

Evaluating the impact of a pre-recorded online video on Doctor's knowledge and attitude towards leprosy in Sabah and Labuan - a quasi experimental study

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ABSTRACT

Introduction: Global actions have been implemented worldwide to eliminate leprosy. However, under-recognition and stigmatisation continue to be the challenges. In Sabah, the grade two disability rate was 0.15/100,000 population in 2019, implicating a significant delay in diagnosis. This study aimed to assess the knowledge and attitude towards leprosy and the impact of lecture intervention among doctors in Sabah and Labuan, Malaysia.

Materials and methods: This study consists of two parts. First, a cross-sectional study on the knowledge of and attitude towards leprosy using an online questionnaire was conducted among doctors working in the primary care clinics and hospitals in Sabah and Labuan. Subsequently, the participants were asked to watch an online pre-recorded video lecture on leprosy and to answer the same questionnaire.

Results: Of the 310 participants, one fifth (20.6%) had good knowledge and 36.5% had positive attitude towards leprosy. Being a specialist (adjusted odds ratio [aOR] 4.55, 95% confidence interval [CI] 2.17–9.57, $p < 0.001$), managed ≥ 5 leprosy cases (aOR 3.37, 95% CI 1.52–7.47, $p = 0.003$), and involved in educational activities related to leprosy within last year (aOR 4.7, 95% CI 1.69–13.04, $p < 0.001$) were the significant predictors of good knowledge. Working in tertiary care was significantly associated with good attitude towards leprosy (OR 2.19, 95% CI 1.22–3.94, $p = 0.025$). There was a significant improvement in participants' knowledge post-intervention (87.0% participants post-lecture vs 20.6% participants pre-lecture with good knowledge, $p < 0.001$).

Conclusion: The proportion of doctors in Sabah and Labuan with good knowledge and attitude towards leprosy was low. Knowledge of leprosy improved significantly post-intervention. This highlights the need for educational and training programmes to improve doctors' knowledge of leprosy.

KEYWORDS:

Leprosy, Hansen's disease, knowledge, attitude, doctors

INTRODUCTION

Leprosy is an infectious disease caused by *Mycobacterium leprae* that primarily affects the skin and peripheral nerves.

Untreated disease can lead to mutilating deformities and associated with social stigma. Early diagnosis and treatment play an important role in the prevention of disabilities.¹

Globally, there were 202,256 new cases detected in 118 countries in 2019. The majority of the new cases (79%) were reported in India and Brazil. According to the WHO disability grading, grade 2 disabilities were characterised by visible deformity or visual damage.² Of the new cases, 10,816 cases were detected with grade 2 disabilities (G2D) with a rate at 1.4 per million population and 370 (3.4%) cases were children under the age of 15.³

Malaysia achieved leprosy elimination in 1994.⁴ Although the number of new cases has declined over the past years, there were 198 new cases detected in 2019 in Malaysia.⁵ Sabah has the highest number of cases in Malaysia with 75 (37.9%) new cases. Among which four (5.3%) cases were children and 6 (8%) cases had grade 2 disabilities with a G2D rate of 0.15/100,000.⁶ Sabah did not achieve the WHO target of G2D < 0.02 per 100,000 population and new child cases of $< 3\%$. This is an indication of late diagnosis and lack of community awareness.

In Malaysia, the public health sector comprises of three levels: primary, secondary, and tertiary care with a wide network of health clinics and hospitals. The primary care service comprises of outpatient clinics at the first point of consultation for patients at the local community. Patients may then be referred to secondary and tertiary care services.⁷ Both Sabah and Labuan are located on the Northern Borneo of Malaysia. In 2019, the incidence rate of leprosy in Sabah was 1.9 per 100,000 population as compared to 0.61 in Malaysia.⁵ Thus, it is important for doctors to have adequate knowledge and training in leprosy to recognise and diagnose leprosy early. This study aimed to assess the knowledge and attitude towards leprosy among medical doctors in Sabah and Labuan.

MATERIALS AND METHODS

Study design and population

This was a cross-sectional study with online questionnaire conducted among medical doctors working in the primary care clinics, district hospitals (secondary care), emergency department and medical department of specialist hospitals (tertiary care) in Sabah and Labuan from June 2021 till April

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2022. Doctors working in the Dermatology department were excluded.

