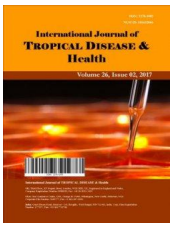

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Curbing Polypharmacy among Primary Health Care Workers: The Impact of an Educational Intervention

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Authors' contributions

This work was carried out in collaboration between all authors. Authors VNO and JSO designed the study, performed the statistical analysis and wrote the protocol. Author VNO wrote the first draft of the manuscript. Author OA managed the design and analyses of the study. Authors FA and AAG proof-read and managed the literature and journal searches. All authors read and approved the final manuscript.

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ABSTRACT

Introduction: Polypharmacy, the concurrent prescription or use of multiple numbers of drugs per patient, has been identified as a significant channel of drug wastage in the health sector. Its habitual practice has been associated with lower cadres of healthcare workers, operating mainly at the grassroots or primary health care (PHC) levels.
Objective: To assess the impact of a two-phased educational intervention on the practice of polypharmacy amongst rural workers of PHC in Kaduna State, north-western Nigeria.
Methods: A quasi-experimental study design was employed in 2 Local Government Areas (LGAs)-one study and one control. A two-phase educational intervention was carried out in the study of LGA. Pre- and post-intervention audit and analysis of the prescription records of the selected facilities was done with SPSS version 20.0. A bi-variate analysis was carried out to test the

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relationship between the independent and outcome variables with p-value of 0.05 as the level of significance.

Results: Both study and control facilities had baseline (pre-intervention) evidence of polypharmacy, with means (averages) of 4.3±1.56 and 3.85±1.14 drugs per patient, respectively (and ranges of between 1-13 drugs per patient and 1-10, respectively). This falls by about 43.5%, to an average of 3.26±1.19 and later, to 2.43±0.29 drugs per patient in the study group, following the first and second phases of the intervention, respectively ($p<0.05$). No statistically significant changes were observed in the control facilities.

Conclusions: Following the intervention, a significant improvement was observed in the prescribing pattern of the health workers in the study area, with regards to polypharmacy. This evidence emphasizes the place, priority, and potential of in-service training and continuous education of healthcare workers to promote the optimum level of practice and curtail unnecessary wastage of limited resources in the health sector, particularly in developing countries.

Keywords: Polypharmacy; PHC; prescriptions; drugs; LGA.

1. INTRODUCTION

The practice of modern day, orthodox Medicine relies heavily, among many other strategies and approaches, on pharmacotherapy, which is the treatment of diseases, syndromes and even mere symptoms through the administration of prescribed pharmaceutical drugs [1]. This is as distinguished from other forms of medically acceptable treatments such as surgery, physiotherapy, radiotherapy etc. The option of pharmacotherapy in medical practice carries along with it some implications; two of which include side effects and financial implications. While the former refers to the occurrence, in individuals of secondary, often undesirable and inconveniencing effects of a pharmaceutical drug; the latter refers to the cost implications for the consumer or recipient (particularly when it is "out-of-pocket" and unsubsidized).

In medical practice, it is not unusual or uncommon to encounter multiple or co-morbidities occurring in individuals; thus warranting the prescription of two or more drugs. This scenario sometimes makes polypharmacy an inevitable (and even beneficial) option [2] for many clinicians; and brings to light another issue of concern, which is adverse drug interactions. This refers to complications arising from interactions between two or more drugs in one individual; the more the number of drugs prescribed per person, the more the chances of adverse drug interactions (ADEs) occurring. ADEs are “undesirable clinical manifestations that are consequent to and caused by the administration of medications, as well as events due to error” [3]. The probability of this occurrence is heightened by polypharmacy.

As a result of the preceding and many other implications stemming from pharmacotherapy, it stands to reason that caution and care, based on objective information is reasonably applied by physicians as well as other healthcare workers (HCWs) when prescribing drugs to patients [4]. Furthermore, polypharmacy does not only potentially carry untoward effects on patients; it has also been identified as a significant channel of drug wastage in the health sector. This is particularly of concern in resource-constrained countries of the developing world. The World Health Organisation (WHO) reports that huge financial expenditure and economic losses are associated with polypharmacy; and other forms of irrational drug use in developing and low-income countries [5,6].

