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Evaluating the Use of Diode Laser for the Treatment of Recurrent Aphthous Stomatitis (RAS)

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Abstract

Objectives: to assess the efficiency of diode laser in the treatment of recurrent aphthous stomatitis – RAS. **Method:** conduct control clinical trials on 2 groups: group A (not use laser) and group B (use laser). **Results:** **Post-treatment pain:* In group A, 34 patients (92%) suffered from pain on the first day after treatment, 30 patients (81%) suffered from pain on the 2nd day; on the third day, 24 patients still felt painful (65%); on the fourth day 8 patients still felt painful (22%); on the fifth day, there was still 1 patient who suffered from pain (2.7%) and from the 6th day onwards, no more patients had to suffer from pain. There is no difference of statistical significance in the ratio % between male and female patients who suffered from pain after treatment ($p > 0.05$). In Group B, 29 patients (78.4%) felt painful on the first day after treatment, in addition 17 patients (46%) suffered from pain on the second day, from the third day, 5 patients still suffered from pain (13.5%), and from the fourth day, no patients claimed to feel painful. **Level of pain:* observations from the two research groups have shown that when used in treatment, diode laser has led to obvious pain relief, specifically, in group B, only 29 patients suffered from pain at level 1 and 8 patients suffered from mild pain at level 2 and no patients had pain at level 3. In group A, 1 patient suffered from pain at level 1 and 36 patients were reported to suffer from pain at level 2 or level 3. **Healing:* in group A, 28 ulcers were healed on the fifth day, accounting for 27.5%; on the sixth day, 31 ulcers were healed, equivalent to 83.8%; on the seventh day, there were 35 ulcers which were healed, equivalent to 95.6%. In group B: 18.9% of ulcers were healed after the fourth day; on the fifth day, that number was 34 ulcers (91.9%); on the sixth day, all ulcers were healed. **Patients' satisfaction level:* we recorded that up to 94.6 % of patients were very satisfied of the treatment result, only 02 patients were not satisfied with the new treatment method (8.3%) and no dissatisfaction was recorded.

Conclusion: from the above results, we can see that among patients who received RAS treatment using diode laser, there was a high rate of satisfaction and there was an obvious improvement in pain level and healing process with no functional complication ($p < 0.05$), patients can functionally normally immediately after treatment.

Keywords: diode laser, recurrent aphthous stomatitis.

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1. Introduction

Recurrent aphthous stomatitis (RAS) is the ulcer condition with unknown causes; some researchers suggest that main causes are physical trauma, bacteria or virus infection, fungus or allergy to medicine. Clinical symptoms are swelling, hot feeling, redness, ulcers which cause discomfort for daily routines. This disease is usually found in patients 10-40 years old and more frequently seen in female than male. The disease can develop in 7-10 days and can heal by itself; however, big ulcers usually last longer and recur, which cause pain and affect patients' daily lives ([Apthuos Ulcer, 2010](#)).

Laser energy was first used in 1960s in ophthalmology. In 1980, non-intrusive laser or soft laser was applied in medical field. The advantages of laser over traditional techniques have been recorded in medical literature, including: antiseptic, hemostatic, injury-healing promotion. For injury healing process, studies show that laser energy speeds up healing process through promoting epithelial proliferation process, differentiating fibroblasts, increasing protein synthesis, reducing inflammatory process, increasing extracellular matrix products and organization of collagen bundles ([Papazolou et al., 2006](#)).

Thanks to these supreme features, in Vietnam, laser is also widely applied in many medical fields to cure many different kinds of diseases. However, there have not been any researches conducted to assess the efficiency of laser energy in the treatment of RAS. Therefore, we would like to conduct this study to assess the efficiency of diode laser in the treatment of RAS.

2. Research objects and methodology:

2.1. Research objects:

Choose convenience sample including 37 patients who were diagnosed with RAS, and having at least 2 ulcers with similar size.

2.2. Study site:

Department of Odonto-Stomatology, Binh Duong Medical College and clinics of Odonto-Stomatology in Binh Duong and Ha Noi, Vietnam.

2.3. Study period:

From February 2015 to November 2015

2.4. Selection criteria:

- Be co-operative in the study.
- Being diagnosed with RAS.
- Have at least 2 ulcers with diameter $\leq 3\text{mm}$.
- Not having systemic diseases: heart disease, high blood pressure, diabetes, allergy, blood diseases and etc.
- Not having mental diseases.

2.5. Elimination criteria:

- not meeting above selection criteria
- Research equipment: Diode Laser Picaso Lite capacity 2.0W ([Dr. Glenn A. van As](#)).
- Intraoral examination tools.
- Survey questionnaires.

2.6. Methodology

Research design: longitudinal study, controlled clinical trials.

2.7. Description of research method

Patients who meet all selection criteria were given explanation and information about the purpose of the study, regulations. Patients must agree to participate in the study and signed their names in consent forms. Patients were given general health examination and regular medical tests.

Patients with ulcers were divided into two equal groups:

- + Group A: receive instructions to rinse their mouths with Hydrogen peroxide 1 % and have Vitamin group B supplements (B12, B6), apply topical cream with Orabase.
- + Group B: same treatment as group A combined with phototherapy with diode laser energy provided by Diode laser 2.0W equipment, the type with intermittent rays and increasing capacity from 0.7-0.9 watt. Laser is shined 3 times on each ulcer, each time 60 seconds with an interval of 30 seconds between each time. This procedure is repeated for 3 days.

After treatment: Each patient was given an assessment sheet and was required to supply all information regarding pain level, diameter of ulcers, and satisfaction level within 07 days after treatment. Patients were observed to measure the level of pain, diameters of ulcers and healing time within 07 days after treatment.

To ensure all information collected was accurate and sufficient, patients were provided with a phone number to call whenever they have inquiries and they would also be given a reminder phone call within 07 days after treatment. After 07 days, treatment journal would be collected.

2.8. Assessment of results

Assessment criteria: All research objects must supply sufficient information on the provided treatment journal to be included in the research sample.

Data to be assessed:

- Gender
- Feeling of pain: information about pain, the highest level of pain was assessed with a 6-point Likert scale from “not painful” to “unimaginably painful” (Likert, 1932).
- Pain relief day is when patients reported “a little painful or not at all painful” (corresponding to grade 0-not painful or grade 1-a bit uncomfortable on Likert scale).
- Satisfaction level: to be assessed through a three-level scale (Very satisfied – Satisfied – Not satisfied)
- Healing time: (calculated from the moment when there were no ulcers seen on mucosa)

2.9. Data processing and analysis

Collected information and data were analyzed and processed by SPSS version 19.0 and other medical statistic methods.