The target participants were recruited by convenience sampling. A link to the questionnaire in Google Form was distributed via email to the relevant clinics and departments in hospitals. Participants answered an online self-administered questionnaire on leprosy and provided their email at the end of the questionnaire. After completion of the questionnaire, participants later received a link to the pre-recorded 5-minute video lecture and the same set of questionnaire via email. Participants were given a 3-month time frame to watch the video lecture and complete the post-video questionnaire. After completion of the questionnaire, participants received their scores and the answers on the knowledge section of the questionnaire.

This study was approved by the Medical Research and Ethics Committee, Ministry of Health, Malaysia, and was registered with the National Medical Research Registry (NMRR-21-1443-60619).

Questionnaire development and content validation

The questionnaire was developed by the investigators of this study. The content validation of the questionnaire was conducted by five senior consultant dermatologists. The questionnaire and the content validation form were sent via email to the consultant dermatologists. The dermatologists rated each question on a four-point Likert scale (1- totally irrelevant content, 2- irrelevant content, 3- relevant content, 4- extremely relevant content). The relevance rating for each item was recoded as 1 (relevance scale of 3 or 4) or 0 (relevance scale of 1 or 2). Then, the sum of the relevance rating of each item was divided by the number of the expert, e.g., $(1+1+1+1)/5 = 1$. The average content validity index (CVI) across all items was 1, which met the satisfactory level. Next, pre-testing of the questionnaire was carried out to ten potential participants. The ten responses were included in this study as there were no major changes from the pre-test.

Video lecture

The 5-minute video lecture was prepared and delivered by the principal investigator. The video lecture explained the cause of leprosy, mode of transmission, classifications, clinical features, treatment and complications. The content of the video was approved by three senior consultant dermatologists.

Questionnaire

Informed consent was obtained from all participants. Demographic data and professional characteristics of the participants were collected in the questionnaire. There was a total of 24 questions in the questionnaire: 20 questions on knowledge and 4 questions on attitude. The questions on knowledge comprised of cause of leprosy, mode of transmission, clinical features, treatment and complications. Every correct answer on the knowledge section will be awarded 1 mark; no mark will be awarded for wrong or unanswered questions. The total marks will be converted to 100% for interpretation. Categorisation of the score was as following: $\geq 70\%$ good knowledge, 40 - 69% average knowledge and $< 40\%$ poor knowledge.

For the attitude section of the questionnaire, a five-point Likert scale was used. The score was calculated as the following: 1- strongly disagree, 2- disagree, 3- neutral, 4- agree, 5- strongly agree. Lower total score indicates better attitude. Participants who answered disagree or strongly disagree on all questions (with a score of ≤ 8) were regarded as having good attitude. A score > 8 was regarded as having poor attitude. Categorisation of the knowledge and attitude score were decided by the investigators of this study after discussion with the three senior consultant dermatologists.

Statistical analysis

The data were tabulated and analysed using IBM® Statistical Package for the Social Sciences (SPSS) Statistics, version 22.0. Descriptive analyses were conducted for demographic and professional characteristics. Continuous variables were expressed as means and standard deviations (SD) and categorical variables as frequencies and percentages. Simple logistic regression analysis was done to analyse factors associated with good knowledge and good attitude. Multivariate logistic regression analysis was conducted for variables associated with good knowledge. Forward and backward stepwise variable selection procedures were applied. McNemar's test was done to analyse participants' knowledge and attitude pre and post-intervention. A *p*-value of < 0.05 was considered statistically significant.

RESULTS

Demographic characteristics of the participants and experience with leprosy patients

A total of 310 participants were included in this study. The mean age of the participants was 31.5 ± 2.91 years. Among the participants working in tertiary hospitals, 129 (95.6%) were from medical department and 6 (4.4%) from emergency department.

The majority of the participants had limited experience with leprosy. More than 80% of them had previously come across, diagnosed, or managed less than five patients with leprosy. Higher proportion of primary care (22.5%) and tertiary care doctors (20.7%) came across ≥ 5 leprosy patients compared to the secondary care doctors (11.6%). Overall, more specialists (25%) managed ≥ 5 leprosy patients than medical officers (9.4%). The majority of the participants (84.8%) did not receive undergraduate teaching on leprosy. Two-thirds (67.7%) of the participants last accessed leprosy materials more than a year ago (Table I).

Knowledge of leprosy

As shown in Table I, participants who were specialists, working in primary care or tertiary care, being in service for ≥ 5 years, experience with leprosy patients (came across or diagnosed or managed ≥ 5 leprosy cases), previously received undergraduate teaching on leprosy and involved in educational activities related to leprosy within last year had better knowledge.

