Polypharmacy and the Risk of Malnutrition among Independently-living Elderly Persons in Trinidad

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ABSTRACT

Objective: *In this study, we evaluated the association of polypharmacy and nutritional status among independently-living elderly persons attending the outpatient clinics at the Eric Williams Medical Sciences Complex (EWMSC).*

Method: *Participants were recruited at the outpatient pharmacy at EWMSC. Face-to-face interviews were conducted using a questionnaire consisting of sociodemographic, health and nutritional status items. Anthropometry was taken using standard procedures. Participants gave oral and written consent prior to enrolment in the study. Participation was voluntary. The study wasapproved by the Ethics Committee, EWMSC.*

Results: *One hundred and three persons − polypharmacy (≥ 6 medications) = 57; non-polypharmacy (< 6 medications) = 46 persons) − participated in the study. There was no significant difference in the age, gender, weight, height, body mass index (BMI), mid-arm circumference, calf circumference, highest educational level achieved and marital status between the groups. The number of medications prescribed was significantly positively associated with the number of ailments (r = 0.56;* p *< 0.001) and the risk of malnutrition (r = 0.30;* p *= 0.006). Persons with polypharmacy were significantly more likely than their non-polypharmacy counterparts to be at increased risk for malnutrition (OR = 3.94, 95% CI: 1.52, 10.13;* p *= 0.004). This finding remained highly significant after simultaneous adjustment for age, gender, ethnicity, highest educational level achieved, marital status and number of diseases (*p *= 0.03).*

Conclusion: *Among participants, polypharmacy and number of ailments were positively associated with an increased risk of malnutrition. Nonetheless, the mechanisms underlying these associations remain unclear.*

Keywords: Elderly, malnutrition, polypharmacy

Polifarmacia y riesgo de malnutrición entre ancianos que viven independientemente en Trinidad

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RESUMEN

Objetivos: *En este estudio, se evaluó la asociación de la polifarmacia con el estado nutricional entre las personas de edad avanzada que viven independientes y que asisten a las clínicas para pacientes externos en el Complejo de Ciencia Médicas Eric Williams (EWMSC).*

Método: *Los participantes fueron reclutados en la farmacia para pacientes externos del EWMSC. Se realizaron entrevistas cara a cara usando un cuestionario consistente en aspectos relacionados con la sociodemografía, la salud y el estado nutricional. La antropometría fue realizada empleando los procedimientos estándares. Los participantes dieron su consentimiento oral y escrito antes de la inscripción en el estudio. La participación fue voluntaria. El estudio fue aprobado por el Comité de ética de EWMSC.*

Resultados: *Ciento tres personas − polifarmacia (≥ 6 medicamentos) = 57; no polifarmacia (< 6 medicamentos) = 46 personas) − participaron en el estudio. No hubo ninguna diferencia significativa en edad, sexo, peso, altura, índice de masa corporal (IMC), circunferencia media del brazo,*

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circunferencia de la pantorrilla, nivel educacional más alto alcanzado y estado civil entre los grupos. El número de medicamentos recetados estuvo significativamente asociado positivamente con el número de dolencias (r = 0.56; p *< 0.001) y el riesgo de malnutrición (r = 0.30;* p *= 0.006). Las personas con polifarmacia fueron significativamente más propensas que sus contrapartes sin polifarmacia a presentar un mayor riesgo de malnutrición (OR = 3.94, 95% IC: 1.52, 10.13;* p *= 0.004). Este hallazgo permaneció altamente significativo después del ajuste simultáneo por edad, género, etnia, nivel educacional más alto alcanzado, estado civil y número de enfermedades (*p *= 0.03).*
Conclusión: *Entre los participantes, la polifarmacia y el número de dolencias estuvieron positivamente asociados con un mayor riesgo de malnutrición. Sin embargo, todavía no están claros los mecanismos subyacentes en estas asociaciones.*

Palabras claves: personas de edad, malnutrición, polifarmacia

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INTRODUCTION

Pathophysiologic changes accompanying the ageing process increase the risk of developing diseases (1). The treatment of these conditions, in many cases, requires the use of multiple medications. The long-term use of these medications increases the risk of polypharmacy (2). There is currently no consensus on the definition of polypharmacy, however, some definitions suggest that polypharmacy constitutes the use of two or more drugs to treat a condition (3). Other suggestions include the use of five of more drugs by patients as the cut-off for defining polypharmacy (4). Data from the treatment of hypertension in Trinidad and Tobago suggest that approximately 10% of persons with hypertension regularly receive three or more medications for their condition. Over 50% of all health visits in Trinidad and Tobago are due to hypertension, diabetes mellitus and related co-morbid conditions. These illnesses increase the potential for polypharmacy in the population. Despite the differing points of view on the definition of polypharmacy. It can have serious negative consequences to patients (5) since both polypharmacy and ageing are known to increase the risk of malnutrition in the elderly (6).

