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The Impact of Mentoring as a GMP Capability Building Tool in The Pharmaceutical Manufacturing Industry in Nigeria

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ABSTRACT

Good Manufacturing Practices (GMP), a component of Pharmaceutical Quality Systems, is aimed primarily at managing and minimizing the risks inherent in pharmaceutical manufacture to ensure the quality, safety and efficacy of products. Provision of adequate number of personnel with the necessary qualifications/practical experience and their continuous training and evaluation of effectiveness of the training is the responsibility of the manufacturer. (World Health Organization [WHO], 2014; International Organization for Standardization [ISO], 2015). The classroom method of training that has been used for GMP capacity building in the pharmaceutical manufacturing industry in Nigeria over the years, delivered by experts from stringently regulated markets, have not yielded commensurate improvement in the Quality Management Systems (QMS) in the industry. It is necessary and long over-due to explore an alternative training method that has a track record of success in other sectors. A lot of studies carried out on mentoring as a development tool in several fields such as academia, medicine, business, research etc., reported positive outcomes. The aim of this study was to explore mentoring as an alternative GMP training method in the pharmaceutical manufacturing industry in Nigeria. Specifically, the aim of this study was to evaluate the impact of mentoring as a GMP capability building tool in the pharmaceutical manufacturing industry in Nigeria, with focus on GMP documentations in XYZ pharmaceutical manufacturing company located in South-Western region of Nigeria. The methodology comprised gap assessment of GMP documentation of XYZ company to generate current state data, development of training materials based on the identified gaps and use of the training materials for the mentoring sessions. The outcome of the study was outstanding as gap assessment identified the areas of need that enabled development efforts to be targeted at these areas, unlike generic classroom training. The mentees' acceptance of the mentoring support was evident by their request for additional training in some other areas related to the microbiology operations that were not covered in the gap assessment. This result portrays mentoring as a promising tool for GMP capacity building, but more structured studies need to be conducted in this area to generate results that can be generalized.

KEYWORDS

Mentoring, mentoring program effectiveness, capability building, mentor

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1. INTRODUCTION

Principles of Pharmaceutical Quality

The Principles of Pharmaceutical Quality System (PQS) requires the manufacturer to assume responsibility for the quality of the pharmaceutical products to ensure that they are fit for their intended use, comply with the requirements of the marketing authorization and do not place patients at risk due to inadequate safety, quality or efficacy. The attainment of this quality objective is the responsibility of senior management and requires the participation and commitment of staff in different departments and at all levels within the company, the company's suppliers and the distributors. To achieve this quality objective reliably there must be a comprehensively designed and correctly implemented pharmaceutical quality system (PQS) incorporating GMP and QRM. (WHO, 2014, p. 85-86).

ICH Q10 Guideline - Pharmaceutical Quality System is described as one comprehensive model for an effective pharmaceutical quality system that is based on International Organization for Standardization (ISO) quality concepts including applicable Good Manufacturing Practice (GMP) regulations and complements ICH Q8 "Pharmaceutical Development" and ICH Q9 "Quality Risk Management (QRM)". "ICHQ10 is a model for a pharmaceutical quality system that can be implemented throughout the different stages of a product lifecycle. Much of the content of ICH Q10 applicable to manufacturing sites is currently specified by regional GMP requirements" (ICH Q10 Guideline, 2008).

Good Manufacturing Practices (GMP) is that part of quality management which ensures that products are consistently produced and controlled according to the quality standards appropriate to their intended use and as required by the marketing authorization, clinical trial authorization or product specification. GMP is concerned with both production and QC. GMP is aimed primarily at managing and minimizing the risks inherent in pharmaceutical manufacture to ensure the quality, safety and efficacy of products. (WHO, 2014, p.90).

The manufacturer is required to have an adequate number of personnel with the necessary qualifications and practical experience. This is because the establishment and maintenance of a satisfactory system of Quality Assurance (QA) in addition to the correct manufacture and control of pharmaceutical products and active ingredients rely upon people. (WHO, 2014, p. 99). It is the manufacturer's responsibility to provide training for "all personnel whose duties take them into manufacturing areas or into control laboratories (including the technical, maintenance and cleaning personnel), and for other personnel as required". They should be given continuous training and practical effectiveness of the trainings should be periodically assessed. (WHO, 2014. P. 103).

The quality, safety and efficacy of pharmaceutical products manufactured in Nigeria are regulated by National Agency for Food and Drug Administration and Control (NAFDAC) through her GMP guideline - NAFDAC Good manufacturing practice guidelines for pharmaceutical products, 2016 amongst other guidelines.Though, the national guideline is aligned with the WHO Good Manufacturing Practices for Pharmaceutical Products: Main Principles, the WHO GMP guideline is universally accepted as the minimum standard of GMP. Hence, the WHO guideline will be used as a standard upon which the GMP documentation of XYZ pharmaceutical manufacturing company will be assessed. It is the ultimate goal of this work that local pharmaceutical manufacturers in Nigeria be able to place products in the stringent regulated markets in the near future. To facilitate this goal, the PICS GMP Guide (2018):PE 009-14 (Part I) - Guide to Good Manufacturing Practice for Medicinal Products, was also used as a second standard since this is the common standard used by regulators in the stringently regulated markets for inspections.