Table II shows the responses to questionnaire pre and post-video lecture. The majority of the participants were familiar with the causative microorganism (96.5%) and the investigations of suspected leprosy patients (83.5%). One-

Table I: Demographic characteristics of the participants, experience with leprosy patients, knowledge and attitude towards leprosy

Characteristics	Overall	Knowledge			Attitude	
	n (%) n=310	Good (≥70%) n = 64	Average (40-69%) n = 216	Poor (<40%) n = 30	Good (≤8) n = 113	Poor (>8) n = 197
Age - years, Mean (SD)	31.5 (2.91)	32.4 (3.45)	31.3 (2.72)	30.9 (2.58)	31.5 (2.85)	31.5 (2.94)
Gender						
Male	140 (45.2)	28 (20.0)	99 (70.7)	13 (9.3)	57 (40.7)	83 (59.3)
Female	170 (54.8)	36 (21.2)	117(68.8)	17(10.0)	56 (32.9)	114 (67.1)
Ethnicity						
Bumiputera Sabah	59 (19.0)	9 (15.3)	44(74.6)	6 (10.2)	23 (39.0)	36 (61.0)
Malay	95 (30.6)	22 (23.2)	56 (58.9)	17 (17.9)	33 (34.7)	62 (65.3)
Chinese	115 (37.1)	26 (22.6)	83 (72.2)	6 (5.2)	39 (33.9)	76 (66.1)
Indian	38 (12.3)	7 (18.4)	30 (78.9)	1 (2.6)	16 (42.1)	22 (57.9)
Others	3 (0.9)	0	3 (100)	0	1 (50.0)	1 (50.0)
Position						
Medical officer	266 (85.8)	44 (16.5)	193 (72.6)	29 (10.9)	93 (35.0)	173 (65.0)
Specialist	44 (14.2)	20 (45.5)	23 (52.3)	1 (2.3)	20 (45.5)	24 (54.5)
Workplace						
Primary care	89 (28.7)	26 (29.2)	55 (61.8)	8 (9.0)	30 (33.7)	59 (66.3)
Secondary care	86 (27.7)	8 (9.3)	61(70.9)	17 (19.8)	23 (26.7)	63 (73.3)
Tertiary care	135 (43.5)	30 (22.2)	100 (74.1)	5 (3.7)	60 (44.4)	75 (55.6)
Years of service						
< 5	174 (56.1)	29 (16.7)	124 (71.3)	21 (12.1)	59 (33.9)	115 (66.1)
≥ 5	136 (43.9)	35 (25.7)	92 (67.6)	9 (6.6)	54 (39.7)	82 (60.3)
Number of leprosy patients came across						
< 5	252 (81.3)	40 (15.9)	184 (73.0)	28 (11.1)	86 (34.1)	166 (65.9)
≥ 5	58 (18.7)	24 (41.4)	32 (55.2)	2 (3.4)	27 (46.6)	31 (53.4)
Number of leprosy patients diagnosed						
< 5	301 (97)	59 (19.6)	212 (70.4)	30 (10.0)	108 (35.9)	193 (64.1)
≥ 5	9 (3)	5 (55.6)	4 (44.4)	0	5 (55.6)	4 (44.4)
Number of leprosy patients managed						
< 5	274 (88.4)	46 (16.8)	199 (72.6)	29 (10.6)	95 (34.7)	179 (65.3)
≥ 5	36 (11.6)	18 (50.0)	17 (47.2)	1 (2.8)	18 (50.0)	18 (50.0)
Received undergraduate teaching on leprosy						
Yes	263 (84.8)	58 (22.1)	178 (67.7)	27 (10.3)	99 (37.6)	33 (70.2)
No	47 (15.2)	6 (12.8)	38 (80.9)	3 (6.4)	14 (29.8)	164 (62.4)
Last involved in educational activities related to leprosy						
Never	61 (19.7)	8 (13.1)	43 (70.5)	10 (16.4)	17 (27.9)	44 (72.1)
Within last year	39 (12.6)	18 (46.2)	21 (53.8)	0	17 (43.6)	22 (56.4)
More than 1 year	210 (67.7)	38 (18.1)	152 (72.4)	20 (9.5)	79 (37.6)	44 (72.1)
Educational source on leprosy accessed						
Website	170 (54.8)	36 (21.2)	119 (70.0)	15 (8.8)	67 (39.4)	103 (60.6)
Continuing Medical Education	104 (33.5)	27 (26.0)	69 (66.3)	8 (7.7)	48 (46.2)	56 (53.8)
Leprosy Management Manual	47 (15.2)	13 (27.7)	33 (70.2)	1 (2.1)	20 (42.6)	27 (57.4)
Textbook	118 (38.1)	25 (21.1)	82 (69.5)	11 (9.3)	40 (33.9)	78 (66.1)
Journal articles	33 (10.6)	7 (21.2)	25 (75.8)	1 (3.0)	13 (39.4)	20 (66.7)
Courses	3 (1.0)	2 (66.7)	1 (33.3)	0	1 (33.3)	2 (66.7)
Never access any leprosy related resources	30 (9.7)	5 (16.7)	21 (70.0)	4 (13.3)	8 (26.7)	22 (73.3)

