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Effect of an Educational Intervention about Herbal Medicine on the Knowledge of Physicians and Pharmacists

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Authors' contributions

This research was a collaborative effort among all authors. Authors ET, KJ, JEC and RK designed the study and all the authors put together the research proposal. Authors ET, KJ and JEC put together content for the video and facilitated the participation of persons in the video. Author TT produced the questionnaire with input from all the other authors. Author TT also performed the statistical analysis. Author ET wrote the first draft of the manuscript. Authors KJ, JEC and RK managed the literature searches. All authors read and approved the final manuscript.

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ABSTRACT

Aims: To evaluate the effect of a video educational intervention, on the knowledge of physicians and pharmacists with respect to their awareness of the difference between local bush medicines (bush) and imported herbal medicines (herb); and, their uses, side effects, contraindications and drug interactions. Also, to determine if there was exposure to and an interest in formal training on Complementary, Alternative and Bush Medicine (CABM).
Study Design: A cross-sectional study of registered pharmacists and physicians in Guyana, attending their annual conferences, was carried out with a self-administered survey questionnaire on medicinal plants.

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Methodology: Participants completed the Pre-Questionnaire; then were shown a video and subsequently given a similar Post-Questionnaire. The impact of the video was investigated using Confirmatory Factor Analysis (CFA), Wilcoxon Sign Rank tests and logistic and multinomial regression models.
Results: A total of 274 (134 pharmacists and 140 doctors) persons participated. The bush which most were aware of, was corilla/bitter melon, both in the pre-questionnaire (60%) and in the post-questionnaire (83%). Cranberry (pre-score 48%, post-score 51%) was the most identified herb. A comparison of the pre and post scores using the paired t-test (t=2.528, df=175, *P*=0.005) indicated improved awareness. Most persons were able to identify one use of corilla/bitter melon (pre-score 61%, post-score 70%). However, for the other bush/herbs, and for the side effects, contraindications and drug interactions, knowledge was lacking although there were significant improvements after the intervention. 44% indicated that CABM was part of their formal training and pharmacists were more likely to have had formal training. 88% were interested in further training.
Conclusion: The study found a paucity of knowledge about medicinal plants and therefore strongly recommends implementing formal education on CABM in university curricula and in future Continuing Education (CE) sessions. The video intervention had a significant impact and should be used as a template.

Keywords: Knowledge; video; educational intervention; herbal medicine; pharmacists; physicians.

1. INTRODUCTION

Traditional medicine integrates a number of distinct practices which are historically influenced by the belief systems of the indigenous populations who utilise it.

Further, "Traditional medicine that has been adopted in other populations (outside its indigenous culture) is often termed Alternative or Complementary Medicine." [1]. Complementary and Alternative Medicine (CAM) may include meditation, chiropractic care, massage, and prayer [2]. Traditional medicine also involves the use of herbal medicines or medicinal plants. In Guyana, the term bush medicine is used to denote medicinal plants originally used by the Amerindians (who were the first inhabitants) and Africans brought by the slave trade. Traditionally, bush medicine was also associated with the spiritual aspect of Amerindian and African culture [3].

There is remarkable scientific interest in the therapeutic potential of medicinal plants or herbal medicines, including bush medicine as part of the spectrum of CAM strategies. Laboratory research has shown that herbal medicines have anti-inflammatory, antipyretic and anticonvulsant effects. Indeed, a perusal of the literature, reveals that researchers have investigated the use of St. John's wort *(Hypericum perforatum)* for depression, *Ginkgo biloba* (also known as the maidenhair tree) for dementia and *Echinacea species* for the treatment of the common cold [4]. In Guyana, some of the common bush medicine include neem, also known as Indian lilac (*Azadirachta indica*) which has antihyperglycemic, antimalarial and antifungal properties [5]; corilla also known as carilla, coraila, karela, bitter gourd or bitter melon (*Momordica charantia*) used in the management of diabetes [6]; and lemongrass (*Cymobopogon citratus*) which has been shown to diminish hyperalgesia in rats [7].

Globally, the use of CAM has been increasing, however, most health care professionals (HCPs) seem unaware of the advantages and disadvantages [8]. Studies of knowledge and practices of HCPs have the potential to guide best practices and capitalise on the beneficial aspects of CAM.

Few studies have reported on the actual use of educational interventions with respect to knowledge of traditional medicine. However, educational interventions such as videos and pamphlets show some ability to effect improved knowledge [9]. Previous studies have shown that videos and the use of a professional environment were especially useful in transmitting knowledge and changing behaviour [9,10]. In general, educational interventions should focus on audit and feedback and should be plausible, feasible and the mode of delivery should be efficient. Furthermore, interventions in the initial stages should address behavioural intention (that is, a measure of the willingness or motivation of the subjects) rather than a complete change in professional behaviour [11]. Thus, exposure to a video on medicinal plants for HCPs attending their Continuing Education (CE) sessions, where

most of their peers are present, offers an excellent opportunity to generate discussion on the positives and negatives of Complementary, Alternative and Bush Medicine (CABM).

In Guyana, research on the knowledge, attitudes and practices (KAPs) of HCPs in relation to CAM in general and local bush medicine in particular, is scarce and therefore this study has the potential to guide university curricula design for both Pharmacy and Medical programmes. It is hoped that findings of this study can also propel policymakers to institute mechanisms whereby HCPs can readily access information/databases on the correct uses, risks and benefits of the medicinal plants available in Guyana.