2.10. Research ethics:

- The study was conducted on patients who agreed to participate in the study under no pressure.
- Patients may exit the study at any time during the study time.
- All information regarding the research methodology must be read and explained clearly to patients.

3. Results and discussion

There was a total number of 37 patients (12 male, 25 female) who met all criteria to participate in the study.

3.1. Male and female proportion:

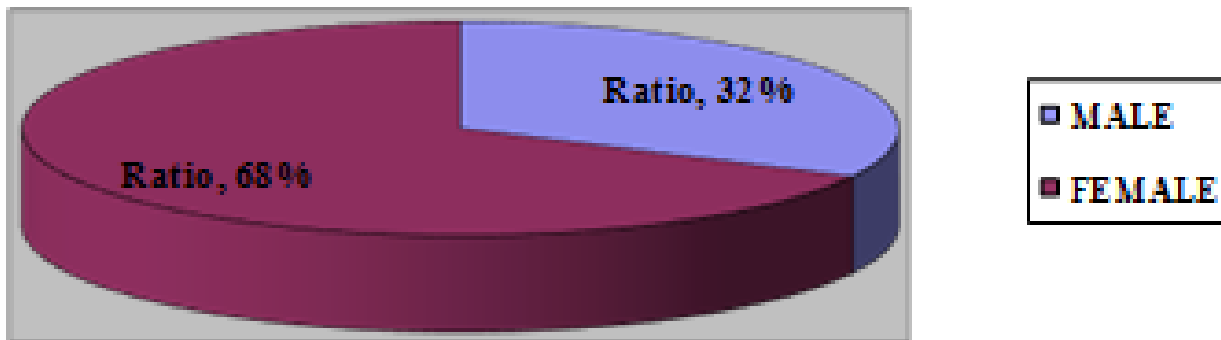


Fig. 1. Male and female proportion

3.2 Post-treatment pain:

Table 1. Percentage of patients who suffered from pain from aphthous stomatitis after treatment (day x after treatment) in group A

Time Gender	Day 1	Day 2	Day 3	Day 4	Day 5	Day 6	Day 7
Male (n=12)	11 (92%)	9 (75%)	7 (58%)	3 (25%)	0 (0%)	0 (0%)	0 (0%)
Female (n=25)	23 (92%)	21 (84%)	17 (68%)	5 (20%)	1 (4%)	0 (0%)	0 (0%)
Total (n=37)	34 (92%)	30 (81%)	24 (65%)	8 (22%)	1 (2.7%)	0 (0%)	0 (0%)

Regarding post-treatment pain in group A, we discovered that 34 patients (92 %) suffered from pain on the first day after treatment; 30 patients (81 %) suffered from pain on the second day, and that figure on the third day was 24 patients (65 %), the figure for the fourth day was 8 patients (22 %) and for the fifth day was 1 patient (2.7 %) and from the 6th day there were no patients who suffered from pain (Table 1).

Table 2. Percentage of patients who suffered from pain from aphthous stomatitis after treatment (day x after treatment) in group B with the supplement of diode laser

Time Gender	Day 1	Day 2	Day 3	Day 4	Day 5	Day 6	Day 7
Male (n=12)	8 (66.7%)	3 (25%)	1(8.3%)	0 (25%)	0 (0%)	0 (0%)	0 (0%)
Female (n=25)	21 (84%)	14 (56%)	4 (16%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Total (n=37)	29 (78.4%)	17 (46%)	5 (13.5%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)

Regarding post-treatment pain in group B, we discovered that 29 patients (78.4 %) suffered from pain on the first day after treatment; 17 patients (46 %) suffered from pain on the second day, and that figure on the third day was 5 patients (13.5 %), and from the 4th day there were no patients who suffered from pain.

3.3. Level of pain after treatment:

Table 3. Percentage of patients by pain level after treatment (pain level classified by Likert scale) in group A

Level Gender	Level 0	Level 1	Level 2	Level 3	Level 4	Level 5	Level 6
Male (n=12)	0 (0%)	0 (0%)	9 (75%)	3 (25%)	0 (0%)	0 (0%)	0 (0%)
Female (n=25)	0 (0%)	1 (4%)	19 (76%)	5 (20%)	0 (0%)	0 (0%)	0 (0%)
Total (n=37)	0 (0%)	1 (2.7%)	28 (75.6%)	8 (21.7%)	0 (0%)	0 (0%)	0 (0%)

Results show that there are two patients (2.7 %) with pain level 1 (very mild pain), 28 patients with pain level 2 (mild pain), equivalent to 75.6 %, and 8 patients at pain level 3 (moderate pain) (21.7 %), no patients suffered from pain level 4 to pain level 6 (unimaginably painful) (Table 3).

Table 4. Percentage of patients by highest pain level after treatment (pain level classified by Likert scale) in group B

Level	Level 0	Level 1	Level 2	Level 3	Level 4	Level 5	Level 6
Gender							
Male (n=12)	0 (0%)	10 (83.4%)	2 (16.6%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Female (n=25)	0 (0%)	19 (76%)	6 (24%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Total (n=37)	0 (0%)	29 (78.4%)	8 (21.6%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)

Results show that there are 29 patients (78.4 %) with pain level 1 (very mild pain), 8 patients with pain level 2 (mild pain), equivalent to 21.6 %, and no patients suffered from pain level 3 to pain level 6 (unimaginably painful) (Table 4).

Observations from the two study groups show that the use of diode laser in treatment has led to considerable pain relief, specifically in group B, only 29 patients were reported to suffer from pain level 1 and 8 patients suffered from mild pain (level 2) and no patients suffered from pain level 3. In group A, 1 patient suffered from pain level 1 and 36 patients reported to suffer from pain level 2 to level 3. There is no statistical difference between male and female proportion ($p > 0.05$).