History of local pharmaceutical manufacture in Nigeria

Mackintosh, Banda, Wamae, & Tibandebage, 2016 (as cited in Lartey, Graham, Lukulay, & Ndomondo-Sigonda, 2018) stated that the first pharmaceutical manufacturing facilities in Nigeria were set up in 1945 by Multinational companies. The enactment of the Indigenization Policy in 1978 by the Nigerian Government forced most of the multinational companies to sell 60% of their shares to Nigerian investors. It is important to note that investors go into business to have return on their investment and may not understand the technicalities of running such businesses. The Indigenization Policy era was followed by the Import License regime, a period characterized by a very unfriendly economic environment prohibiting ease of doing business. The result was gradual divestment of multinational companies from local pharmaceutical manufacturing in the country. The outcome was emergence of 100% locally owned pharmaceutical manufacturing facilities in Nigeria (Ogbonna, Ilika, & Nwabueze, 2015), with many new entrants. Thus, Nigeria became the leading pharmaceutical manufacturing country in Sub-Saharan Africa, (Wambebe, & Ochekpe, 2011 as cited in Lartey, Graham, Lukulay, & Ndomondo-Sigonda, 2018), with about 200 local pharmaceutical manufacturing facilities, as reported in the baseline

assessment of the Nigerian pharmaceutical sector, published by World Health Organization (2002). The numerical growth of pharmaceutical manufacturing facilities in Nigeria did not have commensurate growth in the Quality Management Systems of the industry.

Development of Pharmaceutical Manufacturing in Africa

The pharmaceutical manufacturing industry in Nigeria is not alone in the dilemma of slow technical development. The issue cuts across the Sub-Sahara African (SSA) region and even Africa as a continent. Despite the age of the local pharmaceutical manufacturing industry in Sub-Saharan Africa, the rate of development is extremely slow. “It is instructional to note that pharmaceutical manufacturing started in India in 1930” (Indian Mirror as cited in Lartey, Graham, Lukulay, & Ndomondo-Sigonda, 2018), the same year as in SSA. In the 1970s, the Indian pharmaceutical manufacturing industry started its exponential growth (Shah, 2012 as cited in Lartey et al 2018), and is far more advanced than the industry in Africa with Indian manufacturers exporting medicines to stringent regulated markets, such as the USA and Europe. However, the story is different for the African local pharmaceutical manufacturing industry that is still struggling and unable to be self-sufficient in producing quality, safe and efficacious medicines for the patients in the continent.

The World Health Organization (2013) estimated that over 70%, or 37 million persons, living with HIV are in SSA and only 35% of them have access to antiretrovirals (Global HIV & AIDS statistics — 2019 fact sheet | UNAIDS), which are mostly supplied by donor Agencies like Global Fund who procure World Health Organization pre-qualified generics. Out of the 172 formulations (WHO, 2017) pre-qualified by WHO (WHO-PQ) for the treatment of HIV and associated opportunistic infections, only six are manufactured in Africa while 119 are from India (Lartey et al 2018). The lack of exponential growth coupled with absence of backward integration to cover the entire value chain (which involves new drug discovery, development, active pharmaceutical ingredient manufacturing and manufacture of finished dosage forms), has made it alarmingly apparent that Africa is heavily dependent on others for its medicine supply and public health. This looming security threat led to recognition of the pharmaceutical manufacturing sector as vital to sustainable development and was instrumental to the resolution of the African Union (AU) Heads of State and Government to develop the sector (Lartey et al 2018). The outcome was the development of pharmaceutical manufacturing plan for Africa: business plan. (PMPA-BP). The stakeholders drafted the terms of reference, enabling the partnership between (Africa Union Congress (AUC) and the United Nations Industrial Development Organization (UNIDO) to oversee development of the PMPA-Business Plan (Ngozwana et al 2012). Several studies sponsored by Deutsche Gesselschaft fur Technische Zussamennar and UNIDO, conducted in some key manufacturing countries including Ghana, Kenya, Nigeria and Uganda, led to comprehensive delineation of common challenges facing the industry.

These included:

1. Poor compliance with Good Manufacturing Practices (GMP);
2. Lack of effective regulatory capacity of National Medicines Regulatory Authorities (NMRAs);
3. Unfavorable business and market dynamics;
4. Inadequate application of business principles;
5. Lack of government support and political will;
6. Lack of access to capital.

The Nigerian pharmaceutical manufacturing industry is weighed down by all these challenges, just like the other countries in Africa that were part of the studies. Despite these challenges, a few companies have worked hard to achieve international GMP standards with the intention to have products prequalified by WHO.This was made possible through the support of the Nigerian Health Authority, National Agency for Food and Drug Control (NAFDAC) and the World Health Organization (WHO), (Ngozwana et al 2012). It is also documented in the PMPA-BP that there is evidence that production to international standards is possible across our continent and that we have entrepreneurs with the appetite for risk, energy, and commitment to achieve these goals. However, as well as these (and other) leading players, we know that there are many other companies licensed to manufacture products whose quality systems fall in some cases way below what should be acceptable. Whilst there has been no systematic study, experts who have visited plants, and comments by regulators with access to confidential GMP inspection reports, provide categorical evidence that this is the case. (Ngozwana, West, Olajide, & Byaruhanga, 2012).

With Nigeria leading in pharmaceutical manufacturing in SSA with about 200 players, it implies that a good number of pharmaceutical manufacturers in Nigeria are likely to be among the “other companies licensed to manufacture products whose quality systems fall in some cases way below what should be acceptable” (Ngozwana, West, Olajide, & Byaruhanga, 2012). Poor compliance with Good Manufacturing Practices (GMP) was identified as number one challenge in the PMPA-BP. It is common knowledge that the

pharmaceutical manufacturing industry in Nigeria has benefitted from many GMP training by experts from the stringent regulated markets. However, most of these trainings were delivered using the conventional classroom approach. This approach has been criticized "for being finite, passive, not social, and disconnected from real practice, resulting in less than optimal learning" (Martin et al2014). The ineffectiveness of classroom / presentation method of training was succinctly captured by Murray, (2002) in the following statement.