The aims of this study were to investigate the knowledge of pharmacists and physicians for the differences between local bush medicine (bush) and imported herbal medicine (herbs) with respect to their uses, side effects, contraindications, and herb/bush-drug interactions of common bush/herbs. These comparisons were intended to assist in assessing the effectiveness of an educational intervention (video) and their prior exposure to formal training on their knowledge about CABM.

2. MATERIALS AND METHODS

2.1 Study Design and Sample

The study was cross-sectional and extended from June 2014 to December 2015. Those who were registered, practising pharmacists with qualifications of Associate Degree/Diploma in Pharmacy and above; or registered physicians who were trained and practising modern medicine; who had the qualification of Bachelor of Medicine, Bachelor of Surgery (MBBS) or Doctor of Medicine (MD) and above, were all eligible to participate in the study. Most of the HCPs in Guyana received their training either at the University of Guyana (UG), which is the local national University; or at one of the offshore medical schools in Guyana; or in Cuba, China, or Russia. At the University of Guyana, pharmacists receive much more formal training about CAMB than the physicians. In the Pharmacy programme, there are two 4-credit courses (Natural Products I and II) part of which deal with medicinal plants [12]. There are no such courses in the Medical programme [13].

There were 180 pharmacists and 328 physicians registered at the time of the study, according to data from the Pharmacy and Medical Councils. Persons who attended the Annual Medical Conference in 2014 (physicians) and the first Continuing Pharmacy Education (CPE) session in 2015 (pharmacists) all participated. A total of 274 individuals participated in the study: 140 physicians and 134 pharmacists.

2.2 Questionnaire

A self-administered pre-questionnaire, designed by the researchers, was used which elicited information about socio-demographics; and knowledge of the uses, side effects, contraindications, and herb/bush-drug interactions of the more popular imported herbal medicines (herbs) and local bush medicines (bush).

2.2.1 Awareness of local bush and imported herbs

To evaluate the awareness of local and imported bush/herbs, practitioners were presented with 26 herbs/bush and were required to select five that were local in origin and five that were imported. The herbs/bush presented were[1] in Chart 1.

2.2.2 Knowledge about the use of bush and herbs

To test knowledge about the uses of various bush/herbs, the practitioners were presented with five bush/herbs and ten uses. They were asked to match the bush/herbs with the uses, with the possibility that some uses are applicable to more than one herb/bush. The list of herbs/bush and uses presented, are shown in Table 1.

2.2.3 Knowledge about the side effects of bush/herbs

Knowledge about the side effects of bush medicine and other herbs was measured by the inclusion of an item that required that the practitioners match a list of seven side effects to five bush/herbs with the possibility of matching several side effects to several bush/herbs. A table, similar to Table 1, was set up in the questionnaire with the following information:

The five bush/herbs were Cranberry, Stinging Nettle, Neem/Indian lilac, Echinacea and Soursop[2]. The seven side effects for matching were: 1. Causes nephrotoxicity and hepatotoxicity. 2. Hypersensitivity reactions. 3. Causes hypotension. 4. Causes hypoglycaemia. 5. Causes impotence. 6. Leads to skin irritation. 7. Causes dehydration.

[1] *Among these, items **A, D, F, K, N, P, Q, R, V, X and Z (in bold)** are local bush medicines, items C and O are distractors (not applicable) and the remainder are imported herbs.*

[2] *The correct side effects are as follows: Cranberry: 4; Stinging Nettle: 6; Neem/ Indian lilac: 1, 2, 7; Echinacea: no correct answer; Soursop: 3.*

Table 1. Bush/Herbs and their uses

Use	Bush/Herb				
	Corilla/Bitter melon	**Milk Thistle**	**Soursop**	**Periwinkle**	**Turmeric**
1. Has hepatoprotective properties	1	1	1	1	1
2. Used to treat BPH and urinary retention in men	2	2	2	2	2
3. Arthritis	3	3	3	3	3
4. Has anticancer properties	4	4	4	4	4
5. Diabetes	5	5	5	5	5
6. Stimulates lactation	6	6	6	6	6
7. Has antiparasitic and antibacterial properties	7	7	7	7	7
8. Alleviates peri and postmenopausal symptoms	8	8	8	8	8
9. Improves cognitive function	9	9	9	9	9
10. Anti-inflammatory and antioxidant	10	10	10	10	10

The correct uses for the bush/herbs are Corilla/Bitter melon: 4, 5; Milk Thistle: 1, 6; Soursop: 4, 7, 10; Periwinkle: 4, 9, 10 and Turmeric: 3, 4, 5, 10