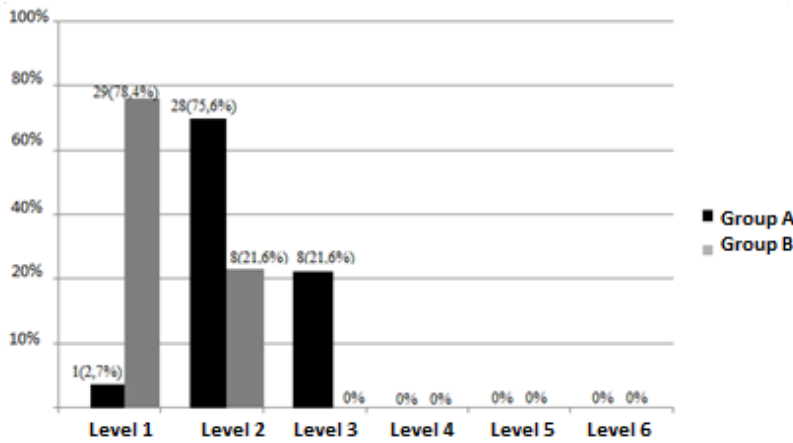


Fig. 2. Comparing pain levels classified by Likert scale between the two study groups

3.4. Healing after treatment:

Table 4. Distribution of proportion and number of patients who recovered after treatment

Time	Day 2	Day 3	Day 4	Day 5	Day 6	Day 7	After day 7
Group							
Group A	0 (0%)	0 (0%)	0(0%)	28 (75.7%)	31 (83.8%)	35 (95.6%)	37 (100%)
Group B	0 (0%)	0 (0%)	7 (18.9%)	34 (91.9%)	37 (100%)		

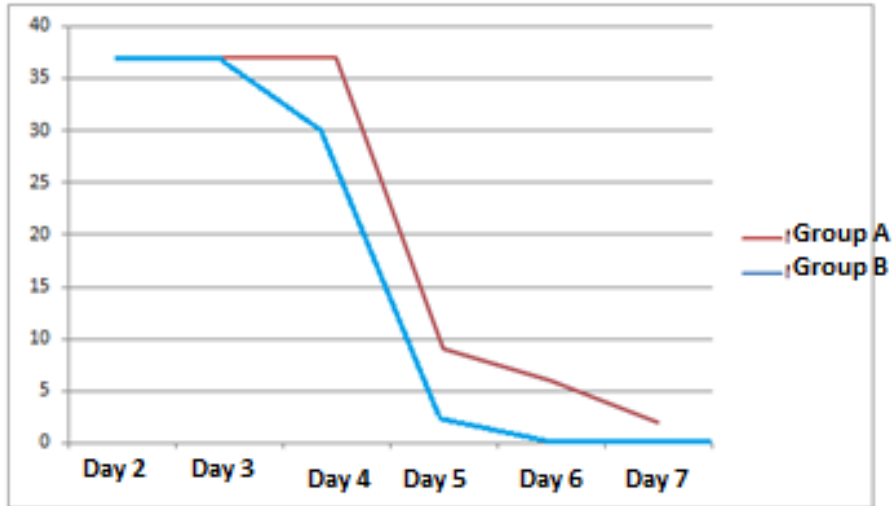


Fig. 3. Comparing healing time between the two treatment groups

In terms of healing time, we recognize that in group A, the number of ulcers healed after the fifth day was 28, equivalent to 27.5 %; on the sixth day there was 31 ulcers, equivalent to 83.8 %, on the 7th day, there were 35 healed ulcers, equivalent to 95.6 %). In group B, which diode laser was used to support the healing process, the number of ulcers healed after the 4th day was 7, accounting for 18.9 %; on the fifth day, 34 ulcers were healed, which accounted for 91.9 %; on the sixth day, all ulcers were completely healed.



Fig. 1. Before treatment

Fig. 2. shine laser on RAS

Fig. 3. 4 days after treatment

3.5. Patients' satisfaction level after treatment:

Table 5. Percentage of satisfied customers after being treated with Diode laser machine

Level	Very satisfied	Satisfied	Dissatisfied	Total
Gender				
Male	11 (91.7%)	1 (8.3%)	0 (0%)	24
Female	24 (96%)	1 (4%)	0 (0%)	19
Total	35 (94.6%)	2 (5.4%)	0 (0%)	43 (100%)

Through the survey with 37 patients about their satisfaction when being treated with diode laser (Diode laser AMD Picaso Lite 2.0w), we have found that up to 94.6 % of patients were very satisfied with treatment results; 02 patients were satisfied with the new treatment method (8.3 %) and not patients were dissatisfied.

In short, using diode laser in the treatment of RAS has proved to be useful and effective and is a reliable method for soft tissue treatment. Laser energy is more effective on soft tissues than other methods. Evidence on histology has shown that injuries treated with laser energy contain very few fibroblast (Zeinoun et al., 2001). This means that injuries treated with laser will contract less and leave fewer scars. In addition, laser energy has antiseptic power on injuries during

treatment process, thus reducing requirement for injury care and antibiotics, contributing to bring comfort and satisfaction for patients. Using diode laser in treating RAS also avoid swelling and pain because heat from laser energy helps close capillaries, lymphatic system due to modification of proteins, and stimulates blood clotting factors (VII) to promote healing process (Pie-Sanchez, 2011).

4. Conclusion

From the study on the 37 objects receiving treatment for RAS. In the first stage, we draw some conclusions as follows:

4.1. Post-treatment pain:

In group A, we have found that 34 patients (92 %) suffered from pain on the first day after treatment, in addition 30 patients (81 %) suffered from pain on the second day; the figure for the third day was 24 patients (65 %), 8 patients on the fourth day (22 %), 1 patient on the fifth day (2.7%) and from the sixth day, there were no patients reporting pain. (Table 1)

In group B we have found 29 patients (78.4 %) who suffered from pain one day after treatment, in addition 17 patients (46 %) suffered from pain two days after treatment, and 3 days after treatment, 5 patients were still painful (13.5 %), and from the fourth day onwards no patients were reported to feel painful (Table 2).

4.2. Pain level: 29 patients (78.4 %) suffered from pain level 1 (mild pain), 8 patients had pain level 2 (mild pain), equivalent to 21.6 %, and no patients suffering from pain level 3 (average pain) to pain level 6 (unimaginably painful). There was no statistical difference in proportion of male and female patients ($p > 0.05$). (Table 3)

4.3. Healing time: we have found that in group A, the number of ulcers healed after the fifth day was 28, equivalent to 27.5 %, on the sixth day 6 there was 31 ulcers healed, which accounted for 83.8 %, on the 7th day, 35 ulcers were healed, equivalent to 95.6 %. In group B, which used diode laser, the number of ulcers healed after the fourth day was 7, accounting for 18.9 %; on the fifth day, 34 ulcers were healed, equivalent to 91.9 %, on the sixth day all ulcers were healed.

4.4. Patients' satisfaction level: we have found that up to 94.6 % of patients were very satisfied with treatment results; 02 patients were satisfied with the new treatment method (8.3 %) and not patients were dissatisfied.

In short the treatment of RAS using diode laser has been efficient.