Polypharmacy has been widely reported by diverse researchers in Nigeria. While the derived standard values for the WHO prescribing indicators as developed from a study in Nigeria, for the average number of drugs per encounter or patient is estimated at an average of 1.6- 1.8 drugs [7], many studies have reported prescriptions of as high as 3 to 7 drugs per patient [5,8,9]. Nigeria operates a 3-tier health care system corresponding with her 3-tier levels of civil governance, where Primary Health Care (PHC) is under the purview of the lowest tier of government- the Local Government Council (LGC) [10]. The PHC level serves as the first line of contact and point of entry into Nigeria’s healthcare system. Many PHC facilities, particularly those which are situated in rural areas, are often and typically manned by lower cadres of healthcare workers; mainly auxiliary healthcare workers that include community health officers, community health extension workers etc [11,12]. There are often no physicians in such facilities, particularly in northern Nigeria. This raises curiosity as to the daily operations obtainable at such levels of healthcare in Nigeria.

This study's objective is to assess the pattern of prescriptions issued by Primary Health Care (PHC) workers, those who serve at rural PHC facilities in north-western Nigeria (with particular reference to the number of drugs prescribed per visit or consultation) as well as to demonstrate the potential role of educational interventions in correcting or improving these patterns or practices.

2. METHODOLOGY

2.1 Study Areas

The study was conducted in two Local Government Areas (LGAs) in the northern part of Kaduna State, north-western Nigeria. These served as the study and control LGAs (or "districts"). The study LGA, Giwa consists of 6 health districts (namely: Giwa, Shika, Wayzata, Gangara, Kaya, and Kidandan); while the control LGA, Makarfi has five health districts (namely: Makarfi, Gangara, Guduchi, Mayena and NasarawaDoya).

The study LGA has 6 PHC centres, 36 PHC clinics, three privately-owned PHC facilities and a mission clinic. There are about 175 health personnel in its employment- none is a medical doctor or pharmacist. Domiciled within the control LGA are 5 PHC centres, 31 PHC clinics, and several other privately-owned health facilities. The state-owned Shehu Idris School of Health Technology, which trains diverse categories of PHC workers, is sited in Makarfi town. A total of 146 health workers are employed in this LGA; with no medical doctor or pharmacist.

Services rendered in the PHC centres of both LGAs are on an out-patient basis. Admissions, which rarely occur, are usually for patient observation, lasting only a few hours.

2.2 Study Design

A descriptive, interventional, quasi-experimental (non-randomised, controlled, pre-test/post-test experimental) study design was used for the study.

2.3 Study Population

The total number of prescriptions issued by the prescribing health workers in selected PHC centres of both LGAs over a period of three months (a total population/sample study) was reviewed. Each prescription issued per patient or encounter constituted the unit of inquiry.

2.4 Sampling Technique

Each health district within each LGA constituted a "cluster", half of these districts were selected for the study by simple random sampling technique.

2.5 Study Methods

An audit and analysis of the records of all the prescriptions issued in the PHC centres of the sampled health districts in both LGAs (study and control), before and after two phases of an educational intervention in the study LGA were conducted. Educational interventions were face-to-face and interactive, and involving question-and-answer sessions to clarify ambiguities and emphasize on key points concerning prescriptions and rational drug use as a whole.

Interventions consisted of weekly contact (teaching) sessions, each lasting over an hour, for three weeks. The sessions included recess or rest periods as well as interactive sessions, at intervals. Topical areas covered in the intervention include the concept, definition and rationale of rational drug use, the drug management cycle, types and examples of irrational drug use, adverse effects and impacts of polypharmacy on patients and the health system and services, methods of monitoring and evaluating drug use, strategies for improving drug use etc.

2.6 Data Analysis

Data collected by the aid of a checklist at both baseline (pre-intervention) and post-intervention surveys were validated for errors and analyzed electronically.

2.7 Ethical Considerations

Permission and approval were obtained from the Local Government authorities, while informed consent was obtained from the PHC Co-ordinators of each LGA.

3. RESULTS

Baseline data of the number of drugs prescribed per patient in the study and control facilities were 4.3±1.56 and 3.85±1.14, respectively. After the first and second phases of the intervention,

evidence of polypharmacy fell in the study group to an average of 3.26±1.19 and later, to 2.43±0.29 drugs per patient, respectively ($p<0.05$).