Chart 1. The herbs/bush presented

A. Neem/Indian Lilac (*Azadirachta indica)*
B. Garlic (*Allium sativum)*
C. Coconut Husk
D. Corilla/karela/bitter gourd/bitter melon (*Momordica charantia)*
E. Milk Thistle (*Silybum marianum)*
F. Daisy (*Bellis perennis)*
G. Chamomile (*Matricaria chamomilla)*
H. Dong Quai *(Angelica sinensis)*
I. Cranberry *(Vaccinium oxycoccos/ Vaccinium macrocarpon)*
J. Sarsaparilla Bark/Root *(Smilax ornata)*
K. Stinging Nettle/ *(Urtica dioica)*
L. Saw Palmetto *(Serenoa repens)*
M. Turmeric *(Curcuma longa)*
N. Crabwood (Oil)/Crab Oil *(Carapa guianensis)*
O. Star Apple Bark
P. Periwinkle *(Catharanthus roseus)*
Q. Tulsi/Holy Basil *(Ocimum tenuiflorum/ Ocimum sanctum)*
R. Orange Peel *(Citrus X sinensis)*
S. Black Cohosh *(Actaea racemose)*
T. Cascara *(Rhamnus purshiana)*
U. *Gingko biloba*
V. Black Sage *(Cordia curassavica)*
W. *Echinacea species*
X. Congo pump *(Cecropia species)*
Y. Evening Primrose (Oil) *(Oenothera species)*
Z. Soursop *(Annona muricata)*

2.2.4 Knowledge about contraindications

Contraindications are specific circumstances for which a medication should not be used, for example, pregnancy. With respect to knowledge about contraindication of bush/herbs, the practitioners were presented with five herbs and nine potential contraindications similar to Table 1. They were required to match them with the possibility that a contraindication may be correct for more than one bush/herb or none at all.

The five bush/herbs were Tulsi/Holy basil, Periwinkle, Echinacea, Soursop and Evening Primrose Oil. [3] The nine potential contraindications were: 1. Pregnancy. 2. Breastfeeding. 3. Patients with cancers fuelled by high oestrogen levels. 4. Patients with Parkinson's. 5. Patients with Multiple Sclerosis. 6. Alzheimer's disease. 7. Epileptics and/or schizophrenics. 8. Diabetes. 9. No contraindications have been identified.

2.2.5 Knowledge about drug interactions

A drug interaction is a reaction between two or more medications or between a medication and food, beverage, or a supplement. Drug-bush/herb interactions were investigated in the surveys, similar to Table 1, with respect to five bush/herbs. As for the previous items testing knowledge, an interaction was applicable to more than one bush/herb.

The five bush/herbs were Dong Quai, Soursop, Periwinkle, Evening Primrose Oil and Stinging Nettle. [4] The ten possible drug interactions to choose from were 1. Anticoagulants. 2. Diuretics. 3. Warfarin. 4. Angiotensin-converting enzyme Inhibitors (ACEIs). 5. ATP Enhancers/Coenzyme Q10 (CoQ10). 6.

[3] *The correct contraindications are as follows: Tulsi/Holy basil: 1, 2; Periwinkle: 1, 2; Echinacea: 5; Soursop: 1, 2, 4; Evening Primrose Oil: 6, 7.*

[4] *The correct drug interactions are as follows: Dong Quai: 3, 8; Soursop: 5; Periwinkle: 4, 6, 7; Evening Primrose Oil: 1, 8; and Stinging Nettle: 1, 2.*

Angiotensin II receptor blockers (ARBs). 7. Calcium channel blockers (CCBs). 8. Aspirin. 9. Ginkgo biloba. 10. Metformin.

2.2.6 Other questionnaire details

Participants were also questioned about any previous formal education and interest in subsequent training related to CAM and medicinal plants. A video (described subsequently) was then shown on specific medicinal plants; after which a similar post-intervention questionnaire was distributed. The post-intervention questionnaire did not contain any socio-demographic questions.

To determine the effect of the video intervention, it was important to link the pre- and post-intervention questionnaires from individuals. To achieve this, while maintaining the anonymity of the individuals, the participants were provided with a unique identifying number at the beginning. This number was known by only the individual to which it was assigned, and each participant was asked to write the number on the document containing his/her responses to the questions for both the pre- and post-intervention questionnaires.

The validity of the questionnaire was examined by a physician, pharmacist, herbal doctor, statistician, and an epidemiologist. The reliability of the questionnaire was checked as a pilot survey on a small group of Medical and Pharmacy students. Suggestions, mostly on the length of the questionnaire, were raised and addressed.

2.3 The Intervention

The video contained information on common medicinal plants. This included their scientific and common names; uses; contraindications; interactions with conventional medicines; adverse effects; clinical trials; information of some concomitant use of conventional and medicinal plants; and authoritative sources of information such as specific journal articles. It was 15 minutes in length and began with some history of bush medicine use in the 1950s in Guyana, followed by an interview with two herbal doctors and a pharmacist who spoke about the usefulness of bush medicine and the potential of Guyana to become the hub of patented medicinal plants once clinical trials have been successful. They also stressed the importance of HCPs enquiring of their clients about their use of any bush medicine or herbal medication.

Part of the video also mentioned some of the bush medicine used in Guyana–neem/Indian lilac, tulsi/Holy basil, congo pump, corilla/bitter melon, soursop, periwinkle, daisy, noni, crab oil and black sage but then provided additional information on the uses, side effects, contraindications and drug interactions of the more popular ones, that is, neem/Indian lilac, tulsi/Holy basil, corilla/bitter melon, soursop, stinging nettle and periwinkle.

The following imported herbal remedies were identified: Echinacea, saw palmetto, milk thistle, evening primrose oil, flaxseed oil, senna, cranberry, dong quai, ginkgo biloba, turmeric and cascara. Information on the uses, side effects, contraindications and drug interactions of the more popular ones, namely echinacea, milk thistle, evening primrose oil, dong quai, cranberry and turmeric, was given. Several journal articles about clinical trials, were also mentioned including one entitled: Papaya Extract to Treat Dengue: A Novel Therapeutic Option? [14].