There was no statistical difference in the proportion of male and female patients during the study ($p > 0.05$).

From above results, we can see that patients who were treated RAS with diode laser show a high satisfaction level; pain relief and healing has shown improvement and there is no functional complication ($p < 0.05$), patients can have normal routine immediately after treatment.

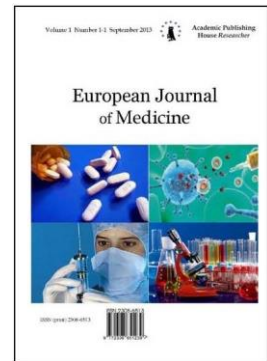
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Acute Kidney Injury, Multiple Myeloma and Heparin Like Syndrome

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Abstract

Heparin like Syndrome is an entity discovered in 1980s. Although uncommon in clinical practice, this syndrome can lead to death in many cases because of severe bleeding. We report the fourth clinical case of a heparin like Syndrome associated to multiple Myeloma and acute kidney injury with a favourable outcome. We describe the evolution of clinical bleeding as activated partial thromboplastin time (APTT) and CD138 (transmembrane heparin sulphate on tumor cells surface) dosage over time.

Keywords: multiple myeloma, partial thromboplastin time, syndrome heparin like, AKI.

1. Case report

We report the case of a 65-year-old Caucasian man. The patient's past medical history was remarkable for cardiovascular risk factor such as diabetes, hypertension, tobacco and dyslipidemia responsible for coronaropathy. He was referred in May 1996, for a chronic myeloid leukemia in chronic phase. Sokal and Hasford scores lead to low risk. He was initially treated with hydroxyurea. In July 2001, he was enrolled in the YNKO1 trial and received interferon and orally aracytine until march 2002 when treatment was switched to imatinib. Major molecular response was obtained in 2003.

In July 2012, he was hospitalized in the department of Nephrology for a severe acute kidney failure with anuria, dyspnea and bone lumbar painful evolving from one month. At the admission, the creatinine level was 1 553 $\mu\text{mol/l}$ (166 $\mu\text{mol/l}$ on June). Anaemia (5.9 g/L) was isolated. Total calcemia was elevated at 3.09 mmol/l. The urinary sediment revealed hematuria and leukocyturia. The ratio proteinuria/creatinuria was 2.12 g/g with tubular profile (24.1 % albumin). The partial thromboplastin time (APTT) was prolonged over 150 seconds and anti Xa activity measured at 0.56 UI/ml without heparin treatment. The serum level of free light chains Lambda was 30 100 mg/l. A Multiple Myeloma (MM) IgG Lambda Salmon and Durie stage IIIB and International Staging System stage III complicated of acute kidney failure (AKIN 3) due to a probably light chain cast nephropathy associated with haemostasis disorder was diagnosed.

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Ultrasonography showed a bilateral enlargement (>12 cms length). A labial salivary gland biopsy was negative for diagnosis of amyloidosis. The kidney biopsy was rejected because of abnormality of coagulation with a prolonged activated partial thromboplastin time (APTT) and previous antiaggregant treatment.

Evolution was complicated by clinical hemorrhagic syndrome with severe bleeding after salivary gland biopsy and insertion of temporary haemodialysis catheter in femoral site that led to eleven red blood cell transfusion in eighteen days.

The first step was to investigate the APTT prolongation. Mixing between patient plasma and normal plasma showed no correction. Factors VIII, IX, XI, XII measurements were normal. The research of anti-phospholipid or antibodies anti-factor was negative. We concluded that the presence of a heparin like substance was responsible of the APTT and Thrombin time (TT) prolongation. The main hypothesis was a heparin like Syndrome (HLS).

Secondly, exploration of APTT in vitro showed no effect of heparinase (enzyme cleaving heparin and inhibiting its effects) (data not shown) and an effect of protamin sulfate only at high doses (Table 1).

The patient was treated therapy with MPV consisting in melphalan (Alkeran^o) (9 mg/m² D8 at D11) and prednisone (60 mg/m²) on day 6 and once a week (D13 and D20), either in association with bortezomib (Velcade^o) (1.3 mg/m²) (D7, D10, D14, D17) (Figure 1).

The normalisation of APTT was obtained at the 9th days of treatment (D15 after admission) and after the first plasmatic exchanges (Figure 1). In multiple myeloma, Syndecan-1 (CD138) has been identified as a transmembrane heparin sulphate on tumor cells surface localised in the bone marrow. We observed in the patient's plasma the decrease of cell tumor burden (marked by Syndecan-1 or CD138) correlated with the normalization of APTT (Figure 1). After 4 cycles, given a rapid decrease of M-protein component, free light chains and an improvement of overall condition and kidney clearance. A high-dose therapy with melphalan (Alkeran^o) with autologous stem cell transplantation was planned in May 2013. The dialysis treatment has been stopped in November 2012 (5 months after starting hemodialysis).

One year after MM diagnosis, the patient had a good evolution with chronic kidney disease stage 3B (CKD-EPI 41 ml/min/1.73m²).

2. Discussion

Patients with MM have an increased thrombotic risk (Auwerda et al. 2007) but there are few data concerning bleeding complications (Auwerda et al. 2007).

Bleeding complications have been the results of some abnormalities like a clinical hyperviscosity syndrome (Kwaan, Bongu, 1999), acquired Von Willebrand disease (Huang, Saidi, 2004) or hemophilia due to myeloma (Loftus, Arnold, 1994).

Moreover, another entity has been discovered due to disorder of physiologic heparinoid substance synthesis by the liver (Bienkowski, Conrad, 1984). The main role is to maintain homeostasis (Bourin, Lindahl, 1993).

In multiple myeloma, Syndecan-1 (CD138) has been identified like a transmembrane heparin sulphate on tumor cells surface localised in the bone marrow. Studies identified two functions otherwise of this CD 138: inhibitor activity on cells growth (Kato et al., 1998), (Yang et al., 2002) (ectodomain) and also biologically active heparin sulphate chains (Kato et al., 1998) (after proteolysis of the extracellular domain). High level of Syndecan 1 is an indicator of poor prognosis (Yang et al., 2002) stimulating tumor growth and dissemination.

There are only three cases reports of Heparin like syndrome in MM (Khoory et al., 1980), (Torjemane et al., 2007) complicated by a poor prognosis with death (Palmer et al., 1984), (Rodgers, Corash, 1985) because of severe bleeding. Moreover, a heparin like syndrome was described in others clinical situations like sepsis, hepatitis disorders (Llamas et al., 2000) (Senzolo et al., 2009) and breast tumour (Rodgers, Corash, 1985).