third (33.5%) of the participants thought that leprosy was transmitted by direct contact. Only 64 (20.6%) participants had good knowledge (score $\geq 70\%$). Nearly two-thirds of the participants (69.7%) had average knowledge (score 40 - 69%) and the remaining 30 (9.7%) participants had poor knowledge (score $< 40\%$).

Table III shows the univariate and multivariate logistic regression analysis of the potential predictors of better knowledge score. Position as a specialist (adjusted odds ratio [aOR] = 4.55, 95% confidence interval [CI] = 2.17–9.57, $p < 0.001$), previously managed ≥ 5 leprosy cases (aOR = 3.37, 95% CI = 1.52–7.47, $p = 0.003$), and last accessed educational

materials related to leprosy within the last year (aOR = 4.7, 95% CI = 1.69–13.04, $p < 0.001$) were significantly associated with good knowledge.

Attitude towards leprosy

More than one-third (37.8%) of the participants thought patients with leprosy need to be isolated from the community. Only 113 (36.5%) of the participants had good attitude towards leprosy (score ≤ 8). Participants who were specialists, working in tertiary care, with working experience ≥ 5 years, experience with leprosy patients, previously received undergraduate teaching on leprosy and involved in educational activities related to leprosy within last year had

Table II: Responses to knowledge and attitude questions

Knowledge and attitude questions	Pre-video lecture, n = 310 n (%)	Post-video lecture, n = 270 n (%)
Leprosy is caused by which microorganism?		
Mycobacterium leprae*	299 (96.5)	267 (98.9)
Treponema pallidum	10 (3.2)	3 (1.1)
Madurella mycetomatis	1 (0.3)	0
Mycobacterium ulcerans	0	0
Leprosy is also known as:		
Hansen's disease*	299 (96.5)	268 (99.2)
Humphrey's disease	11 (3.5)	1 (0.4)
Hartmann's disease	0	1 (0.4)
Harry's disease	0	0
The mode of transmission for leprosy is:		
Direct contact	104 (33.5)	12 (4.4)
Droplet*	180 (58.1)	257 (95.2)
Faecal oral route	17 (5.5)	1 (0.4)
Vector	9 (2.9)	0
Leprosy primarily affects:		
I. Bone, II. Nerve, III. Skin, IV. Eyes		
I, II	2 (0.6)	1 (0.4)
II, III *	121 (39.0)	99 (36.7)
II, III, IV	128 (41.3)	146 (54.1)
All of the above	59 (19.0)	24 (8.9)
What are the typical cutaneous features of leprosy?		
I. Hypopigmented patch,		
II. Loss of sensation,		
III. Loss of hair, IV. Loss of sweating		
I, II	147 (47.4)	40 (14.8)
II, III	8 (2.6)	1 (0.4)
II, III, IV	12 (3.9)	3 (1.1)
All of the above*	143 (46.1)	226 (83.7)
What are the cardinal signs of leprosy?		
I. Skin patch with loss of sensation		
II. Enlarged/thickened peripheral nerve with corresponding loss/impairment of function		
III. Presence of acid-fast bacilli in slit skin smear		
IV. Loss of corneal reflex		
I, II	78 (25.2)	12 (4.5)
I, II, III*	125 (40.3)	235 (87.0)
II, III	14 (4.5)	6 (2.2)
All of the above	93 (30.0)	17 (6.3)
Which nerve is the most frequently affected nerve in leprosy?		
Optic	82 (26.4)	9 (3.3)
Popliteal	21 (6.8)	1 (0.4)
Sciatic	12 (3.9)	1 (0.4)
Ulnar*	195 (62.9)	259 (95.9)
Which is the most severe form of leprosy?		
Borderline tuberculoid	1 (0.3)	1 (0.4)
Lepromatous*	269 (86.8)	259 (95.9)
Mid borderline	1 (0.3)	0
Tuberculoid	39 (12.6)	10 (3.7)
Which of the following patient has leprosy? (patients' photos)		
a	6 (1.9)	3 (1.1)
b *	42 (13.6)	35 (13.0)
c	257 (82.9)	229 (84.8)
d	5 (1.6)	3 (1.1)
What are the complications of leprosy?		
I. Claw hand, II. Lagophthalmos, III. Scleritis,		
IV. Neuropathic ulcers		
I, II	45 (14.5)	15 (5.6)
II, III	8 (2.6)	6 (2.2)
II, III, IV	53 (17.1)	4 (1.5)
All of the above *	204 (65.8)	245 (90.7)