> *There is growing disenchantment with conventional educational and training programs offered within organizations. Such formal training for specific skills is essential, and we are not suggesting that it be replaced by mentoring. However, when training courses use traditional academic formats such as lecture and presentation, the busy manager gets frustrated and bored. Many times there is no follow-up to determine whether skills are applied back on the job. The bottom line is that attitudinal and behavioral changes are extremely difficult to accomplish, especially for the individual left on his or her own. In formal training the content may be conveyed but not the context for application of that knowledge to the work environment. The perceptions and experiences of the mentor provide that context, as well as a model of behavior worthy of emulation.*

The ineffectiveness of classroom/presentation method of training (Murray, 2002) as well as the observation by Bjursell & Sädbom (2018) that it might be difficult, or even impossible, to apply what one has learned (from traditional training approach) when one returns to one's workplace, explains the slow progress in the development of the Quality Management Systems in the pharmaceutical manufacturing industry in Nigeria. The slow development of technical capabilities in the pharmaceutical manufacturing industry in Nigeria is the problem that this study is trying to solve by exploring the use of mentoring as GMP capability building tool. Gap assessment is a tool used in pharmaceutical industry to identify gaps to be worked on for continuous improvement of the quality systems. This tool was used to identify the areas of need in GMP documentation in XYZ pharmaceutical manufacturing company. The mentoring program was targeted at the identified gaps. In view of the problem that this study aimed to solve and adopting gap assessment for needs identification, the next section described the research questions that this study was to answer.

Research Question

Below are the questions that this study aimed to answer:

- **Research question 1:** Can Gap Assessment serve as a tool for assessing training needs in a mentoring program?
- **Research question 2:** Can mentoring serve as a GMP training method targeted at the mentees' and organizational needs?
- **Research question 3:** Will mentoring serve as a method for presenting GMP training to aid knowledge transfer, ease of understanding and application of knowledge acquired?
- **Research question 4:** Can mentoring gain acceptance as a GMP training method, in the pharmaceutical manufacturing industry in Nigeria?

Prior to initiating the study, a review of literature on mentoring was conducted to understand the current knowledge on mentoring, especially mentoring in the workplace.

The search strategy

The purpose of this study was to explore the impact of mentoring as a GMP capability building tool in the pharmaceutical manufacturing industry in Nigeria. The use of mentoring as a GMP training method is new to the industry. Therefore, it was not likely that studies on this topic existed in the literature. Therefore, the literature search was generic on mentoring as a capability building tool. The knowledge obtained from the studies in other fields assisted in the adaptation of mentoring for GMP training.

A preliminary search for the keywords mentoring and "capability building" and their synonyms coaching and "capacity building" in Google Scholar, Web of Science and EBSCOhost databases was done. The results were too large and review of the titles in the first few pages of the search results from the three databases showed that most of the articles did not have relevance to the title of this study. The following additional keywords (impact of mentoring program, impact of mentoring on capability building, impact of mentoring programs in GMP capability building, mentoring program effectiveness, effectiveness of mentoring program, Effectiveness of mentoring program on capability building, Effectiveness of mentoring programs in GMP capacity development) were used in the subsequent searches which were refined using the Boolean operators and limiters. The inclusion criteria were peer-reviewed articles

published between1999 to 2019 and related to workplace mentoring program. The date range of publications was restricted to 1999 and 2019 (articles published in the past twenty years), so that review could be built on the recent literature, considering changes in method of information retrieval and synthesis due to technological advancement (Xiao & Watson, 2019).

After review of the titles of the articles in the search results of the 3 databases, 228 peer-reviewed journal articles were selected. Most of the articles were on studies in academic / youth mentoring and some on mentoring in medical education and practice. The literature search did not turn in any study on use of mentoring as GMP capability building tool in the pharmaceutical manufacturing industry. Few peer-reviewed articles with focus on effectiveness of mentoring in other fields like education, medicine and business were selected for review. For instance, study by Núñez, Rosário, Vallejo & González-Pienda, (2013) in academic setting showed positive results. The study by Pillai, Chibale, Constable, Keller, Gutierrez, Mirza, ... & Ramsay, (2018) is interesting as it mimicked the Biotechnology Innovation and Regulatory Sciences (BIRS) program model and demonstrates an example of how multi-sectoral partners can contribute to scientific and professional development of researchers in low- and middle-income countries (LMICs). It supports the idea that capacity-building efforts should be tailored to the specific needs of beneficiaries to be maximally effective.

BIRS capacity-building model is a program by Purdue University USA that is enabling the manufacture of quality medicines in Africa for Africans by equipping leaders in pharmaceutical industry in Africa with the requisite knowledge and skills through higher education aligned with building industrial capacity (Clase Ekeigwe, Mann, Mukungu, & Mwangomo, 2019).

The review of mentoring literature in the medical field by Buddeberg-Fischer and Herta, (2006) revealed that majority of the programs lacked concrete structure as well as short- and long-term evaluation. Though these studies were not specifically in an organizational work setting similar to pharmaceutical manufacturing industry, there is learning that can be of importance in planning a mentoring program in a pharmaceutical manufacturing organization.

Additional relevant peer-reviewed journal articles were identified by forward and backward citation search. The selection of articles through this method was made taking into consideration the date of publication (1999 –2019) set as inclusion criterion. A few of the articles selected through this “snowballing” approach were published before 1999 but were included in the list of articles for review because of their relevance to this study. The abstracts of the selected articles were reviewed, in addition to the discussion, before final decision on inclusion was made. After this process, the number of peer-reviewed journal articles that are original research and review articles selected due to their relevance to this study reduced to 16 with a book on mentoring included. Other articles included were mainly regulatory references relevant to pharmaceutical manufacturing compliance. The citation of all the selected articles were exported to an EndNote Basics account and retrieved from there for review and synthesis.

Next, a literature map was prepared with select articles, using the top-down approach concluding at the bottom with the proposed study (Creswell & Creswell, 2017) as shown in Figure 1 below.