The treatment of heparin like syndrome is not well established but the treatment of the cause (hemopathy, sepsis, hepatitis) seems to be the main objective. The authors couldn't conclude on effective therapies due to few cases described and many early deaths among them.

In our case report, we think that the main treatment leading to APTT normalization was the specific myeloma treatment because of correlation between the decrease of CD138/Syndecan-1 and

APTT correction after chemotherapy (Figure 1). We think it could be discussed whether plasma exchange could help reduce the pathogenic immunoglobulin but not reduce heparinoid substances.

Table 1. Neutralization assay in vitro by protamin sulfate

	patient + 0 U/ml protamine	patient + 10 U/ml protamine	patient + 50 U/ml protamine	patient + 100 U/ml protamine	patient + 200 U/ml protamine
TT s	119,7	50,5	24,5	12,6	
AXA UI/ml	0,35	0,25	0,4	0,36	0

TT: Thrombin time; AXA: anti-factor X a activity

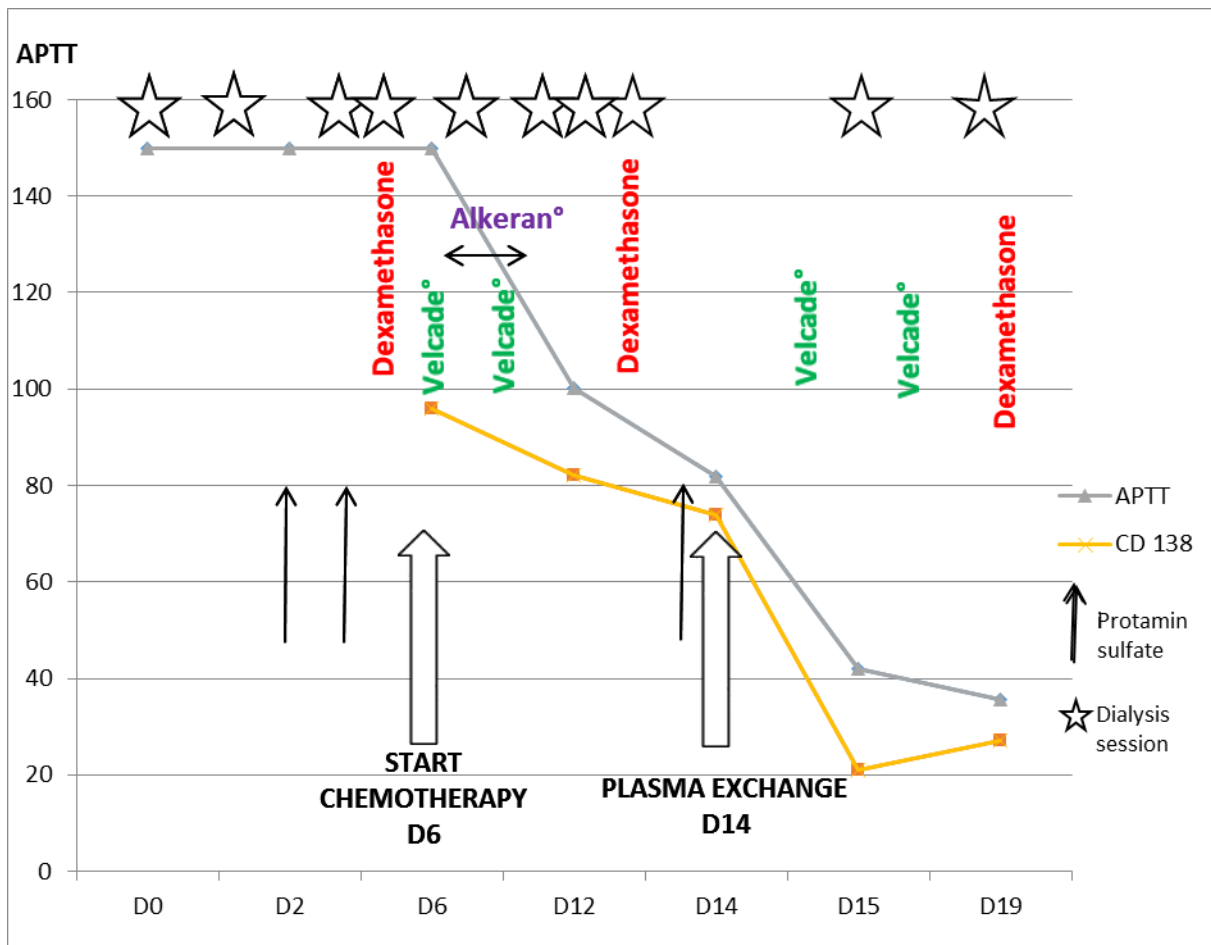


Fig. 1. APTT and CD138 evolution over the time and treatment (Do: admission day)

3. Conclusion

We report the fourth case of heparin like syndrome with hemorrhagic syndrome and acute kidney failure secondary to multiple myeloma IgG with good evolution.

In this case, start quickly chemotherapy treatment permit to control severe hemorrhagic complications.

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Diabetes in West Africa: Using Meta-Ethnography to Synthesise Qualitative Studies in Ghana, Cameroon and Nigeria

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Abstract

The aim of this study was to apply meta-ethnography to synthesise qualitative studies in the area of diabetes care in Ghana, Cameroon and Nigeria. Full text qualitative studies were collected from several recognised electronic databases to select quality papers for the analysis. Controlling for all possible selection biases, we chose eight standard peer reviewed qualitative studies in the area of diabetes mellitus. Subsequently, we pragmatically applied the seven-stage procedure of Noblit and Hare to conduct a meta-ethnography. As a qualitative alternative to meta-analysis, the meta-ethnography approach allowed us to employ both induction and interpretation. Subsequently, the following five concepts: tripartite aetiology; healer choice; adherence; coping strategies; and discriminatory switch were derived. In addition, we also derived second-order and third-order interpretations from our synthesis. Although we do not intend to make any generalisation claim, our study offered to illuminate a more coherent story about diabetes care within the West African mind so far.

Keywords: Diabetes Mellitus, Diabetes Care, West Africa, Ghana, Cameroon, Nigeria, Meta-Ethnography, Qualitative Research.