4. DISCUSSION

The provision or supply of essential drugs is central to the functional existence and smooth running of Primary Health Care (PHC), [13] as it constitutes one out of the eight core components of PHC as documented in the Alma Ata Declaration [14]. It also contributes immensely to the confidence reposed by communities and the general public in orthodox health care; and adds credibility to the healthcare system [7]. However, many prescription medicines are often inaccessible or even out-rightly unavailable at many PHC facilities of rural areas in developing countries [15].

Table 1. Summary of number of drugs prescribed at different phases of study by study status groups

Study status of groups	Phase of study		
	Pre-intervention (baseline)	**Post-intervention I: (after first intervention)**	**Post-intervention II: (after second intervention)**
Study	4.3 ± 1.56 *(range= 1-13; N= 2,838)*	3.26 ± 1.19 *(range= 1-11; N= 1,744)*	2.43 ± 0.29 *(range= 1-5; N= 695)*
Control	3.85 ± 1.14 *(range= 1-10; N= 1,417)*	3.89 ± 1.26 *(range= 1-10; N= 962)*	3.82 ± 0.81 *(range= 1-9; N= 545)*

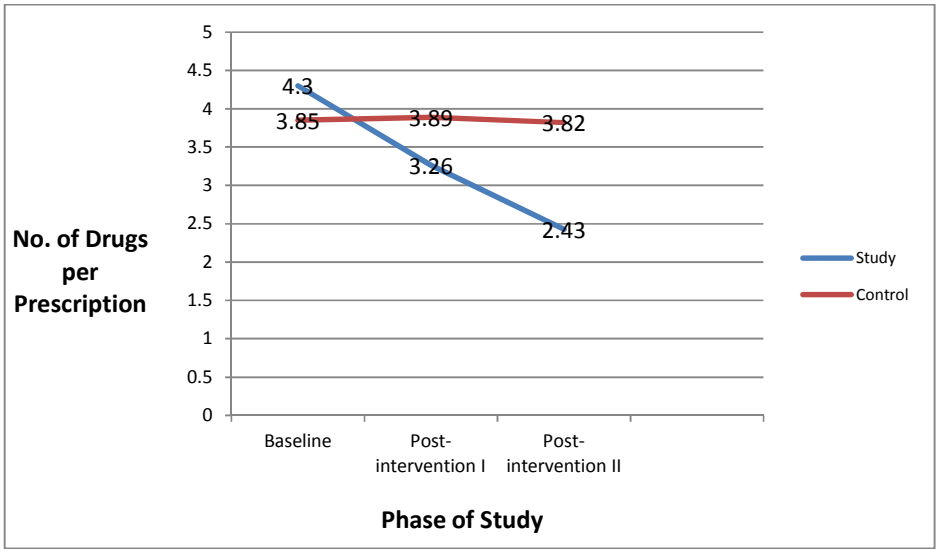

Fig. 1. Trend of number of drugs per prescription during study period

Table 2. Variation in number of drugs per prescription (*Post-intervention I*)

Study status of groups	Average no. of drugs per prescription ± standard deviation		
	Pre-intervention (baseline)	**Post-intervention I (after first intervention)**	**p-value (z- test)**
Study	4.30 ± 1.56 *(N= 2,838)*	3.26 ± 1.19 *(N= 1,744)*	P < 0.05
Control	3.85 ± 1.14 *(N= 1,417)*	3.89 ± 1.26 *(N= 962)*	P > 0.05

Table 3. Variation in number of drugs per prescription (*Post-intervention II*)

Study status of groups	Average no. of drugs per prescription ± standard deviation		
	Pre-intervention (baseline)	**Post-intervention II (after second intervention)**	**p-value (z- test)**
Study	4.30 ± 1.56 *(N= 2,838)*	2.43 ± 0.29 *(N= 695)*	P < 0.05
Control	3.85 ± 1.14 *(N= 1,417)*	3.82 ± 0.81 *(N= 545)*	P > 0.05

On the other hand, where availability is not the challenge, some medicines are simply unaffordable to rural dwellers. In the midst of this dismal situation, the healthcare system also has to tackle issues of poor management and wastage of limited resources including prescription drugs via channels such as poor storage conditions, inadequate security, deficient inventory control systems; pilferage, misuse and expiry of medicines as well as poor or non-compliance by patients [16,17]. This situation undermines the basic principles and rationale intended for the successful operation of the essential drugs concept [18].