2.4 Procedure

Prior to the conference/CPE session, invitation letters were sent to potential participants, through their respective Councils, outlining the project and informing them that the questionnaire would be administered and that there would be an educational intervention in the form of a video.

Immediately before the administration of the questionnaires at the conference/CPE session, a brief presentation was done about the project, its objectives, and its significance. The need to use the unique identification number on both questionnaires, was emphasised. The pre-intervention questionnaire was approximately 20 minutes in duration. Once, completed and returned, the 15-minute video was shown, after which, the post-intervention questionnaire was administered. This questionnaire required 10-15 minutes for completion.

Upon submission of the post-intervention questionnaire, the participants were given a pamphlet containing additional information and scientific sources of information on medicinal plants. The entire activity (introduction, administration of pre-questionnaire, showing of video, administration of post-questionnaire) took about one hour.

2.5 Data Analysis

The data were analysed using a variety of techniques depending on the nature of the variables and on the kind of inferences to be made. At each stage of the analysis, the 5% level was employed as the basis for determining the significance of the results. Statistical Package for Social Sciences (SPSS) Version 19 (SPSS Inc., Chicago, IL, USA) was used for data entry, cleaning, and analysis.

To determine the effect of the intervention, several knowledge items were presented in the pre- and post-intervention questionnaires. In the analysis, the number of correct responses was compared between the two data collection points to provide measures of the knowledge gained due to the intervention. These data were compared primarily using Wilcoxon Sign Rank tests which is a nonparametric test that does not require that the variables be normally distributed. Logistic and multinomial regression models were also estimated, depending on the number of response categories to facilitate the evaluation of the characteristics of the practitioners with respect to prior formal training and interest in future training.

3. RESULTS

A majority (56.4%) of the participants were 20-30 years old and most were female (60.3%) (see Table 2). Most persons (86.5%) did not have post-graduate experience and whilst most of the pharmacists (96.8%) received their education at the University of Guyana; most of the physicians did not. Overall, most (51.8%) of the participants had at most five years of professional experience (Table 2).

3.1 Awareness of Local Bush and Imported Herbs

Participants were asked to identify five bush and five herbs amongst a list of 26 items. Overall, more participants were able to identify the bush medicine, especially A (Neem/Indian lilac) and D (Corilla/Bitter melon) than imported herbs (Table 3). Option R (Orange Peel) was identified by the smallest number of individuals. The intervention resulted in a higher identification rate for most of the items.

Of note, Options C (Coconut Husk) and O (Star Apple Bark) were distractors and are neither bush nor herbs. However, 29/267 (10.9%) participants identified Option C and 8/267 (3%) chose Option O as local bush medicine in the pre-intervention survey. In the post-intervention survey, 8/148 (5.4%) persons still selected Option C as a bush, whilst none chose Option O.

To investigate the number of correct answers, each individual was assigned a value corresponding to the number of correct answers with 5 being the highest. This was done for the answers provided in both surveys (see summary by group in Table 4). Although there was a tendency to obtain more correct answers after the intervention, this pattern was not uniform (Table 4).

To check whether there was a significant difference in the results before and after the intervention, the differences in the pre-and post-intervention scores were calculated and analysed. At the individual level, this difference ranged between -5 and 4 with a mean of 0.23 and a standard deviation of 1.22. A paired t-test returned a significant result ($t=2.528$, $df=175$, $P=0.005$) thereby indicating that there was an effect of the intervention. In particular, the intervention resulted in improved awareness of local bush/herbs.

3.2 Knowledge about the Use of Bush and Herbs

The percentage of individuals in the respective groups who selected the respective number of correct answers to indicate knowledge about the use of bush/herbs was examined (Table 5). Except for corilla/bitter melon and turmeric, more than half of the practitioners identified no correct answers in the pre-intervention survey. This changed in the post-intervention survey for all except milk thistle for which although there was improvement (of approximately 10%), 53.4% of the practitioners still could not identify a correct use (Table 5).

When the data are disaggregated by profession, it was observed that large percentages of the physicians (as much as 84.5% for milk thistle and periwinkle) were unable to identify correct uses of the various herbs/bush. Despite improvement in the post-intervention survey, this group still lagged behind the group of pharmacists.

Table 2. Demographic characteristics of the respondents

Characteristic	Total Number (%)	Physicians Number (%)	Pharmacists Number (%)
Age			
20-30	154 (56.4)	78 (55.7)	76 (57.1)
31-40	70 (25.6)	40 (28.6)	30 (22.6)
41-50	19 (7)	6 (4.3)	13 (9.8)
51-60	20 (7.3)	11 (7.9)	9 (6.8)
>60	10 (3.7)	5 (3.6)	5 (3.8)
Total number of persons who responded	273	140	133
Gender			
Female	164 (60.3)	69 (48.9)	95 (72.5)
Male	108 (39.7)	72 (51.1)	36 (27.5)
Total	272	141	131
Education			
Below Post-Graduate	135 (86.4)	43 (70.5)	92 (96.8)
Post-Graduate	21 (13.5)	18 (29.5)	3 (3.2)
Total	156	61	95
University Attended			
Other University	51 (32.3)	47(77.1)	3 (3.2)
University of Guyana	107 (67.7)	14 (22.9)	92 (96.8)
Total	158	61	95
Nationality			
Non-Guyanese	17 (6.2)	15 (10.6)	2 (1.5)
Guyanese	256 (93.8)	126 (89.4)	130 (98.5)
Total	273	141	132
Profession	274	137	137
Experience (years)			
<=5	141 (51.8)	78 (55.7)	63 (47.7)
6-<10	56 (20.6)	28 (20.0)	28(21.2)
10-<15	24 (8.8)	11 (7.9)	13 (9.9)
>=15	51 (18.8)	23 (16.4)	28 (21.2)
Total	272	140	132

