interrelationship Model in the Prevention of Diseases

Most times the act of preventing diseases and maintaining excellent healthcare and health screening can be very overwhelming and should not be left in the hands of orthodox medicine alone. Traditional medicine can step up its relevance by engaging more in preventive medicine. However, the overwhelming nature of preventive medicine makes health so complicated that many people just give up. But the truth is that disease prevention is actually not that hard. It only requires the effort of everyone including physicians, traditional healers, microbiologists and medical laboratory experts. Why is it important to prevent disease? One may ask. Prevention of disease is necessary because it makes one to feel good, have more energy and even sleep better. It also helps to prevent healthcare crisis in the society and money spent on health care could be channelled to other useful ventures (Stibich 2019).

Stibich (2019) also added that to prevent diseases, one should constantly undertake health-screening test, avoid smoking, be active, eat healthily, lose weight and take medication. These are actions to be taken by the people, not the healers. However, he did not explain the role of healers in assisting the people to prevent diseases.

On the other hand, one of the major goals in the field of health promotion and disease prevention is to identify risk factors for disease so that information about these risk factors can then be shared with people. The hope is that people will use the information to change their behaviour in order to lower their disease risk (Syme 2007). However, there are three major problems with this model that requires serious attention. First, it has been difficult to identify disease risk factors. Second, even when the disease risk factors are identified, people may not be willing to modify their behaviour because of cultural beliefs or practices. Third, even when everyone at risk change their behaviour to lower risk, a little opportunist disease can expand to link other diseases, thereby making nonsense of the current model (Syme 2007).

This is why Syme (2007) observed that it is difficult to accomplish the mission of disease prevention by focusing exclusively on individual diseases and risk factors. However, he posited that disease classifications are not of much value in the treatment of individual cases but they are of great importance in showing where diseases are coming from and where one should direct the prevention efforts. As a result, Syme (2007) said that there is need to re-think about the way diseases are classified or grouped. This is where the disease interrelationship model (DIM) becomes relevant. It has tried to showcase diseases and group them as an entry point disease, central disease and point of exit disease. The model is an attempt to involve traditional and orthodox medical practitioners in the process of disease prevention. It is a process of making traditional healers, medical practitioners, microbiologists, medical laboratory experts, medical anthropologists and medical sociologists to understand that treatment of diseases is not only to return the patient to good health but also to prevent other disease that may spring up from the current one.

Buttressing the importance of classification, Hristov et al. (2010) classified disease prevention into two, namely, primary prevention and secondary prevention. According to them, vaccination and avoidance of risk behaviour is the ultimate in primary prevention of diseases whereas, treatment of diseases (such as hypertension) that could lead to other diseases is an example of secondary prevention. Highlighting their point, Hristov et al. (2010) maintained that primary prevention of cervical cancer is achieved by avoidance of exposure to the human papilloma-virus. Secondary prevention is represented by screening and treatment of breast and colorectal cancers. In other words, early detection and treatment of the disease that could lead to other diseases is a measure of secondary prevention, which is the domain of DIM.

It should be noted that Goldston (1987) has earlier classified disease prevention into five, namely, primordial, primary, secondary, tertiary and quaternary prevention. According to him, secondary prevention is a method to detect and address an existing disease prior to the appearance of symptoms or its linkage to other diseases. In other words, it is the process of dealing with latent diseases in order to stop asymptomatic diseases from progressing to symptomatic diseases (Patterson and Chambers 1995; Katz and Ather 2009).

Therefore, secondary prevention consists of early diagnosis and prompt treatment to contain the diseases and prevent it from leading to other diseases. This makes DIM to be a model that is targeted at secondary prevention of diseases. For instance, for a syphilis patient to be diagnosed and treated early, there is need to include a course of antibiotic drugs/herbs to destroy the pathogen. This in turn prevents the syphilis disease from resulting into a disease of the heart and central nervous system, such as blindness or paralysis (Leavell and Clark 1979).