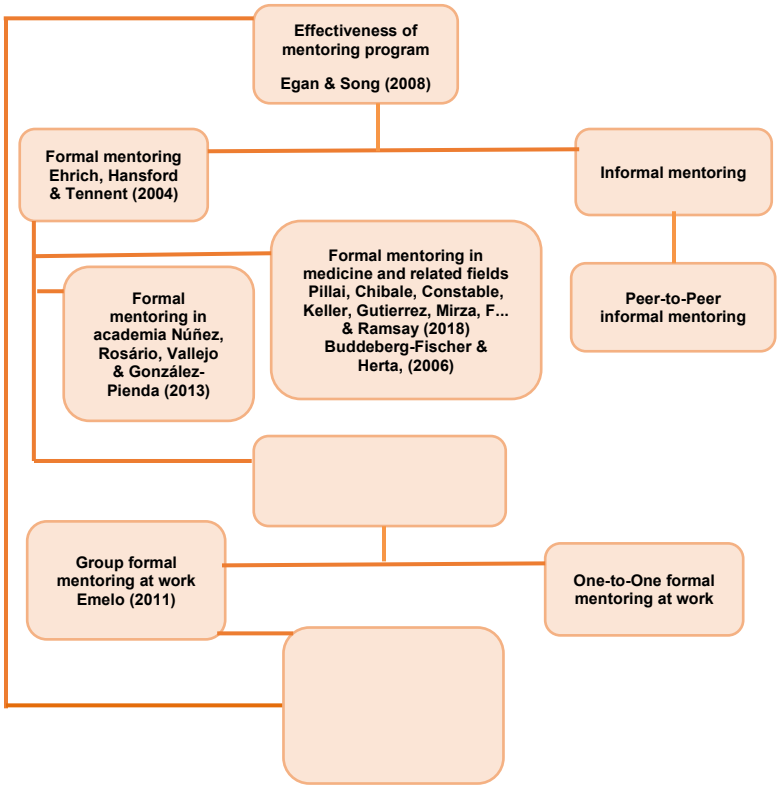

Figure 1: Literature map

The starting point of the literature review was to find out what the construct called “Mentoring” means.

What is Mentoring?

Historically, mentoring is an ancient archetype originating in Greek mythology. A figure in Homer’s *Odyssey,* Mentor was a wise and faithful advisor

entrusted to protect Odysseus's son, Telemachus, while Odysseus sailed against Troy. While the roots of mentoring can be traced to mythology, mentoring is no myth; it is a very real relationship that has been an integral part of social life and the world of work for thousands of years (Ragins & Kram, 2007).

There are many definitions of mentoring in literature, but Ragins & Kram, (2007) integrated the views of Kram, (1985); Levinson, (1978); Noe et al., (2002); Ragins, (1999) and Wanberg et al., (2003) and defined traditional mentoring as a relationship between an older, more experienced mentor and a younger, less experienced protégé for the purpose of helping and developing the protégé's career. Traditional mentoring is an informal relationship that emerges largely through mutual initiation and ongoing connections between protégé and mentor (Ragins & Cotton, 1991 as cited in Egan & Song, 2008).

Who is a Mentor?

It is also important to understand who a mentor is. According to Ehrich, Hansford & Tennent, (2004), the original meaning of the word mentor refers to a "father figure" who sponsors, guides and develops a younger person. Throughout history, mentors have played a significant role in teaching, inducting and developing the skills and talents of others (Ehrich, Hansford & Tennent, 2004). Carol Sankar, a Forbes Council member and Founder of "The Confidence factor for Women in Leadership" summed up the importance of having a mentor in her post on Forbes Coaches Council titled "Behind Every Great Leader are Great Mentors and Advisors." Sankar (2017).

According to Ragins and Kram (2007), the mentor may or may not be employed in the same organization as the protégé or be in the protégé's chain of command or profession. Mentors are viewed as providing two types of function to their protégés and these are career and psychological functions (Kram, 1985 as cited in Ragins & Kram, 2007). Career functions involve a range of behaviors which include coaching protégés, sponsoring their advancement, increasing their positive exposure and visibility, and offering them protection and challenging assignments. Psychosocial functions build on trust, intimacy, and interpersonal bonds in the relationship and include behaviors that enhance the protégé's professional and personal growth, identity, self-worth and self-efficacy. They include mentoring behaviors such as offering acceptance and confirmation and providing counseling, friendship, and role-modeling (Ragins & Kram, 2007).

Types of Mentoring relationships

Historically, mentoring started as an informal relationship referred to as traditional mentoring in mentoring literature. But with the introduction of mentoring into formal developmental processes in educational and business organizations, formal mentoring came into existence. Informal mentoring relationships emerge largely through mutual initiation and ongoing connections between protégé and mentor and occur over time without external intervention or planning. However, formal mentoring relationships are most often initiated by organizational representatives and involve a process for assigning employees or managers to mentors: mentor-protégé pairing. The internal organizational facilitators may set expectations for involvement such as: mandatory participation, induction or ongoing training, number of meeting times, topics for discussion and goal setting (Ragins & Cotton, 1991 as cited in Egan & Song, 2008).

In literature, different mentoring models exist: the classic one-to-one mentoring between mentor and mentee; group mentoring, a (small) group of mentees supervised by a mentor; individual or group mentoring with a number of mentors (the multiple-mentor experience model); and mentoring among co-equals (peer mentoring) (Buddeberg-Fischer & Herta, 2006). These types of mentoring fall into either of the two theoretical forms of mentoring: traditional or relational mentoring.