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Table II: Responses to knowledge and attitude questions

Knowledge item	Pre-video lecture, n = 310 n (%)	Post-video lecture, n = 270 n (%)
What constitutes WHO grade 2 disabilities in leprosy?		
I. Loss of sensation, II. Blindness, III. Resorption of digits, IV. Loss of corneal reflex		
I, II	95 (30.6)	42 (15.5)
II, III *	69 (22.3)	126 (46.7)
III, IV	39 (12.6)	20 (7.4)
All of the above	107 (34.5)	82 (30.4)
What are the clinical manifestations of type 2 reaction?		
I. Painful nodules, II. Fever, III. Lymphadenopathy, IV. Arthralgia		
I, II	37 (11.9)	10 (3.7)
I, II, III	56 (18.1)	36 (13.3)
II, III	40 (12.9)	4 (1.5)
All of the above*	177 (57.1)	220 (81.5)
Investigations for patients suspected of leprosy include:		
I. Skin biopsy, II. Slit skin smear, III. Peripheral blood smear, IV. Blood culture		
I, II*	259 (83.5)	261 (96.7)
I, II, IV	42 (13.6)	5 (1.8)
I, IV	5 (1.6)	0
II, III	4 (1.3)	4 (1.5)
Leprosy should be notified to the nearest district health office within:		
1 month	5 (1.6)	0
1 week *	139 (44.8)	247 (91.5)
2 weeks	7 (2.3)	2 (0.7)
24 hours	159 (51.3)	21 (7.8)
The following drugs are used in leprosy treatment except:		
Clofazimine	52 (16.8)	1 (0.4)
Dapsone	36 (11.6)	1 (0.4)
Isoniazid *	208 (67.1)	263 (97.4)
Rifampicin	14 (4.5)	5 (1.9)
What is the duration of treatment for paucibacillary leprosy?		
3 months	21 (6.8)	3 (1.1)
6 months*	191 (61.6)	259 (95.9)
9 months	37 (11.9)	5 (1.9)
12 months	61 (19.7)	3 (1.1)
What is the duration of treatment for multibacillary leprosy?		
6 months	23 (7.4)	3 (1.1)
9 months	31 (10.0)	4 (1.5)
12 months*	179 (57.8)	257 (95.2)
18 months	77 (24.8)	6 (2.2)
Which of the following drugs is known to cause generalized pigmentation of skin?		
Rifampicin	35 (11.3)	12 (4.5)
Dapsone	125 (40.3)	34 (12.6)
Clofazimine*	139 (44.8)	222 (82.2)
Isoniazid	11 (3.6)	2 (0.7)
Case study 1		
A 50-year-old man diagnosed with borderline leprosy, treatment was started 1 month ago. The existing plaques and patches on his trunk and arms became more erythematous and indurated in the last 4 days. How will you manage the patient before referring to a dermatologist?		
Stop his leprosy treatment immediately	37 (11.9)	20 (7.4)
Ensure the patient continues his leprosy treatment*	88 (28.4)	175 (64.8)
Arrange for an urgent slit skin smear	42 (13.6)	13 (4.8)
Perform full blood count, renal profile and liver function test	143 (46.1)	62(23.0)

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Table II: Responses to knowledge and attitude questions