The particular concern to many stakeholders are the irrational patterns observed among primary health care workers in the prescription and dispensing of drugs; the practice of over-prescription of drugs (polypharmacy) being one of such. The habitual practice of polypharmacy has been associated with lower cadres of healthcare workers, who constitute the majority of the health manpower operating mainly at the "grassroots" or primary health care (PHC) levels [19,20]. Corroborating these reports, the findings in this study, reveal baseline mean number of drugs prescribed per encounter by rural primary health care workers in both study and control areas as 4.30 and 3.85, respectively. The number of drugs prescribed per patient encounter ranged from 1-13 and 1-10 drugs in the study and control areas, respectively - clearly above the WHO-recommended reference target of an average of less than two (<2) per encounter [7,21]. While in the control area, the value observed compares with findings over two decades ago by Hogerzeil, Bimo, Ross-Degnan et al. [22] in a field study of drug use indicators in 12 developing countries, including Nigeria, with an average number of 3.8 drugs per prescription; the observation in the study area (4.30 drugs/encounter) far supersedes it. Reflecting no appreciable or significant changes have occurred over such a period, with reference to these findings. However, similar studies by Babalola, Awoleye et al. [19] and Adisa et al. [20] obtained even higher average values of 6.11 (ranging from 5.39 to 6.82) and 5.8 ± 2.3 drugs per encounter, respectively among PHC workers in south-western Nigeria. Other countries were values higher than the international average of 2.2 drugs per patient [9] have been reported include Ghana (4.8), Cameroun (2.8), Indonesia (3.3) and Pakistan (3.5) [9,23]. The aforementioned findings contrast and differ significantly from lower values reported from other countries in the eastern and southern sub-regions of Africa such as Ethiopia, Zimbabwe, and Sudan, which range between 1.3 to 1.9 drugs per encounter [9,22,24-26] Nonetheless, a review of prescribing indicators across the African region, over a period of about two decades (1995–2015) by Ofori-Asenso et al. [21] shows a regional average of 3.1 drugs per consultation.

These observations evidently call for further exploration into the possible causes of the fore-going, towards addressing the status quo and reversing the trend. Although the reasons for the high prevalence of polypharmacy in many developing countries of sub-Saharan Africa (particularly Nigeria) is not captured, as part of the scope of this study, other researchers [8,24,27-30] have cited some factors as being responsible. These have been identified as being largely socio-cultural in nature; and they include influences and pressure from patients, level of training and knowledge of health workers, clinicians' workload (particularly in out-patient departments), the availability and cost of medicines, the influence of the pharmaceutical industry as well as their sales representatives and marketers etc. Other attributable factors are the increasingly occurring phenomenon of co-morbidities in certain patients as well as the chronicity of many non-communicable diseases as they continue to co-exist with communicable diseases (that is the "epidemiological transition" as reported in many developing countries [31]; the non-availability of diagnostic services for the confirmation of diagnosis, particularly in rural PHC facilities; an extreme zeal or excessive desire by some health workers to demonstrate

concern or empathy by attempting to treat all ailments simultaneously ("symptomatic treatment") [32], among many other contributing factors.

The widespread and consistent practice of polypharmacy, among other patterns of irrational drug use, has been recognized as a significant channel for the mismanagement and wastage of scarce and valuable resources such as drugs, in the healthcare systems of many low-and-medium-income countries (LMIC). This occurs against the backdrop of and within the contexts of lean health sector budgets and competing demands from other sectors [33]. Furthermore, polypharmacy also has other far-reaching negative effects and impacts on the quality of healthcare, by compromising the co-operation and compliance of patients to prescribed treatment [34] (creating an additional cost of treatment for them [9], as out-of-pocket expenditure is the norm in many instances) as well as undermining therapeutic outcomes [32]. Thus, the higher cost of healthcare incurred as a result of polypharmacy creates an additional barrier to accessing quality healthcare, further making it unaffordable and inaccessible to the largely impoverished and illiterate rural populations [35], who represent about two-thirds of the population in Nigeria. Also, there are higher risks and chances of adverse drug reactions and interactions occurring [3,5], sometimes with hazardous and near-fatal consequences. These potential implications of polypharmacy grossly undermine the effectiveness of the healthcare system and call for the need to urgently address them and promote rational medicines use.