Polypharmacy may increase the risk of malnutrition through loss of appetite, malabsorption of nutrients, alterations in metabolism of nutrients and fostering electrolyte imbalances (7, 8). In addition to the processes above, ageing can affect the risk of malnutrition by influencing access to foods that are affordable and nutritious. For many elderly persons, issues related to mobility affect their ability to physically access and prepare foods that are acceptable (9). Additionally, elder persons may have smaller fixed incomes that adversely influence the procurement of nutritious foods (10). Neuro-physiological factors and oral health may impact on chewing and swallowing, complicating the process of eating, while reduced nutrient intakes may increase or decrease the bioavailability of certain drugs and hence significantly increase the risk of malnutrition (6, 11, 12).

Epidemiological data show a declining birth-rate in the English-speaking Caribbean. This, coupled with an increasing life expectancy, means that the number of persons over the age of 60 years is increasing steadily. Projections suggest that persons 60 years and older would constitute 24% (approximately 184 million persons) of the population of Latin America and the Caribbean by 2050 (13). Many of these persons run the risk of polypharmacy based on the projected increase in the prevalence and incidence of chronic non-communicable diseases, with nutritional implications (14). It is imperative that we explore the associations and mechanisms of polypharmacy and disease burden on the risk of malnutrition with a view to developing interventions that can prevent and mitigate their effects on the quality of life in a cost-benefit manner. In this investigation, we sought to determine whether polypharmacy was associated with an increased risk of malnutrition among independently-living elderly persons.

SUBJECTS AND METHODS

Population: The population of interest was persons aged 65 years and over, regularly attending chronic disease outpatient clinics at the Eric Williams Medical Sciences Complex (EWMSC).

Inclusion criteria were as follows:

- Male or female 65 years and older attending the outpatient clinics at EWMSC
- Must be living independently within their community

Exclusion criteria were as follows:

- Persons with any mental disease or condition
- Persons institutionalized in nursing homes etc

Study design: a case-control study design was employed. Cases (polypharmacy) consisted of participants prescribed ≥ 6 concurrent medications. Control (non-polypharmacy) consisted of participants prescribed < 6 concurrent medications.

Sample size: It was assumed that a third of persons with non-polypharmacy would be at increased risk for malnutrition. To determine a minimum odds ratio of four or greater between cases (persons with polypharmacy) and controls (persons without polypharmacy) with 80% power at the 5% significance level, approximately 44 cases and 44 controls were required (15).

Procedure: Participants were recruited during the period October 1, 2013 to March 31, 2014. Prior to enrolment, participants were informed about the nature of the study. Those

giving both oral and written consent were enrolled in the study. Face-to-face interviews were conducted using a structured questionnaire consisting of sociodemographic and nutrition-related items. The dependent variable was nutritional status. The Mini Nutritional Assessment (MNA) tool was used to determine the risk of malnutrition. Persons with a score of ≤ 23.5 were considered at increased risk of malnutrition while those with scores > 23.5 were considered as having a normal nutritional status. This questionnaire has high validity and reliability in assessing risk of malnutrition in the elderly. On completion of the questionnaire, participants had anthropometry measured using standard procedures (16). All participation was voluntary. Ethical approval for the study was granted by the Research Ethics Committee, The University of the West Indies. Permission was also granted from the North Central Regional Health Authority (NCRHA).

The number and type of drugs used by participants were verified from clinic records. All data collected were coded to ensure anonymity.

Statistical analysis: Data were cleaned prior to analysis and were analysed by polypharmacy status. *T*-tests were used to determine mean differences in continuous variables between the groups. Chi-squared tests were used to determine associations between polypharmacy status and important categorical variables such as risk of malnutrition.

RESULTS

One hundred and three persons (polypharmacy = 57; non-polypharmacy = 46 persons) participated in the study. The mean age of the sample was approximately 73 years. Table 1 shows the characteristics of participants by polypharmacy status.