Knowledge item	Pre-video lecture, n = 310 n (%)	Post-video lecture, n = 270 n (%)
Case study 2		
A 35-year-old woman with lepromatous leprosy completed her treatment 1 year ago. She complained of painful nodules over arms and legs of 2 weeks duration. Examination showed multiple, scattered, tender, erythematous subcutaneous nodules. What is your next step in management before referring to a dermatologist?		
Restart leprosy treatment	21 (6.8)	6 (2.2)
Perform a slit skin smear	139 (44.8)	51 (18.9)
Start prednisolone	81 (26.1)	104 (38.5)
Symptomatic treatment *	69 (22.3)	109 (40.4)
Leprosy patients need to be isolated from community during the treatment period.		
Strongly disagree	41 (13.2)	45 (16.7)
Disagree	88 (28.4)	76 (28.1)
Neutral	64 (20.6)	45 (16.7)
Agree	87 (28.1)	78 (28.9)
Strongly agree	30 (9.7)	26 (9.6)
If someone in your family has leprosy, you would never disclose it to anyone.		
Strongly disagree	58 (18.7)	66 (24.4)
Disagree	87 (28.1)	81 (30.0)
Neutral	109 (35.2)	78 (28.9)
Agree	46 (14.8)	32 (11.9)
Strongly agree	10 (3.2)	13 (4.8)
Leprosy patients should not take part in any social activities.		
Strongly disagree	82 (26.4)	81 (30.0)
Disagree	138 (44.5)	112 (41.5)
Neutral	61 (19.7)	37 (13.7)
Agree	25 (8.1)	29 (10.7)
Strongly agree	4 (1.3)	11 (4.1)
You will avoid working with a colleague with leprosy.		
Strongly disagree	81 (26.1)	89 (33.0)
Disagree	147 (47.4)	94 (34.8)
Neutral	57 (18.4)	58 (21.5)
Agree	19 (6.1)	20 (7.4)
Strongly agree	6 (2.0)	9 (3.3)

*Correct answer(s)

better attitude (Table I). Working in the tertiary care hospitals was an independent predictor of good attitude (OR = 2.19, 95% CI = 1.22–3.94, $p = 0.025$).

Pre and post-intervention

There was a significant increase in proportion of participants with good knowledge post-video lecture (87.0 vs 20.6, $p < 0.001$) (Table IV). However, there was no significant change of attitude post-intervention.

DISCUSSION

Only one-fifth of our study participants had good knowledge of leprosy. This finding is consistent with previous studies.⁸⁻¹⁰ In Ethiopia, 519 (86.3%) healthcare workers had poor knowledge of the signs and symptoms of leprosy, leprosy reactions and management.⁸ Similarly, a study in South Africa revealed general lack of basic knowledge of leprosy among the primary care doctors.⁹ Furthermore, poor knowledge was reported among 50% of the doctors in working in the dermatology field in China.¹¹

Our study participants had limited experience with leprosy patients (came across, diagnosed or managed < 5 cases of leprosy). In Italy, only 11 (10.8%) of the doctors had interaction with a leprosy case, and only 6.9% had diagnosed leprosy before and none had managed a leprosy patient.¹² In Southern Malawi, 13 (37%) healthcare workers had never seen a leprosy patient and 29 (83%) had never diagnosed leprosy before.¹³ Among doctors working in dermatology field in China, 20% of them had never seen a leprosy patient and 41% had never diagnosed leprosy.¹¹ Lack of experience of doctors in leprosy could be due to the lack of exposure to leprosy cases in non-endemic areas.

Diagnosing leprosy is challenging as it can mimic any skin condition.¹⁴ In Malaysia, a case series of 27 leprosy patients reported that there were missed diagnoses by primary care doctors in 12 patients (44.4%).¹⁵ Previous experience with leprosy patients was an important predictor of better knowledge in our study and previous studies.^{8,10} Abeje et al reported that good knowledge was associated with training and exposure to leprosy.⁸ In Italy, higher knowledge score was reported among doctors who had diagnosed or interacted