Missing data were handled by list-wise deletion

Table 3. Awareness of local bush and imported herbs

Local Bush Medicine	Overall Total (%)		Imported Herbs	Overall Total (%)	
	Pre	Post		Pre	Post
A Neem/Indian lilac	48.86	75.00	B Garlic	15.34	24.43
D Corilla/Bitter melon	59.66	82.39	E Milk Thistle	25.00	32.39
F Daisy	31.82	32.95	G Chamomile	27.27	19.89
K Stinging Nettle	10.23	28.41	H Dong Quai	12.50	39.20
N Crabwood Oil	29.55	14.20	I Cranberry	48.30	50.57
P Periwinkle	2.84	24.43	L Saw Palmetto	34.09	34.09
Q Tulsi/Holy basil	45.45	44.89	M Turmeric	26.70	26.70
R Orange Peel	6.25	2.84	S Black Cohosh	25.57	26.14
V Black Sage	33.52	26.70	T Cascara	17.05	17.61
X Congo pump	14.77	13.64	U Gingko Biloba	48.86	48.30
Z Soursop	34.66	42.61	W Echinacea	21.59	35.23
			Y Evening Primrose oil	34.09	35.80

Table 4. Percentage of distribution of correct responses for awareness of bush/herbs

Number Correct	Combined		Physicians		Pharmacists	
	Pre	Post	Pre	Post	Pre	Post
0	0.57	0.57	1.41	1.41	0.00	0.00
1	2.84	6.82	5.63	0.00	0.95	0.00
2	9.66	0.00	18.31	5.63	3.81	7.62
3	23.30	19.89	12.68	25.35	30.48	16.19
4	35.23	38.64	30.99	38.03	38.10	39.05
5	28.41	34.09	30.99	29.58	26.67	37.14

The values represent the percentage of practitioners with the respective number of correct answers

Given the discrete categories into which the responses were coded and the small range; non-parametric methods were selected to investigate whether there were significant improvements in knowledge about the uses of bush/herbs due to the intervention. Wilcoxon's Sign Rank test was employed, and one test was conducted for each bush/herb (Table 6). Each of the five tests on different bush/herbs was significant at the 5% level indicating that there was, indeed, significant improvement in knowledge about the uses of the bush/herbs. The intervention, therefore, appears to have been effective in this regard.

3.3 Knowledge about the Side Effects of Bush and Herbs

Many participants were unable to select a single correct side effect for the bush/herb in both the pre- and post-intervention surveys

Table 5. Percentage distributions for correct uses of bush/herbs

Bush/Herb	Number of correct Answers	Combined		Physicians		Pharmacists	
		Pre	Post	Pre	Post	Pre	Post
Corilla/Bitter melon	0	28.41	17.61	43.66	18.31	18.10	17.14
	1	60.80	69.89	45.07	63.38	71.43	74.29
	2	10.80	12.50	11.27	18.31	10.48	8.57
Milk Thistle	0	63.64	53.41	84.51	57.75	49.52	50.48
	1	34.66	40.91	15.49	36.62	47.62	43.81
	2	1.70	5.68	0.00	5.63	2.86	5.71
Soursop	0	64.20	45.45	73.24	46.48	58.10	44.76
	1	29.55	32.95	22.54	23.94	34.29	39.05
	2	6.25	16.48	4.23	25.35	7.62	10.48
Periwinkle	0	68.18	48.30	84.51	56.34	57.14	42.86
	1	28.41	40.91	14.08	32.39	38.10	46.67
	2	3.41	9.66	1.41	9.86	4.76	9.52
Turmeric	0	40.34	28.98	64.79	40.85	23.81	20.95
	1	25.57	33.52	22.54	35.21	27.62	32.38
	2	26.70	29.55	11.27	22.54	37.14	34.29

The values represent the percentage of practitioners with the respective number of correct answers

Table 6. Sign rank test for knowledge of the uses of bush/herbs

Bush/Herb	Z	*P*-value
Corilla/Bitter melon	2.65	0.01
Milk Thistle	2.74	0.01
Soursop	5.52	0.00
Periwinkle	5.03	0.00
Turmeric	2.02	0.00

except for the case of echinacea (Table 7). The side effects of bush/herbs, therefore, appeared to be an area in which very little is known in the medical community. Moreover, the intervention seems to have impacted negatively in the case of stinging nettle. For this bush/herb, the percentage of individuals who got no correct answer is much higher in the combined data and for both physicians and pharmacists in the post-intervention survey. In contrast, it appears that much more was known about the side effects of echinacea and the level of knowledge appears to have improved due to the intervention.