Table 1: Characteristics of participants by polypharmacy status

Variable	Non-polypharmacy n = 46	Polypharmacy n = 57	*p*-value
Age (years), mean (SD)	74.2 (6.6)	72.5 (5.9)	0.18
Gender (female/male) (%)	54.3/45.7	49.1/50.9%	0.69
Ethnicity (%)			
East Indian	52.2	75.4	
African	28.3	14.0	
Mixed	19.6	10.5	0.03
Highest education level (%)			
None	2.2	3.5	
Primary	67.4	66.7	
Secondary	23.9	19.3	
Tertiary	6.5	10.5	0.88
Number of persons in household,mean (SD)	3.8 (2.6)	3.04 (1.8)	0.11
Diabetes (%)	17 (37%)	40 (70.2%)	0.001
Heart disease (%)	14 (30.4%)	46 (80.7%)	<0.001
High blood pressure (%)	30 (65.2%)	42 (73.7%)	0.39
High cholesterol (%)	17 (37%)	31 (54.4%)	0.11
Arthritis (%)	16 (34.8%)	29 (50.9%)	0.11
Marital Status (%)			
Married	58.7	61.4	
Single	15.2	8.8	
Divorced	4.3	5.3	
Widowed	21.7	24.5	0.86

Persons with polypharmacy were more likely than their non-polypharmacy counterparts to have been diagnosed with diabetes (polypharmacy 70.2% *vs* non-polypharmacy 37%, $p = 0.001$) and heart disease (polypharmacy 80.7% *vs* non-polypharmacy 30.4%, $p < 0.001$). Participants were more likely to be of East Indian descent when compared to the other ethnicities ($p = 0.027$). There were no significant differences in age, gender distribution, educational level achieved and marital status between persons with polypharmacy and their non-polypharmacy counterparts. Males had significantly higher MNA scores (24.3 ± 3.4 *vs* 22.3 ± 4.2; $p = 0.016$) and were diagnosed with fewer diseases than females (2.5 ± 1.4 *vs* 3.0 ± 1.3; $p = 0.045$). Females were significantly more likely than males to be diagnosed with hypertension (84.9% *vs* 54.6%; $p = 0.001$). Persons diagnosed with arthritis were significantly more likely than their non-arthritic counterparts to have MNA scores ≤ 23.5 (OR = 3.0, 95% CI: 1.2, 7.4, $p = 0.017$). Approximately 75% of participants reported taking their medication all the time while 95% reported taking the prescribed dosage. Adherence rates for the various diagnoses were as follows: high cholesterol (68.8%), heart disease (76.7%), hypertension (76.4%), diabetes mellitus (71.9%) and arthritis 75.7%.

Table 2 summarizes the distribution of anthropometry, physical activity and dietary behaviour by polypharmacy status. There were no significant differences in weight, height, body mass index (BMI), mid-arm circumference and calf circumference between the polypharmacy and non-polypharmacy individuals. Persons with polypharmacy had significantly lower MNA scores than their non-polypharmacy counterparts ($p < 0.001$). They were also significantly more likely than their non-polypharmacy counterparts to be at increased risk for malnutrition (*ie* MNA scores ≤ 23.5; OR = 3.94, 95% CI: 1.52, 10.13; $p = 0.004$). This finding remained after adjusting for the effects of age, gender, ethnicity, highest educational level achieved, marital status and number of diseases diagnosed (MNA scores ≤ 23.5; OR = 3.94, 95% CI: 1.35, 16.77; $p = 0.015$). Similarly, MNA score was positively correlated with disease burden independent of age, gender, ethnicity, highest educational level achieved and marital status. Approximately one-quarter to one-third of participants consumed high levels of fats, salted snacks and sodas on a weekly basis. Overweight and obesity were positively associated with serum cholesterol levels ($p = 0.02$) and diabetes mellitus ($p = 0.07$); however, the latter was not statistically significant. The Figure shows the proportions of participants with normal nutritional status. Non-polypharmacy participants were more likely than their polypharmacy counterparts to have a normal nutritional status (86.96% *vs* 68.42%, $p = 0.035$). There was a positive correlation between the number of medicines prescribed and the number of diseases diagnosed ($r = 0.54$; $p = < 0.001$).

DISCUSSION

In this study, an increased risk of malnutrition was more prevalent among persons with polypharmacy. This finding

Table 2: Anthropometry, physical activity and dietary behaviour by polypharmacy status

Variable	Non-polypharmacy n = 46	Polypharmacy n = 57	*p*-value
Weight, kg (SD)	69.1 (11.3)	72.6 (18.2)	0.26
Height, cm (SD)	163.5 (7.2)	165.6 (9.7)	0.24
Body mass index [BMI], kg/m² (SD)	25.8 (3.8)	26.7 (7.2)	0.47
BMI ≥ 25 (%)	60.90	59.60	0.98
BMI ≥ 30, n (%)	5 (10.9)	9 (15.8)	0.57
Mini Nutritional Assessment [MNA] score, mean (SD)	27.0 (3.5)	24.3 (3.8)	< 0.001
Number of ailments, mean (SD)	1.7 (1)	2.8 (1)	
Mid-arm circumference ≥ 22 cm (%)	100	96.5	0.5
Calf circumference ≥ 31 cm (%)	97.8	94.7	0.63
Exercise (%)	60.9	40.4	0.05
High fat consumption > 12 times/week (%)	21.7	29.8	0.38
Salted snack consumption > 2 times/week (%)	26.1	35.1	0.39
Soda consumption > 2 times per week (%)	39.1	26.3	0.20
Alcohol consumption (%)	29.5	28.1	0.87