Phases in the Mentoring Process

Kram (1983) described the following four phases in a mentoring relationship: initiation, cultivation, separation and redefinition. Her brief description of each phase is as stated below:

- Initiation: A period of six months to a year during which time the relationship gets started and begins to have importance for both managers.
- Cultivation: A period of two to five years during which the range of career and psychological functions provided expands to a maximum.
- Separation: A period of six months to two years after a significant change in the structural role relationship and / or in the emotional experience of the relationship.
- Redefinition: An indefinite period after the separation phase during which time the relationship is ended or takes on significantly different characteristics, making it a more peer-like friendship.

Kram's phases in mentoring process was based on the context of mentoring in the workplace where a senior manager mentors a young manager. As mentoring models have evolved, strict adherence to the proposed activities and, especially, the timelines for each phase may not be sacrosanct. However, this phase approach is a good guide for modeling one-to-one mentoring relationship (Kram, 1983).

Strengths and Weaknesses of Mentoring

There are strengths and weaknesses in humans, processes and everything that is in existence. Mentoring is not an exception. It has its strengths and weaknesses too; and the magnitude will depend on diligence in planning, execution, monitoring and evaluation on both the mentors and the mentees, who should serve in their roles in order to achieve the desired goals.

A structured analysis of over 300 research-based papers on mentoring across three disciplines (educational, medical and business) was conducted by Ehrich, Hansford & Tennent, (2004) in their "attempt to make more valid inferences about the nature and outcomes of mentoring". Specifically, their analysis was to determine the positive and more problematic outcomes of mentoring for the mentor, the mentee and the organization. The result of the analysis revealed that in the business studies, the most frequently cited positive response (50.3%) for the mentees was "career satisfaction / motivation / plans / promotion". While "coaching / feedback/ strategies" was rated in second place (30.5%), "challenging assignments / improved skills / performance" was the third (23.2%) and "counselling / listening / encouragement" was the fourth. For the mentors, "networking / collegiality" came out as the most frequently cited positive response (7.9%). While "career satisfaction / motivation / promotion" (7.3%); "improved skills / job performance" (6.6%) and "pride / personal satisfaction" (6.6%) were the other three most frequently cited positive outcomes for mentors. Career development and skill enhancement emerged prominently in the analysis, in alignment with the outcomes for mentors and mentees in business literature (Ehrich, Hansford & Tennent, 2004).

The education, business and medical reviews had similar problematic outcomes experienced by mentors and mentees. "Lack of time" frequently cited in the reviews, was the most commonly cited problem by mentors in the business studies (6%). It was also identified in the medical studies. "Negative mentee attitude / lack of trust / cooperation" (5.3%) and "little training or little knowledge about the goals of the program" (4.6%), were the second and third most frequently cited problematic outcomes for mentors in the business review. Mentors and mentees in the medical studies viewed lack of mentor training as detrimental to the program. While "jealousy / negative attitudes of others" was the fourth most frequently cited problematic outcome for mentors (except in the medical studies). In the medical studies, "the extra burden or responsibility that mentoring created for mentors" emerged as a problematic workload issue. For the mentees in the business studies, "issues relating to race and gender (7.9% of the studies)" and "cloning or conforming or over-protection (7.3% of the studies)" were the two most frequently cited problems. The race and gender issues arose as a consequence of matching female mentees with male mentors and black mentees with white mentors. The third most frequently cited negative outcome for mentees in the business studies was "ineffective and untrained mentors" (6.6%). While "problematic attitude of others" (6%) came fourth. In the medical studies, perception of the mentees that seeking help was a signal of weakness or inability to cope came out as an important problematic outcome. (Ehrich, Hansford & Tennent, 2004).

Almost twice as many business studies (30.5%) cited one or more positive outcome for the organization, in contrast to the education studies. The most frequently cited benefit reported in 13.9% of studies was improved productivity / contribution / profit by employees. Other positive outcomes from the business studies included retention of talented employees (11.9%), promotes loyalty (6.6%) and improves workplace / communications / relations (4%). (Ehrich, Hansford & Tennent, 2004).

Both the education and business literature featured fewer studies reporting problematic outcomes of mentoring for the organization. Two of these problematic outcomes cited in more than a single study were high staff turnover (which was seen to hinder the development of long-term relationships between mentors and mentees) and gender or cultural bias in the organization (which resulted in good staff being overlooked in the mentoring process). In seven out of the eight medical studies reviewed, organizational or attitudinal barriers was the most frequently cited problematic outcome of mentoring. The problematic organizational problems in the medical studies included ambivalence to the project by management, minimal management support, resource issues, schedule planning issues and belief that mentoring should not be formalized. (Ehrich, Hansford & Tennent, 2004).

Results from a one-year longitudinal quasi-experiment that examined the effectiveness of a formal mentoring program at a Fortune 100 corporation showed that subjects with formal mentors

reported significantly higher levels of job satisfaction, while a small to medium effect for "participation" in the mentor program was observed for organizational commitment (Seibert, 1999). This corroborates the results for mentors and mentees in the review by Ehrich, Hansford & Tennent, (2004).

The results of the survey questions sent by Emelo (2011) to 211 participants, across 24 different group mentoring events with a total of 73 people (35% response rate) showed two key findings:

1. 93% of responders reported that the topics of the mentoring programs they participated in were relevant to their roles in their organizations.
2. A total of 96% reported that they could apply the information gained from the group mentoring experience directly to their roles in their organizations.

Results from a provincial government ministry group mentoring program showed that 87% of mentees rated their learning as effective. Relevance of the learning and the use of current issues, events and personal stories by the senior leader / mentors were some of the benefits reported by the mentees. (Harris, Cheng & Gorley, 2015). These reports are all aligned on the effectiveness of group mentoring from the perspective of the mentees.