Wilcoxon Sign Rank test was used to evaluate the significance of the observations. The results of the test for each bush/herb are shown in Table 8. The results indicate that the intervention was effective, notwithstanding the negative impact in relation to stinging nettle. The reason for this unexpected result is not immediately clear but it suggests that there might be limits to the effectiveness of the intervention.

3.4 Knowledge about the Contraindications of Bush and Herbs

Apart from periwinkle, most of the practitioners were unable to identify a correct contraindication for each bush/herb in the pre-intervention survey (Table 9). This holds also when the disaggregated data for physicians and the pharmacists are considered. There appeared to be little knowledge in the medical community regarding the contraindications.

Although large percentages of the practitioners were still unable to identify at least one correct contraindication in the post-intervention survey, large shifts towards being able to identify at least one correct contraindication were observed for tulsi/Holy basil, and soursop. There were also improvements for echinacea and evening primrose oil, but these appeared to be comparatively more modest which suggested that there were still lingering knowledge deficiencies (Table 9). Therefore, although the intervention appeared to have improved knowledge about the contraindications, there was still a large knowledge deficit.

The case of periwinkle was particularly interesting. Although some individuals were able to identify contraindications correctly in the pre-intervention survey, no one made correct identifications in the post-intervention survey. This suggested that some confusion was created in relation to this case or that the practitioners chose to not provide an answer.

Table 7. Percentage distributions for correct side effects of bush/herbs

Bush/Herb	Number of correct Answers	Combined		Physicians		Pharmacists	
		Pre	Post	Pre	Post	Pre	Post
Cranberry	0	97.73	93.75	97.18	88.73	98.10	97.14
	1	2.27	6.25	2.82	11.27	1.90	2.86
Stinging Nettle	0	64.20	98.30	71.83	100.00	59.05	97.14
	1	35.80	1.70	28.17	0.00	40.95	2.86
Neem/Indian lilac	0	78.98	59.09	85.92	60.56	74.29	58.10
	1	19.89	26.14	14.08	23.94	23.81	27.62
	2	1.14	12.50	0.00	12.68	1.90	12.38
Echinacea	0	29.55	40.34	18.31	43.66	37.14	38.10
	1	70.45	59.66	81.69	56.34	62.86	61.90
Soursop	0	91.48	80.11	80.28	83.10	87.62	80.00
	1	8.52	19.89	19.72	16.90	12.38	20.00

The values represent the percentage of practitioners with the respective number of correct answers

Table 8. Sign rank test for side effects of bush/herbs

Herb/Bush	Z	*P*-value
Cranberry	1.94	0.05
Stinging Nettle	-7.50	0.00
Neem/ Indian lilac	5.02	0.00
Echinacea	2.29	0.02
Soursop	3.33	0.00

Table 9. Percentage distributions for correct contraindications of bush/herbs

Bush/Herb	Number of Correct Answers	Combined		Physicians		Pharmacists	
		Pre	Post	Pre	Post	Pre	Post
Tulsi/Holy basil	0	85.80	43.18	90.14	40.85	82.86	44.76
	1	9.09	16.48	7.04	16.90	10.48	16.19
	2	5.11	40.34	2.82	42.25	6.67	39.05
Periwinkle	0	42.05	100.00	43.66	100.00	40.95	100.00
	1	16.48	0.00	15.49	0.00	17.14	0.00
	2	41.48	0.00	41.90	0.00	41.90	0.00
Echinacea	0	92.61	86.36	95.77	84.51	90.48	87.62
	1	7.39	13.64	4.23	15.49	9.52	12.38
Soursop	0	89.20	51.14	95.77	47.89	84.76	53.33
	1	7.95	19.89	4.23	21.13	10.48	19.05
	2	1.70	25.00	0.00	25.35	2.86	24.76
Evening Primrose Oil	0	93.75	82.39	94.37	70.42	93.33	90.48
	1	6.25	14.77	5.63	23.94	6.67	8.57
	2		2.84	0.00	5.63	0.00	0.95

The values represent the percentage of practitioners with the respective number of correct answers

The Wilcoxon Sign Rank tests for the difference in the distributions of the matched responses between pre- and post-intervention surveys, were all significant at the 5% level (Table 10). Therefore, with the exception of periwinkle, the intervention was effective in improving knowledge about the contraindications of the bush/herbs.

3.5 Knowledge about the Drug Interactions of Bush and Herbs

Most of the practitioners were unable to identify any correct drug interaction for each of the bush/herbs. This is true for both the pre- and post-intervention surveys. Nevertheless, there appeared to be improvements in the post-intervention survey for all bush/herbs except stinging nettle (Table 11).

The Sign Rank Tests showed that the observed improvements are all significant at the 5% level except in relation to Stinging Nettle (Table 12). Although the intervention resulted in improvement in knowledge about drug interactions, the improvements were due to relatively small proportions of the practitioners.

3.6 Training in Complementary, Alternative and Bush Medicine (CABM)

The practitioners were asked whether their formal training included CABM, and whether they were interested in further training.

Of a total of 274 possible responses in the pre-intervention survey, 121 persons (44.16%) indicated that CABM was part of their formal training, whereas 130 (47.45%) said that it was not and 23 (8.39%) did not provide an answer. An interesting question arose as to whether the background variables were significantly related to having had CABM as part of formal training. In this regard, it is not expected that variables such as ethnicity, region and gender would have a significant relationship. In fact, it would be difficult to interpret such relationships substantively except in the case where they were strongly correlated with other variables that have significant relationships with the response. We therefore investigated the relationship of having had CABM as part of formal training on, profession, university attended and age. The latter variable gave some indication of whether the introduction of CABM into formal training was done recently.