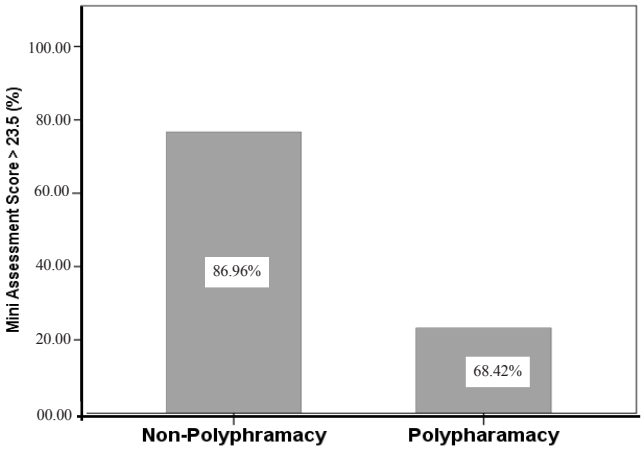

Figure: Proportion of participants with normal nutritional status by polypharmacy status.

was statistically significant. While this phenomenon is well established among elderly persons in hospitals and others institutions of care, this study adds to the growing body of evidence that suggests that this association is also present among persons with polypharmacy living independently within their communities (5, 6). We found that this association was independent of the number of diseases diagnosed. This suggests that the use of multiple medications among the elderly may independently contribute to the increased risk of malnutrition.

While we did not investigate the nature of the mechanisms linking polypharmacy to malnutrition, studies suggest that the use of multiple medications may increase the risk of malnutrition by suppression of appetite, alteration in the sense of smell and taste, altering the rate of absorption of nutrients from the gut and altering the metabolism and utilization of absorbed nutrients (6, 7, 17). This is important, as malnutrition resulting from the prolonged use of some of these medications can influence the pharmacokinetics and pharmacodynamics of the drugs themselves, leading to increased or decreased efficacy (18). This may have serious implications for adjustment or treatment regimes. It may also lead to changes in the use of the various medications by the clients in order to diminish symptoms experienced (5).

We also found associations between certain diseases and diet-related behaviours. For example, persons diagnosed with diabetes mellitus were more likely than those without to report declining levels of food intake in the three months preceding the interview ($p = 0.05$) and those diagnosed with heart disease were more likely than their disease-free counterparts to report mobility as an issue ($p = 0.08$). In addition to the reduced food intake ($p = 0.08$) and supplement use ($p = 0.07$), persons diagnosed with high cholesterol were more likely than their counterparts without the condition to report psychological challenges ($p < 0.05$). Each of these may result in dietary behaviours which negatively affect the nutritional status of the elderly since mobility issues may influence procurement as well as preparation of meals, while psychological issues may lead to reduce intake of foods (19). In fact, persons in the present study who felt that they were better off than individuals with the same diseases were less likely to be at increased risk for malnutrition (10.3% *vs* 48.6%; $p < 0.001$).

The role that these diseases play in increasing the risk of malnutrition varies and should not be underestimated in this vulnerable group (20, 21). In addition to the clinical data collected at visits, a simple set of screening questions that collect data on appetite, changes in the sense of taste and smell, self-reported health, presence of nausea and the ability to swallow as well as procure and prepare meals can assist greatly in the successful management of many of these conditions. We also recommend that all patients receive nutritional counselling as a routine part of their care (22–24).

This study has several limitations. Firstly, the sample was non-random. This increased the risk of bias associated with selection. Secondly, while investigating issues related to the risk of malnutrition with polypharmacy, it did not investigate the associated mechanism between polypharmacy, disease status and risk of malnutrition. An advantage of the study was the fact that interviews were done on a face-to-face basis. This provided an opportunity for the participants to address misconceptions with the interviewer, thereby improving the quality and the accuracy of data collected.

CONCLUSION

Among participants, polypharmacy and number of ailments were positively associated with an increased risk of malnutrition. Nonetheless, the mechanisms underlying these associations in the study population remain unclear.

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