It is important to note that the model of mentoring planned for this research was formal group mentoring, where the mentors were from outside the organization. Therefore, the problematic experiences in the studies in the above review that arose because the mentors and mentees were working in the same organization were automatically eliminated in this study. But the concern for lack of time observed in the above review was encountered in this study at the beginning during the presentation of the project charter, when the department heads objected to the study to be carried out in their organization due to time constraint.

2. METHODS

Ethical Considerations

As the study design was documentation review, there was no need for ethics committee approval. However, the researcher and the Subject Matter Experts (SMEs) signed and presented to the management of XYZ pharmaceutical manufacturing company, confidentiality agreement pledging to maintain confidentiality of the company information. (See Appendix: I).

Design and Implementation

This study is a basic type of Qualitative research (Creswell & Creswell, 2017). Selection of the organization where the study was performed was done by convenience sampling method.The aim of the study was to explore the use of mentoring as a GMP capability building tool in the pharmaceutical manufacturing industry in Nigeria. The focus was on GMP documentation review at a company called XYZ pharmaceutical manufacturing company (for reason of confidentiality), located in the South-Western region of Nigeria.

The first step was preparation of a Gap Assessment Template (with Microsoft Excel) on GMP documentation by the researcher using two references:

- WHO TRS 968, (2014). Annex 2 -WHO good manufacturing practices for pharmaceutical products: main principles, and
- PICS GMP Guide (2018): PE 009-14 (Part I) - Guide to Good Manufacturing Practice for Medicinal Products guidelines.

Corrections of errors in the prepared Gap Assessment Template (GAT) was done by the researcher and cross-checked by one of the SMEs before the instrument was put to use in the review of the GMP documentations of the XYZ company by the two SMEs.

Each of the SMEs cross-checked the records of the review done by the other expert and any disagreement discussed and resolved with the author and the researcher. This was to generate data on the current state of the GMP documentation in the company. This method for conducting needs analysis was a tool for continual improvement in GMP environment and is aligned with Tannenbaum and Yukl (1992) who stated that "the importance of conducting a thorough needs analysis is well accepted in the training literature."

The initial plan to prepare a specimen Corrective Action, Preventive Action (CAPA) plan based on the identified gaps to be used as training materials for the mentoring program was dropped. Instead, sample Standard Operating Procedure on Writing of Standard Operating Procedures (SOP of SOPs) was prepared and used with the completed GAT for the mentoring program.

3. RESULTS AND DISCUSSION

A total of 42 gaps were identified from the GMP documentation review. They were documented in the GAT. See Appendix: II.

Coding

Open and axial coding of the data was done. Before reporting the results of the open and axial coding, it is importatnt to give a brief expanation of the meaning of open and axial coding.

Open Coding

Open coding, commonly used as first step in the analysis of qualitative research, is often used as the initial coding pass in Grounded Theory. With open coding, data is broken down into discrete parts and "codes" created to label them.

As the name implies, open-coding opens the researcher up to new theoretical possibilities, as he starts collecting the qualitative data. Breaking up the data and labeling them with codes enables the researcher to continuously compare and contrast similar events in the data. This is done by collating all pieces of data (such as quotes) that were labeled with a particular code. This process forces the researcher out of preconceived notions and biases about his research.

Open coding in qualitative research most times is followed by one or more coding methods, such as Axial Coding. (Corbin & Strauss, 1990 as cited in Delve blog, n.d.).

Axial Coding

Axial coding is the second step in coding that follows open coding in grounded theory. In contrast to open coding where the data is broken into discrete parts, with axial coding connections are drawn between codes. With axial coding in qualitative research, the researcher reads over the codes and the underlying data to find how the codes can be grouped into categories. "A category could be created based on an existing code, or a new category developed that encompasses a number of different codes. After conducting axial coding, a number of categories emerge out of a set of supporting codes. These categories are the "axes" around which their supporting codes revolve. (Corbin & Strauss, 1990 as cited in Delve blog, n.d.).

Out of the 42 gaps identified, 40 were due to non-compliance to Good Documentation Practices, while two were due to Data Integrity issues. Therefore, "Good Documentation Practices" and "Data Integrity" where chosen as codes for coding of the 42 gaps identified using manual open coding. Appendix III shows manual open coding of GMP gaps identified in XYZ Company Documentation Systems.

The codes "Good Documentation Practices" and "Data Integrity" are components of "Document Management Systems". Therefore, using axial coding method, "Document Management Systems" is the category that connects the two codes as shown in Figure 2 below.

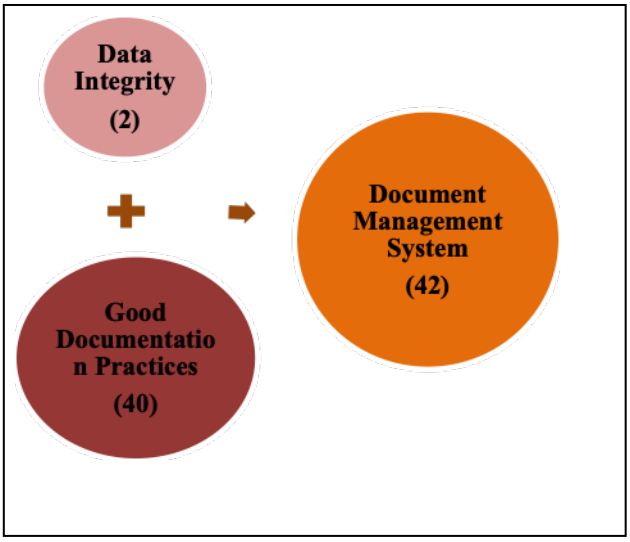

Figure 2: Axial Coding (of codes from open coding) of GMP gaps identified in XYZ Company Documentation Systems.