The model selected for this purpose is a logistic regression model which accounts for only whether formal training was received and not for the absence of a response. The logistic regression model (Table 13) showed overall significance at the 5% level (chi-square = 23.93, df = 4, *P*-value = 0.00) and significant effects of each of the included variables. The results indicate that pharmacists are more likely to have encountered CABM in their formal training than physicians, that attending the University of Guyana decreases the likelihood of formal training in CABM, and that older practitioners who are over 40 years old are less likely than younger practitioners to have encountered CABM in formal training. Given the significant difference between physicians and pharmacists,

Table 10. Sign rank tests for knowledge about contraindications of bush/herbs

Herb/Bush	Z	*P*-value
Tulsi/Holy basil	8.26	0.00
Periwinkle	-9.91	0.00
Echinacea	2.29	0.02
Soursop	7.34	0.00
Evening Primrose Oil	3.68	0.00

Table 11. Percentage distributions for correct drug interactions of bush/herbs

Bush/Herb	Number of Correct Answers	Combined		Physicians		Pharmacists	
		Pre	Post	Pre	Post	Pre	Post
Dong Quai	0	90.91	76.70	95.77	74.65	87.62	78.10
	1	4.55	14.20	4.23	14.08	4.76	14.29
	2	4.55	9.09	0.00	11.27	7.62	7.62
Soursop	0	97.73	89.20	100.00	88.73	96.19	89.52
	1	2.27	10.80	0.00	11.27	3.81	10.48
Periwinkle	0	92.05	79.55	91.55	77.46	92.38	80.95
	1	5.68	11.36	5.63	15.49	5.71	8.57
	2	1.14	6.82	1.41	2.82	0.95	9.52
Evening Primrose Oil	0	96.02	88.64	95.77	85.92	96.19	90.48
	1	3.41	9.66	2.82	11.27	3.81	8.57
	2	0.57	1.70	1.41	2.82	0.00	0.95
Stinging Nettle	0	91.48	88.07	97.18	92.96	87.62	84.76
	1	7.95	9.09	2.82	7.04	11.43	10.48
	2	0.57	2.84	0.00	0.00	0.95	4.76

The values represent the percentage of practitioners with the respective number of correct answers

Table 12. Sign rank tests for knowledge about drug interactions with bush/herbs

Herb/Bush	Z	*P*-value
Dong Quai	3.91	0.00
Soursop	3.27	0.00
Periwinkle	3.60	0.00
Evening Primrose Oil	2.61	0.01
Stinging Nettle	1.37	0.17

Table 13. Logistic regression for having had CABM in formal training

Variable	Estimate	Odds Ratio
Profession (1 = physician, 0 = pharmacist)	-1.39*	0.25
	(0.38)	
University (1= University of Guyana, 0 = other)	-1.29*	0.28
	(0.38)	
Age 21 – 30 (baseline = age >40)	1.00*	2.72
	(0.38)	
Age 31 – 40 (baseline = age >40	1.27*	3.55
	(0.44)	
Constant	0.49	1.63
	(0.47)	

**Significant at the 5% level*

Table 14. Logistic regression model for interest further training

Variable	Estimate	Odds Ratio
Profession (1 = physician, 0 = pharmacist)	-1.74*	0.18
	(0.51)	
University (1= University of Guyana, 0 = other)	-0.95*	0.39
	(0.49)	
Age 21 – 30 (baseline = age >40)	0.51	1.66
	(0.47)	
Age 31 – 40 (baseline = age >40	-0.19	0.82
	(0.59)	
Constant	3.39*	29.63
	(0.72)	

** Significant at the 5% level*

it is possible that having CABM in formal training has a direct impact on knowledge of CABM.

When asked whether or not they are interested in further training on CABM, approximately 88.19% of the practitioners in the combined sample said yes. Among the physicians, approximately 82.4% said yes, while approximately 93.90% of the pharmacists said yes.

Interest in further training is significantly associated with profession and university attended but not age (Table 14). This is determined from a logistic regression model for further interest with age, profession and university as predictors (chi-square = 14.91, df = 4, *P*-value = 0.01). The model indicates that physicians are less likely to be interested in further training than pharmacists and that those who attended the University of Guyana are also less likely to be interested in further training (Table 14).

4. DISCUSSION

This study investigated and compared the knowledge of bush medicine and imported herbal medicines for pharmacists and physicians before and after a video educational intervention. When the HCPs were asked to select the local bush medicine and imported herbs; most of them could more readily identify bush medicine than imported herbs and this was similar to the findings of a study done in Trinidad [15]. This could be attributed to the role of family history and the influence of the use of bush medicine in some participants' households as they were growing up.

We obtained interesting baseline data about the awareness of our participants. In other studies, lemongrass and marijuana [15]; and garlic, ginger and St. John's wort [16], were more familiar to the respondents; however we found that corilla/bitter melon and neem/Indian lilac were the options most frequently selected by our participants, probably since they are known to have medicinal use within the Guyanese community whilst lemongrass is more considered as a 'bush tea'. We did not list marijuana in our list of selections so perhaps this could be an avenue for research in future studies.