1. Introduction

Diabetes mellitus (DM) is a chronic non-communicable metabolic disorder which is gradually becoming a global pandemic. Its pathophysiology is manifested by a state of hyperglycaemia, a syndrome of food nutrients' metabolism, which is due to poor insulin secretion, insulin action, or both ([American Diabetes Association, 2003](#)). DM prevalence is estimated by projection, to rise from 171 million people with DM in 2000 to 366 million by 2030 ([Wild, Roglic, Green, Sicree, & King, 2004](#)). Notwithstanding this, Africa is lagging behind in its diagnostic and holistic management protocols ([International Diabetes Federation \[IDF\], 2015; Sarfo, 2014](#)).

Africa has more than two-thirds of its estimated cases of people with DM as undiagnosed, although no country or continent has successfully diagnosed every case of DM ([IDF, 2015](#)). When sub-Saharan Africa is evaluated on such claims, the picture becomes quite gloomy due to its lack of resources and poor governments' commitment to prioritise DM screening. The estimated statistics

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for sub-Saharan Africa shows an average percentage of 66.7 % people with undiagnosed DM as compared to 35.8 % in high-income countries (IDF, 2015).

The problem of undiagnosed and possible late DM case detection often leads to complications such as heart failure, retinopathy, chronic kidney disease, neuropathy and neuropsychological dysfunctions even after biomedical healthcare is finally sought. In addition, ignorant people with undiagnosed cases in sub-Saharan Africa fail to take healthy steps to manage their lifestyles or condition (Sabanayagam, Lim, Wong, Lee, Shankar, & Tai, 2010; Sarfo, 2014; Sarfo, Cudjoe, Fosu, & Schlatter, 2015; Sarfo, & Mate-Kole, 2014). Coupled with the undiagnosed and lately diagnosed DM cases, our synthesis is grounded the following key assumptions. To begin with, there are few researchers in sub-Saharan Africa who are keen to study DM cases. This has resulted in scarce or even missing incidence data on the DM case in sub-Saharan Africa. In addition to this huge research gap, only a few number of these DM studies from sub-Saharan Africa offer in-depth qualitative pictures of recent DM situations in the sub-Saharan Africa or West Africa to be specific (IDF, 2015).

Besides the paucity in qualitative data, the linkages among their results seem quite disjointed owing to the fact that some of these qualitative studies pay more attention to some constructs than others (Awah, 2014; de-Graft Aikins et al., 2012; de-Graft Aikins, 2005; de-Graft Aikins, 2004; Doherty et al., 2014; Ibrahim et al., 2015; Kiawi et al., 2006; Kratzer, 2012). Granting the disputed nature and criticisms labelled at most qualitative researches (Murphy, Dingwall, Greatbach, Parker, & Watson, 1998), a comprehensive synthesis of the few available quality studies in West Africa is crucial (Britten et al., 2002). Finally, there is a greater need for clinicians, educators, policy makers and stakeholders to know the existing frame of illness perception among persons with DM in the sub-region. This will help shape the focus of care to provide a more acceptable, holistic and convenient care vis-à-vis the sociocultural context (Sarfo, 2014).

Even though this paper is not meant to yield a generalizable theoretical explanation of the existing DM situation in West Africa, it brings to light a common cumulative cord of facts about the DM illness perceptions which is meaningful within their sociocultural context. The purpose of this study is to use meta-ethnography to synthesise a more coherent story of DM within the common West African setting.

2. Method

Sources of data

We searched Cochrane Library, MEDLINE (PubMed), MEDICAL SUBJECT HEADINGS (MeSH), Google Scholar, PsycINFO and African Journal Online (AJOL) to find all related studies. We combined keywords such as; “diabetes” or “diabetics” with “Cameroon”, “Ghana”, and “Nigeria”. Various related terms like “West Africa”, “sub-Saharan Africa”, “qualitative study”, “interview”, “health beliefs”, “adherence”, “self-management”, “lay perceptions”, “compliance”, or “self-care” were added to narrow down our search output.

Procedure

Discovering relevant studies was vital to our initial interest. Following online database searches, we reviewed titles and abstracts. We selected any abstract of a qualitative paper that might have studied DM in Cameroon, Ghana or Nigeria. We then downloaded the full-text copies of these selected abstracts controlling for all possible selection biases like author’s name, institutions and publishers. Afterwards, each author serving as an independent coder reviewed each paper for not less than three times. Other colleagues were passively and voluntarily involved in this process to enhance objectivity. The final decisions about inclusion/exclusion and quality assessments were made together following careful assessment of research goals and standards.

The general criterion we used for the synthesis was meta-ethnography as outlined by Noblit and Hare (1988). This is an alternate form of quantitative meta-analysis. Our synthesis was guided by the pragmatic perspective, as we followed systematic methods of induction and interpretation. This approach allowed us to translate selected qualitative researches into one another (Britten et al., 2002).

3. Results

Getting started

The first step in the process described by Noblit and Hare (1988) is '*getting started*'. At this stage, we formulated a good research question that could be answered by qualitative research. Our synthesis sought to answer the following research questions:

- (a) What are the concepts of DM within the three (3) West African countries?
- (b) What interpretations can be made from the key constructs?

These research questions guided our synthesis.

Deciding what is relevant to the initial interest

The next step was focused on '*deciding what is relevant to the initial interest*'. As defined by Noblit and Hare (1988), this is the point where we selected and determined the path of synthesis. In essence, it entailed; "*defining the focus of the synthesis; locating relevant studies; making decisions on inclusion; and quality assessment*" (Atkins et al., 2008: 3). It is noteworthy that there is little agreement on the issue of quality assessment of publications in meta-ethnography by researchers (Atkins et al., 2008). Nonetheless, our assessment of quality was pragmatic and essentially based on methodological strengths.

Studies were limited to (1) qualitative studies that were reported in English; (2) studies specific to samples from Cameroon, Ghana, and Nigeria [*interest for these 3 countries was based on IDF (2015) estimations and related risk projections*]; and (3) studies should have a 100 % to 50% DM focus. Based on this criteria, twelve (12) studies were initially included. We finally agreed on eight (8) papers but had little control on the distribution of studies across the 3 countries [i.e. Awah (2014) and Kiawi et al. (2006) from Cameroon; de-Graft Aikins et al. (2012), de-Graft Aikins (2005); de-Graft Aikins (2004), Doherty et al., 2014 and Kratzer (2012) from Ghana; Ibrahim et al. (2015) from Nigeria].

Reading the studies

At this stage, we did a careful '*reading of studies*' to become familiar with every detail and content (Noblit, & Hare, 1988). At this step, we tried as much as possible to appreciate the content of all selected studies. In addition, we started taking out 'metaphors' or emerging themes (Atkins et al., 2008). We took initial notes of emerging themes and agreed on their suitability before adding them. We also took record of the nature of study's sample, data collection and settings. This served as our foundation for explanations and interpretations studies (Britten et al., 2002). Table 1 shows the summary of selected papers.