The mentoring process

A trend discovered in all the SOPs (which formed majority of the documents reviewed), was poor document design, which originated from non-compliant Standard Operating Procedure on Writing of Standard Operating Procedures (SOP of SOPs). Since the root cause of the gaps was poor document design , the initial plan to prepare a Corrective Action, Preventive Action (CAPA) plan (after the GMP documentation review) to be used for mentoring was dropped.

Instead, one of the Subject Matter Experts (SMEs) prepared sample SOP of SOPs (Appendix IV). The completed GAT and the sample SOP of SOPs were used as training materials for the mentoring sessions. Also, the mentees requested training on the following areas that were found challenging:

- How to establish growth promotion test for pharmaceutical culture media;
- Environmental and plant hygiene monitoring;
- Trend analysis of environmental monitoring, water and microbial limit results.

One of the SMEs prepared sample SOPs on these topics and these were used as training materials together with power point slides on growth promotion test during the mentoring session. These are found in:

Appendix V: Sample SOPs on How to establish growth promotion test for pharmaceutical culture media;

Appendix VI: Sample SOP on Trend analysis of environmental monitoring, water and microbial limit results;

Appendix VII: Environmental and plant hygiene monitoring;

Appendix VIII: Power point slides on Growth promotion test.

The mentoring process was interactive and the training targeted at the areas of need of the organization/mentees and performed by mentors who were experts and experienced in pharmaceutical GMP. The effectiveness of the mentoring sessions was evident by the request for additional support in other areas outside the gaps identified during the documentation review.

The emergence of 2 sub-themes (Data Integrity and Good Documentation Practices), both of which were integrated to form the main theme, "Document Management System", is a pointer to the knowledge gap that exists in the company. Also, the finding that majority of the gaps fell under non-compliance to Good Documentation Practices is an indication of a general knowledge gap on the regulatory requirements, despite previous classroom trainings attended on this subject. It is therefore important to provide a summary of these sub-themes (Data Integrity and Good Documentation Practices) and main theme Document Management System.

Data Integrity

According to US FDA draft Guidance - Data Integrity and Compliance with cGMP Guidance for Industry, "data integrity refers to the completeness, consistency, and accuracy of data. Complete, consistent, and accurate data should be attributable, legible, contemporaneously recorded, original or a true copy, and accurate (ALCOA)" (US FDA, 2016). This definition is also aligned with WHO draft Working Document QAS/19.819, 2019. (WHO,2019)). However, PIC/S Guidance, PI 041-1(Draft 3), 2018 has additional attributes to form ALCOA +. These additional attributes are complete, consistent, enduring and available.

Good Documentation Practices

"Good documentation practices are those measures that collectively and individually ensure that documentation, whether paper or electronic, is secure, attributable, legible, traceable, permanent, contemporaneously recorded, original and accurate." (WHO, 2016)

Document Management System

WHO TRS 996, Annex 5, (2016) describes the principles of Good Document and Records Practices as a systematic approach that should be implemented to provide a high level of assurance that throughout the product life cycle, all GxP records and data are complete and reliable. The US FDA draft Guidance on Data Integrity and Compliance with cGMP Guidance for Industry describes it as Data Governance System. According to this guidance, data governance is the sum total of arrangements which provide assurance of data quality. These arrangements ensure that data, irrespective of the process, format or technology in which it is generated, recorded, processed, retained, retrieved and used will ensure attributable, legible, contemporaneous, original, accurate, complete, consistent, enduring, and available record throughout the data lifecycle. The data lifecycle refers to how data is generated, processed, reported, checked, used for decision-making, stored and finally discarded at the end of the retention period.

In other words, a pharmaceutical manufacturing company should have a system of managing the records and data for the products they are producing in order to give assurance of the completeness and reliability of the records and data throughout the product's life cycle. Failure to do this implies that the records and data attesting to the quality, safety and efficacy of the products are questionable and the patients taking the products are exposed to risk. Therefore, it is very critical that all personnel involved in the processes of generating and handling data and records in a GMP environment be given training using a method that will aid their understanding and application of knowledge gained.

The gap assessment of the GMP documentations of XYZ pharmaceutical manufacturing company using the GAT (generated from the requirements of the regulatory guidelines), adequately identified the needs of the mentees and the organization. By targeting the mentoring efforts on the areas of need of the mentees and the organization, this study has positively answered the **Research questions 1 and 2 below:**

- **Research question 1:** Can Gap Assessment serve as a tool for assessing training needs in a mentoring program?

- **Research questions 2:** Can mentoring serve as a GMP training method targeted at the mentees' and organizational needs?

This outcome corroborates the finding by Ehrich et al. (2004), from their structured analysis of over 300 research-based papers on mentoring across three discipline (educational settings, medical and business context). The results from a one-year longitudinal quasi-experiment by Seibert (1999), which examined the effectiveness of a formal mentoring program at a Fortune 100 corporation, also reported significantly higher levels of job satisfaction. Though the mentees' and mentors' perception about the mentoring program was not evaluated in this study, one may assume that the mentees derived immense benefit from the mentoring program. This could be inferred from their request for training in other areas that were not covered during the documentation review. This perceived acceptance of mentoring as GMP training tool answers positively the **Research question 4:** Can mentoring gain acceptance as GMP training method in the pharmaceutical manufacturing industry in Nigeria?

The creation of GAT and sample SOP of SOPs and other sample SOPs used for the mentoring sessions is a creative way of using mentoring for GMP training. This certainly will aid understanding and application of the knowledge gained from the process. Also, explanation of the rationale behind the requirements in the guidelines using examples that the mentees could relate with is another way of aiding understanding and will motivate them to implement what was learnt. This study shows that use of mentoring as a GMP training method answered positively **Research question 3:** "Can mentoring serve as a method for presenting GMP training to aid knowledge transfer and ease of understanding and application of knowledge acquired?" The creation and use of GAT, the sample SOP of SOPs and other sample SOPs for the mentoring sessions in this study is a creative way of applying mentoring to GMP training. This approach enhanced understanding and will certainly aid mentees to apply the knowledge gained to their job. Also, explanation of the rationale behind the requirements in the guidelines using examples that the mentees could relate with is another way of aiding understanding and will motivate them to implement what was learnt. Therefore, the use of mentoring for GMP training in this study answered positively **Research question** 3, which is "Can mentoring serve as a method for presenting GMP training to aid knowledge transfer and ease of understanding and application of knowledge acquired?"