Overall, the respondents tended to only know the use of corilla and turmeric out of the five examples presented (corilla, milk thistle, soursop, periwinkle, and turmeric). Both are well known, and their benefits well recognised in Guyana; therefore, our findings were not unexpected. The pharmacists knew more about the uses of the bush medicine/imported herbs than the physicians, and this was also supported in the literature when comparing medical students and nursing students [17] or physicians and other HCPs [18-20]. Indeed, at the University of Guyana, pharmacists receive much more formal training about CAMB than the physicians via two Natural Products courses which are not offered in the Medical programme [12,13]. Also, it is our belief that the Pharmacy curriculum, as well as the interactions of pharmacists and clients in community pharmacies, aid in the increased knowledge of pharmacists. They tend to have to listen more and spend more time educating clients who in turn, often share their knowledge with their 'neighbourhood' pharmacists.

There was a lack of knowledge noted for the side effects, contraindications, and drug interactions for most of the bush/herbs. Similar findings were encountered for pharmacists in Palestine [21] where more than half of the participants did not know side effects, contraindications and herbal-drug interactions; and in Lebanon, where although pharmacists knew about the uses of products such as echinacea and ginkgo biloba, their knowledge of the side effects and drug interactions was poor [22]. Clement et al., also reported similar results for the physicians in Trinidad [15].

The observed improvement in awareness of our participants after the intervention points to its overall usefulness. A follow-up study in the United States showed that after the introduction of continuing education courses and seminars, physicians were more familiar with certain aspects of CAM such as herbal medicine, homeopathy and naturopathy. However, with respect to the knowledge of uses of herbal therapy, the researchers found that deficits in knowledge still existed and recommended that they be addressed with customised educational programmes [23]. In general, our analysis indicated that our video intervention had a positive impact on increasing knowledge and therefore, should be used as a model for any formal training programmes.

Several studies have found that HCPs tend to agree that CAM is a useful addition to conventional therapy [19,24] and in some cases as much as 91% of participants believe that HCPs should have some knowledge of CAM and conventional therapy to better inform clients about improving their health [24]. Clearly, physicians and pharmacists in Guyana recognise and are requesting opportunities for formal training; overall, more than 80% of our respondents requested further training. This is similar to the findings of a study in Trinidad and Tobago, where 84% of doctors and 83% of pharmacists indicated that HCPs should receive more formal teaching about CAM [19]. The researchers in Lebanon, found that most pharmacists requested that continuing education programmes on CAM, be made compulsory to ensure the safe and efficacious use of herbal medicines [22].

Undoubtedly, our study indicates that there is a paucity of knowledge with respect to medicinal plants. It is of concern that a few persons identified the distractors as local bush medicine, and this points to the need for formal training with respect to CABM.

Our study had some limitations. We did not conduct the study with a control group, that is, using another cohort but with a different intervention method to see how accurately effective the choice of using a video was, in improving knowledge. The absence of a control group is an important limitation, but given that short term knowledge gains were evaluated, inclusion of a control group was perhaps unnecessary as it is rather unlikely that the individuals can spontaneously generate new knowledge within a day. In this regard, it was better to expose everyone to the intervention which served the greater purpose of teaching more about CABM than to purely conduct a study.

Our study was also limited because the timeframe within which the study was conducted was short. Therefore, the results for knowledge about CABM represent short term knowledge gains rather than long term retention. Nevertheless, given that some tendency towards knowledge improvement was demonstrated, the approach could at least be used at an introductory level. In addition, studies on long term retention should be conducted.

We selected what we thought were the most popular herbs/bush to ask about uses, side effects, contraindications and drug interactions and it is possible that some respondents were more knowledgeable about other herbs/bush. In addition, CAM often involves other techniques, including massage, music therapy and meditation and the use of marijuana. We did not ask participants if they have ever specifically employed or suggested these methods. This avenue provides an opportunity for further research. In addition, we used a self-administered questionnaire to evaluate multifaceted perspectives, rather than interviews and small groups and perhaps this can be considered for future studies.

5. CONCLUSION

Although it was found that the level of knowledge of local bush medicine and imported herbs was low, the positive impact of the video was evident, and it could be modified and used as a template to improve knowledge for other HCPs. Physicians seemed to know less about the uses, side effects, contraindications and drug

interactions than pharmacists. Although this was expected, because of the emphasis of the different curricula, it also shows areas for possible strengthening in the Medical and Pharmacy programmes. There was evident enthusiasm for opportunities for further training.

Finally, studies such as these pave the way for future research on incorporating CABM and conventional therapy in well-structured, patient-centred clinical trials which will eventually lead to better patient outcomes.

CONSENT AND ETHICAL APPROVAL

The participants were informed about the objectives and significance of the study and that their participation was completely voluntary. Completion of the questionnaires implied consent to participate and the use of the unique number for each respondent ensured anonymity since no list of the persons to whom the specific numbers were issued was kept The research proposal, together with the questionnaire, were endorsed by the Ministry of Public Health (MoPH), Institutional Review Board (IRB). The MoPH IRB approval for Protocol #197 was dated 3/07/2014 and the document number was FWA00014641

Completion of the questionnaire was taken as consent to participate in the study.

The Ministry of Public Health, Institutional Review Board gave ethical approval to conduct this study which was received and preserved by the authors.

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COMPETING INTERESTS

Authors have declared that no competing interests exist.

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