Determining how the studies are related

The fourth step in the process described by Noblit and Hare (1988) was '*determining how the studies are related*'. At this step, we finally agreed on our generated themes. We also looked for their relationships and in some cases, we juxtaposed them. In all, five (5) concepts were eminent using Schutz's (1962) framework of first- and second-order constructs. Our 5 concepts included: tripartite aetiology; healer choice; adherence; coping strategies; and discriminatory switch.

The first concept which was the tripartite aetiology included the three-way causal attributions that were common to the West African settings. These included the '*natural myths*', '*natural facts*', and '*supernatural causes*'. The natural myths were natural causal or risk factors that had no scientific bases like being rich [*as in rich people's disease*], eating sugar or sweet things. The natural facts were natural risk factors that had scientific bases like taking alcohol, sedentary lifestyle, high fat food, obesity, and overweight. Lastly, supernatural causes like witchcraft, sorcery and ancestral curses were seen as the third causes (Awah, 2014; de-Graft Aikins et al., 2012; de-Graft Aikins, 2005; de-Graft Aikins, 2004; Kiawi et al., 2006).

The second concept was a person's healer choice at a given time. This included the biomedical and traditional health-care / faith healers. Some went in for one-at-a-time or both concomitantly. It should be noted that both providers seem to be equally valued (Awah, 2014; de-Graft Aikins, 2005).

The third concept was diabetes care adherence. This was viewed as compliance with biomedical diabetes care which could be stable and problematic adherence (Awah, 2014; de-Graft Aikins, 2005; de-Graft Aikins, 2004; Doherty et al., 2014; Ibrahim et al., 2015; Kiawi et al., 2006; Kratzer, 2012).

The fourth concept in our synthesis was coping strategies. These were the methods of adaptation during biomedical treatment. These included multiple coping approaches like adopting family support, religious coping, taking medication, and so on.

Finally, the fifth concept was the art of discriminatory switching among healers. This is the active or passive, but selective, back-and-forth moment between biomedical and traditional caregivers/faith healers. As noted by de-Graft Aikins (2005) as healer shopping, we introduced the term discriminatory switch to illuminate the conscious and selective act of 'hopping' from one caregiver to the other. This is often motivated by economic factors, need for cure rather than control, social factors, and caregiver attitudes. A tabular display of these studies are shown in [Table 2](#).

Translating the studies into one another

'Translating the studies into one another' involved the process of comparing one study's themes and metaphors with the themes and metaphors in another study (Noblit, & Hare, 1988). We used "a method of reciprocal translation by first arranging each paper chronologically" (Atkins et al., 2008: 7). From there, we compared paper one with the second paper. Subsequently, both papers were compared with the third paper until all 8 were completed. Blank spaces were indicated with a minus sign [-] in [Table 1](#) to show the lack of germane information about concepts in a particular paper.

In [Table 1](#), we also included the second-order explanation for the specific papers while we made a synthesised second-order explanation for all the papers in [Table 2](#). In effect, our second-order explanation for all the papers indicates the following; (a) there are 3 main causal attributions determining succeeding health behaviours, (b) the desire for flexibility of care protocols and cure rather than control of diabetes are the hypothetical advantages that traditional caregivers/faith healers have over biomedicine, (c) the non-compliance to biomedical management is an alternative coping strategy and a 'cost-benefit' analysis outcome of persons living with diabetes, and (d) healer switching is a cognitive dissonance response to problematic adherence, treatment barriers and need for cure.

Synthesising translations

The next stage of our meta-ethnography was aimed at *'synthesising translations'*. During this stage, we advanced from reciprocal translations to a more complex level of synthesis; where we made use of third-order interpretations and constructs (Britten et al., 2002). Our interpretations were shared with researchers and clinicians who shared strong agreements. We came out with two (2) interpretations. These include; (a) biomedical care is as important as traditional health-care/faith healers among persons living with diabetes and (b) healer switching to alternative caregivers flourishes once perceived or actual biomedical care barriers increases.

Table 1. Completed Grid: Lay Meanings of Diabetes and its Care

Tripartite aetiology	Setting	Data collection	Sample	Methods and concepts
Natural myths, Natural facts, Supernatural	One urban and one rural health districts in Cameroon.	Observations, conversations, interviews, focus group discussions, biographies, case studies, and documentary evidence.	Community members, diabetes sufferers, Biomedical and traditional health-care providers.	Awah (2014)
Natural myths, Natural facts,	Four urban health districts in Cameroon.	Semi-structured individual interviews.	Community members.	Kiawi et al. (2006)
Natural myths, Natural facts, Supernatural	Two rural communities in Ghana.	Semi-structured individual and group interviews.	Persons living with diabetes and lay healthy people.	de-Graft Aikins (2004)
Natural myths, Natural facts, Supernatural	Two urban and two rural towns in Ghana.	Focus groups, interviews, and Ethnographical studies.	Persons living with diabetes.	de-Graft Aikins (2005)
Natural myths, Natural facts, Supernatural.	Three towns in Ghana.	Focus group discussions.	Lay people.	de-Graft Aikins et al. (2012)
-	Capital of Ghana	Individual and dyadic interviews.	Families with a child with Type 1 diabetes.	Kratzer (2012)
-	One urban community in Ghana.	Focus groups discussions and individual interviews.	Persons living with Type 2 diabetes and their caregivers.	Doherty et al. (2014)
-	Capital of Nigeria	Non-participatory observation, in-depth interviews and focus group discussion.	Persons living with diabetes and their healthcare providers.	Ibrahim et al. (2015)

Discriminatory switch	Coping strategies	Diabetes Care Adherence	Healer choice
Healer switching occurs once patients do not get desired results.	Multiple	Compliance with biomedicine is not very firm because it proposes control rather than cure.	Biomedical and traditional health-care providers were equally valued.
-	Multiple	Knowledge and resource availability affect compliance with biomedical care.	Determined by on knowledge and resource availability.
-	Multiple	Knowledge, social support, resource availability and cost affect compliance with biomedical care.	Rest on knowledge and availability and cost of resource.
Healer switching occurs once patients cannot cope with the cost and psychosocial burden.	Multiple	Cost and psychosocial burden determine compliance with biomedicine.	Biomedicine is more preferable although traditional health-care is vital.
-	-	-	Biomedicine is more preferable although traditional health-care is vital.
-	-	Knowledge, biomedicine cost and education affect compliance with bio - medicine.	Biomedical care and lifestyle reforms.
-	-	Sociocultural practices and knowledge affect biomedical care compliance.	Biomedical and lifestyle change.
Healer switching occurs once patients cannot cope with hospital barriers like waiting time.	Multiple	Hospital barriers and sociocultural beliefs affect biomedical care compliance.	Biomedical and traditional health-care providers.