The use of sample SOP of SOPs and the other sample SOPs, as well as the completed GAT for the training, shows that mentoring is practical and specific to the organizational needs as opposed to the classroom method of training, which uses generic, high level training materials. This study demonstrated that use of mentoring as a GMP training method has potential to aid understanding and applicability of knowledge acquired. This is in alignment with the result of capacity building for scientific and professional development of researchers in low- and middle-income countries (LMICs) reported by Pillai et al (2018) in which mentorship was a component of the program. Evaluation of the program showed strong evidence of knowledge and skills transfer and personal report by the researchers (mentees) confirmed that the program had impact on their research output and their personal career. The program demonstrated an example of how multi-sectoral partners can contribute to scientific and professional development of researchers in LMICs. It also supports the idea that capacity-building efforts should be tailored to the specific needs of beneficiaries to be maximally effective. Lessons learned from the program may be applied to the design and conduct of other programs to strengthen science ecosystems in LMICs. (Pillai et al, 2018).

In this study, sharing of past experiences by the mentors provided psychological support to the mentees, letting them know that the mentors have been through what they were going through and with their knowledge and experience, capable of supporting them (the mentees) to achieve their developmental goals. This supports the report of one of the benefits mentees acknowledged in the study by Harris et al., (2015).

Therefore, this study has proved that the improvement in GMP that could not be achieved in the pharmaceutical manufacturing industry in Nigeria for decades through classroom training is possible within a short period of time through use of mentoring. However, proper planning and implementation by competent and empathic mentors as well as participation by highly motivated mentees are essential for the success of the program.

Though this study has shown some potential in the use of mentoring as a GMP capability building tool, there are some limitations that may not allow generalization of the results. The use of convenience sampling in selection of XYZ pharmaceutical manufacturing company for conduct of this study was a limitation. This sampling method was used because it was easier to negotiate access to the organization through existing contact. This was in alignment with Sauders, Lewis & Thorhill (2012) as cited in Dudovskiy (n.d.).

Another limitation is that the review of the GMP documentations of XYZ pharmaceutical was based on the subjective judgment of the researcher and the SMEs. Their judgement was influenced by their academic and professional background, experiences and culture. Therefore, it may not be easy for other researchers to replicate the study and get similar outcomes. On the other hand, the background of the researcher and the SMEs was a positive for this study. In addition to the other limitations is that the study was conducted in only one company. Also, only the GMP documentations of XYZ pharmaceutical manufacturing company presented to the researcher were reviewed. GMP records, and other existing GMP documents not presented, were not covered in this study. It could be pointed out that SOPs are the foundation for good GMP. Therefore, this is a logical place to begin a study like this one. The first step is to write a compliant SOP for SOPs.

4. CONCLUSION

The finding that most of the SOPs were deficient as a result of poor design (which originated from non-compliant Standard Operating Procedure on Writing of Standard Operating Procedures [SOP of SOPs]) was a major outcome of the study. Good SOPs are fundamental to the GMP process. Establishment of effective SOPs requires collaboration between the Subject Matter Experts and those who will use the SOPs to perform their work.

This study revealed that mentoring (formal group mentoring) is a promising tool for GMP capability building, making it likely to yield faster development of the GMP standards in the pharmaceutical manufacturing industry in Nigeria. This is the first study on use of mentoring as GMP capability building tool in the pharmaceutical manufacturing industry in Nigeria as no study on this topic was found in the literature search performed. The outcome of this study forms a foundation on which further studies on this topic can be built so that in the near future, this approach to GMP capability building will be better understood and structured. Achievement of this goal will yield the long-awaited development of the Quality Systems of pharmaceutical manufacturing industry in Nigeria.

5. RECOMMENDATIONS FOR NEXT STEPS

- It is recommended that the management of XYZ pharmaceutical manufacturing company (the organization where this project was conducted) apply the lessons from this study to other areas of their QMS. The lessons are:
    - SOP of SOPs designed according to the regulatory requirements is the guide to proper design of all other SOPs.
    - Effective SOPs are the foundation for building sound GMP processes.
    - Preparation of SOPs requires collaboration between the SMEs and users of the SOPs to ensure compliance and ease of applicability of SOPs by users.
- The above lessons will enable the management of XYZ pharmaceutical manufacturing company make short-, medium- and long-term development plans for their QMS.
- It is recommended that additional research be conducted on use of formal group mentoring as a GMP capability building tool in the pharmaceutical manufacturing industry in Nigeria. Additional research will facilitate understanding of specific factors that will affect mentoring as a GMP capability building tool, thereby providing data for planning for future studies and for development of the industry in general.
- It is also recommended that lessons learned in this and future studies be applied to improve mentoring as a GMP capability building tool in the Sub-Saharan African region.

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APPENDICES:

Appendix I: Signed copies of Confidentiality Agreements by the researcher and Subject Matter Experts.

Appendix II: Gap Assessment Template (GAT)

Appendix III: Manual Open Coding of GMP gaps identified in XYZ Company Documentation Systems

Appendix IV: Sample SOP of SOPs

Appendix V: Sample SOPs on How to establish growth promotion test for pharmaceutical culture media

Appendix VI: Sample SOP on Trend analysis of environmental monitoring, water and microbial limit results

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