From all these, it can be seen that the disease interrelationship model (DIM), which is geared towards secondary prevention of diseases believes that no disease is in isolation. This is because most diseases belong to a network of causal and resultant infirmities. Therefore, the study of diseases as well as disease diagnosis must consider this pathological network.

In other words, DIM's principal objective is to achieve secondary prevention of disease. This is why the model explains that if any disease in the network is checked at the point of entry into the network, then the entire system of diseases will be truncated leading to termination of the network and prevention of resultant diseases. For instance, if pile is detected and treated early, it will definitely prevent infertility and subsequently STDs, hypertension or birth defects. This idea

is also in line with the argument of the functionalists that if one aspect of a system (in this case a network) does not perform its role, the entire network will be affected. Even though the functionalists view refers to sustenance of the society, it could also be applied in the attempt to disorganise an obstructive trend like the presence of disease. Therefore, the best secondary preventive strategy against diseases is to prevent or treat at early stage, the disease that may give rise to other diseases either directly or indirectly (through the negative behaviour of its victims).

In actual fact, DIM suggests that disease (such as infertility) is like a tree whose roots are those diseases that lead to it and it also produces fruits (those diseases that result from it). So, the best attempt to prevent this tree (disease) from producing such lethal fruits is to destroy the roots of the plant and surely the tree will dry up and produce no lethal fruits. In short, the prevention and/or treatment of diseases must recognise that there is an interrelationship between and among diseases, which if followed will lead to successful reduction or elimination of such diseases. In simple terms, DIM believes that most diseases whether in human or animals have a network, and it is this network and its expanse that determine the severity and complexity of such a disease.

To this end, DIM has been able to establish a clear-cut definition of disease networking. This network of diseases and associated consequences is here referred to as Disease Union (Nwosu 2011). Therefore, a Disease Union is a group of diseases that belong to the same network in terms of aetiology and consequences. In other words, one can have an Infertility Disease Union (IDU). A Disease Union is usually named after the disease at the centre of its network. Therefore, it is also possible to have a Diabetes Disease Union (DDU). This line of thinking is essential in order to isolate disease networks with the aim of disorganising such networks for the ultimate goal of preventing subsequent diseases.

It is essential to emphasise that every Disease Union has entry and exit points. The entry point may involve a multiple of diseases, while the exit has only two possible outlets, that is, restoration of health and death (Fig. 2). Therefore, the aim of the DIM is to achieve and sustain good health for all through the prevention of the entry-point-diseases in a Disease Union. It should be noted that before the point of exit, there is a "point of resolution" (POR). But if the entry point is prevented, other points of activity will not emerge, and where primary prevention eludes and treatment is achieved at that point, other points of activity will wither away. So, an ideal Disease Union must have five points of activities, that is, point of entry (POE), central disease (CD), point of consequence (POC), point of resolution (POR) and point of exit (POEx). It should be noted that prevention and early treatment of diseases should be the target at the point of entry in order to achieve secondary prevention of diseases and ensure excellent human health.

CONCLUSION

This narrative review suggests that diseases become complicated and difficult to manage when they are part of a network. The review demonstrates the need to provide a truly comprehensive understanding of disease networks, which will go a long way to ensure the achievement of effective prevention of diseases especially at the secondary level. Overall, the disease interrelationship model (DIM) demonstrated the framework for understanding the network of diseases in order to achieve the necessary prevention of diseases, which invariably will enhance excellent human health. Secondary disease prevention seems to be an area requiring urgent interest, and has been addressed by the present study as an essential aspect of health promotion practice.

RECOMMENDATIONS

The study therefore suggests that further studies be carried out to reveal other areas in which DIM could be applied to assist the improvement of human or animal health. The model (DIM) identified in this study should be put in view when examining patients. It should be used to identify more disease unions in order to find out the entry point diseases and treat them on time. Treatment therefore, should go beyond helping the patient to regain good health to include secondary prevention of diseases (whether in area of traditional or orthodox medicine). This will go a long way to prevent such a disease from leading to other diseases that may complicate the health situation of the victim. By this, the chanc-

es of achieving excellent health promotion are enhanced and upgraded.

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