Explanation/theory (second-order)	Biomedical care must consider patients' traditional health-care options in order to increase their compliance with care as traditional medicine offers high curative expectations.	Limited biomedical knowledge about diabetes coupled with lay representations and inadequate resources may affect the choice of diabetes care and compliance.	Combination of Biomedical, Psychosocial, and Spiritual / Religious concepts about diabetes, social support, resource availability and cost regulate patients' management practices.	Medical inaction and switching from biomedicine to ethno-medicine, and faith healing by patients is due to psychosocial impact of diabetes and the high cost of biomedical care.	Inadequate knowledge, level make persons to externalise their problems and thus, are less likely to adopt healthy practices in biomedical diabetes care.	Compliance with biomedical care is influenced by the cost of care and low level awareness.	Nutritional knowledge and sociocultural practices affect non-adherence to diabetes dietary regimens.	Persons with diabetes have complications because of hospital barriers and failure to follow regimen due to cultural beliefs.
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Table 2. Synthesis, Including Concepts and Second- and Third-Order Interpretations

Concepts	Second-Order Interpretations	Third-Order Interpretations
TRIPARTITE AETIOLOGY: causal attributions; natural myths, natural facts, and supernatural causes of diabetes.	<ul style="list-style-type: none"> The three main causal attributions determine succeeding health behaviours. Desire for flexibility of care protocols and cure rather than control of diabetes are the hypothetical advantages that traditional caregivers / faith healers have over biomedicine. 	<ul style="list-style-type: none"> Biomedical care is as important as traditional health-care among persons living with diabetes. Healer switching to alternative caregivers flourishes once perceived or actual biomedical care barriers increases.
HEALER CHOICE: range of caregiver options; biomedical and traditional caregivers / faith healers.		
DIABETES CARE ADHERENCE: compliance with biomedical diabetes care; stable and problematic adherence.	<ul style="list-style-type: none"> Non-compliance to biomedical management is an alternative coping strategy and a 'cost-benefit' analysis outcome of persons living with diabetes. 	
COPING STRATEGIES: methods of adaptation during biomedical treatment; the use of multiple coping approaches.	<ul style="list-style-type: none"> Healer switching is a cognitive dissonance response to problematic adherence, treatment barriers and need for cure. 	
DISCRIMINATORY SWITCH: selective, back and forth changes between biomedical and traditional caregivers / faith healers; motivated by economic		

factors; motivated by need for cure; motivated by social factors; motivated by caregiver attitudes.	
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4. Discussion

We used meta-ethnography to synthesise 8 papers to tell a coherent story about the concepts of DM within Cameroon, Ghana and Nigeria. We also provided second-order and third-order interpretations from the selected studies. It is evident from our synthesis that causal attribution of DM is a very essential determinant of future behaviour patterns and decision making. The state of DM in the sub-Saharan is quite alarming with increasing number of cases, undiagnosed and lately diagnosed cases (IDF, 2015). Together with poor compliance during care after delayed diagnosis are more likely to have negative effects on the individual and the nations as well (Sabanayagam et al., 2010; Sarfo, 2014).

In addition, the desire for flexibility of care protocols and cure rather than control of diabetes are the hypothetical advantages that traditional caregivers/faith healers have over biomedicine. This may sound speculative but will continue to serve a latent function in the scope of non-compliance until biomedical caregivers give it the necessary consideration (Awah, 2014; de-Graft Aikins, 2004; de-Graft Aikins, 2005; Kiawi et al., 2006). Moreover, the scope of non-compliance or non-adherence of the person with DM in these settings is to greater extent, an alternative coping strategy and a result of his or her treatment 'cost-benefit' analysis. A similar belief is seen among patients in the developed countries (Britten et al., 2002).

Once a person feels that his or her hopes of getting cured in a more flexible manner, is failing, a possible depressive mood and non-adherence to the DM treatment regimen are inevitable. Consequently, healer switching will continue as a cognitive dissonance response to such problematic adherence, high cost of care, low level awareness, treatment barriers like long waiting time at health facilities and patients need for cure. This result is consistent with the assumptions made in a meta-ethnography on drug non-adherence that, "*alternative coping strategies are not seen by patients as medically legitimate*" and possible "*fear of sanctions and guilt produce selective disclosure*" (Britten et al., 2002: 213). As seen in a meta-analysis by Gonzalez et al. (2008), non-adherence to the DM treatment regimen is significantly associated with depression. This finding is also supported by some recent studies in Ghana too (Sarfo, 2014; Sarfo, & Mate-Kole, 2014).

5. Limitations

Initially, we were of the anticipation that we would be able to obtain a more balanced distribution of papers across the 3 countries, however, our inclusion / exclusion criteria and quality standards could not permit this expectation.

Nevertheless, we did not see this as a greater challenge to our analysis as our research goals were not necessarily meant to compare and contrast the stories among these countries, but to produce a picture of the existing DM illness perception.

6. Conclusion

The trend as observed in our synthesis shows that persons living with DM and other lay community member attribute the causality of DM to three factors; natural myths, natural facts, and supernatural causes.

These illness perceptions are very essential determinants of future management behaviour patterns and decision making. Ignoring the other options to DM by biomedical caregivers is one of the reasons for non-compliance to the management of the condition.

It should be noted that DM Healer switching from biomedical to other alternative DM caregivers will continue to flourish in West Africa once the perceived or actual biomedical care barriers of clients increases.

It is hopeful that our potential readers appreciate importance of traditional health-care/faith healers among persons living with DM in Cameroon, Ghana, and Nigeria.

7. Recommendations

We recommend that governments in selected West African countries should strengthen their policies on improving early DM screening, holistic care and health education. Biomedical caregivers should also work at eliminating or reducing high cost of DM care, low level awareness treatment and other treatment barriers like waiting time, power imbalances between staffs and clients etc.

Likewise, biomedical caregivers should take into respect, the traditional health-care/faith healer options of persons with DM in order to provide the best health education, increase their compliance, and to also make informed decisions within their existing sociocultural context.

In addition, researchers can focus more in testing our third-order interpretations as hypotheses. These recommendations will enhance the future of health promotion and DM management in the sub-Saharan Africa.

8. Conflict of interest statement

The authors declare that they do not have any conflict of interest.

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