Some interventions have been recommended for improving prescription patterns among health workers. These strategies predominantly fall into at least three major categories; namely:

- Educational and communication methods, aimed at informing and persuading prescribers by furnishing them with relevant information and knowledge to improve on their prescribing skills and practices. It includes training of prescribers (formally and informally), the use of printed materials and literature, face-to-face approaches etc
- Managerial and financial methods, aimed at guiding decision-makers as well as prescribers in diverse areas of drug management such as drug selection, quantification, financing and cost-recovery, procurement, distribution and rational use; including monitoring, supervision, and feedback.
- Regulatory methods, aimed at restricting the practices and professional conduct of decision-makers and prescribers via measures such as the enforcement of legal requirements and other controls, eg, drug registration, limited drug lists, prescribing and dispensing restrictions etc [36].

These measures may be used singly or in combination. However, the most commonly used and effective interventions among prescribers have been found to be educational in nature [37,38] or a blend of same with other methods. A wide range of strategies has been proffered or advocated by various authors in developing countries. They include continuing education on rational drug use, increasing prescribers' awareness about non-drug therapy, provision of rapid diagnostic tests especially at side laboratories etc [8,24]. This study employed the use of a two-phased educational intervention. Studies have shown that successful educational interventions are often those which incorporate face-to-face contact and interaction (as opposed to the use of printed literature alone) [11,39] as well as feedbacks with recommendations for change in specific areas.

Following the first phase of an intervention conducted in the study area, which lasted for three weeks, the number of drugs prescribed per patient encounter dropped therein from 4.30 to 3.26 ($p<0.05$); while that in the control area slightly increased from 3.85 to 3.89 drugs per prescription ($p>0.05$). While the range of prescribed drugs dropped from 1-13 to 1-11 drugs per encounter in the study area, that in the control area remained at 1-10 drugs/encounter. This finding is corroborated by similar studies by Isah et al. as well as Odusanya and Oyediran in northern and south-western Nigeria, respectively [38,40]. Of these studies, the average number of drugs per patient reduced from 6 to between 3-5 and from 7.3 ± 2.8 to 6.3 ± 2.3, respectively. Likewise, following the implementation of the WHO-advocated national essential medicines programme (NEMP) for public PHC facilities in China, a study among primary care providers by Song, Bian, Petzold et al. [41] reported a decrease from 3.64 to 3.46 ($p < 0.01$) between 2009 and 2010, post-implementation in study primary care institutions. Furthermore, a controlled study in Uganda by Obua, Ogwal-

Okeng et al. [42] reported a decline in polypharmacy from 3.3 to 2.8 drugs/patient. To further reinforce the gains obtained in the first phase of the intervention and ensure it's sustenance, the second phase of educational intervention was conducted among the same health workers in the study area. Following this intervention, the index of interest clearly improved by almost half (over 40% of) it's baseline value (of 4.30) to 2.43 drugs/encounter ($p<0.05$) in the study area; while that in the control area remained relatively stable at 3.82 drugs per prescription ($p>0.05$). This further affirms the potential of continuing training and education in positively impacting the skills of health workers and enhancing the quality of their prescribing practice. Follow-up interventions of such nature as well as other measures, as reported by other researchers, are proven means of sustaining recorded improvements [38,43].

5. CONCLUSION

Findings obtained from this study reveal the existence of polypharmacy among rural PHC workers. Although the final value of 2.43 drugs/encounter obtained in this study (Fig. 1) is slightly above the international average of 2.2 drugs [9] and the derived standard value for the mean number of drugs per patient encounter in Nigeria (1.6- 1.8 drugs) [6], nonetheless, it still establishes the role of educational intervention in addressing, curbing and reversing the trend of the habitual practice of polypharmacy among this cadre of healthcare workers. Furthermore, it underscores the relevance of continuing medical education (CME) and enlightenment or awareness creation among health workers, as an effective tool in securing the gains attained from various measures of intervention and enshrining best practices.

6. LIMITATIONS

1. The scope of the study did not explore the possible factors that may be attributable to the level of polypharmacy reported. Such information would make valuable contributions in proffering solutions towards ameliorating the status quo.
2. Having identified drug interactions as a possible outcome of polypharmacy, the scope of the study did not probe further, as part of its objectives, to identify specific types of drug interactions that may be characteristic of the particular levels of polypharmacy reported.

CONSENT

As per international standard or university standard, patient's written consent has been collected and preserved by the authors.

ETHICAL APPROVAL

As per international standard or university standard, written approval of Ethics committee has been collected and preserved by the authors.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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