Table III: Factors associated with good knowledge

	Good knowledge (univariate)				Good knowledge (multivariate)			
	Crude odds ratio (OR)	95% confidence interval of OR		p-value ^a	Adjusted odds ratio (OR)	95% confidence interval of OR		p-value ^a
		Lower value	Upper value			Lower value	Upper value	
Age group (years)								
< 30	1.00	1.03	4.69	0.043				
≥ 30	2.20							
Level of care								
Primary care	4.02	1.70	9.50	0.006				
Tertiary	2.79	1.21	6.41	0.001^b				
Secondary	1.00			0.016^b				
Position				<0.001				<0.001
Medical officer	1.00				1.00			
Specialist	4.21	2.14	8.27		4.55	2.17	9.57	
Years in service				0.052				
< 5	1.00							
≥ 5	1.73	1.00	3.12					
Number of leprosy cases came across				<0.001				
< 5	1.00							
≥ 5	3.74	2.01	6.97					
Number of leprosy cases diagnosed				0.017				
< 5	1.00							
≥ 5	5.13	1.34	19.68					
Number of leprosy patients managed				<0.001				0.003
< 5	1.00				1.00			
≥ 5	4.96	2.40	10.25		3.37	1.52	7.47	
Received teaching on leprosy during undergraduate				0.153				
No	1.00							
Yes	1.93	0.78	4.78					
Last time involved in any educational activities related to leprosy				<0.001				<0.001
Never	1.00				1.00			
More than a year	1.46	0.64	3.33	0.364 ^b	1.02	0.43	2.42	0.963 ^b
Within last year	5.68	2.14	15.04	<0.001^b	4.70	1.69	13.04	0.003 ^b

^a Likelihood Ratio (LR) test ^b Wald test

The model has no interaction terms, no multicollinearity problem and no outliers.

Hosmer-Lemeshow goodness-of-fit test for both models was not significant.

Eighty one percent cases are predicted correctly whether they have good knowledge and AUC of ROC is 72.9% (acceptable discrimination).

* No factors associated with good attitude generated from multiple logistic regression

Table IV: Pre and post-intervention knowledge and attitude

Knowledge and attitude	Pre-intervention, n = 310 n (%)	Post-intervention, n = 270 ^a n (%)	p-value ^b
Knowledge			<0.001
Good	64 (20.6)	235 (87.0)	
Average	216 (69.7)	35 (13.0)	
Poor	30 (9.7)	0	
Attitude			0.044
Good	113 (36.5)	114 (42.2)	
Poor	197 (63.5)	156 (57.8)	

^a Response rate for post-intervention is 87.1%

^b McNemar's test (knowledge regroup to two groups - good knowledge vs average to poor)

with leprosy patients.¹² Our participants who were specialists and with longer working experience had better knowledge. This is likely due to specialists having more experience managing leprosy patients (managed ≥ 5 leprosy patients). Primary care doctors with limited experience reported having less confidence in diagnosis and management of leprosy.⁴ Our cohort working in primary care clinic or tertiary hospital had better knowledge compared to those working in secondary care (district hospitals). This is likely due to the primary care and tertiary care doctors having more exposure to leprosy patients (came across ≥ 5 leprosy patients). The majority of our cohort working in tertiary hospital were from the medical department. It is possible that they were well-read on leprosy as a subject in internal medicine.

The majority of our cohort did not receive undergraduate teaching on leprosy. In India, only 40% of medical students were aware of the cardinal signs of leprosy.¹⁶ Furthermore, our study found no association between undergraduate teaching in leprosy and good knowledge and positive attitude. Among medical students in Nigeria, despite having lectures on leprosy, only 24.7% of them had good knowledge of leprosy.¹⁰ A study in India revealed medical interns had better knowledge and attitude compared to final year medical student.¹⁶ A 1-day training program among Indian medical students significantly improved their knowledge and attitude towards leprosy.¹⁷ This emphasises that over and above teaching medical students about leprosy, exposure to leprosy cases and training are imperative to improve knowledge and attitude.

Recent access to educational source on leprosy was an independent predictor of good knowledge of leprosy. A study in Hyderabad revealed that the government doctors had better knowledge than private practice doctors possibly due to continuing medical education programmes.¹⁸ Private doctors in Mumbai were reported to have inadequate knowledge likely due to lack of continuing education on leprosy.¹⁹

Only 25.8% of healthcare workers in Ethiopia had positive attitude towards leprosy patients.⁸ Negative attitude was also reported among doctors working in dermatology field in China.¹¹ In a Sri Lankan study, 34.3% of healthcare providers were scared of leprosy and 22.5% of healthcare providers thought that leprosy patients need to be isolated from others.²⁰ Similar to our findings, misconceptions were reported among the healthcare workers in Guyana, where half of them believed leprosy was transmitted through touch and half were afraid of this disease.²¹ Ekeke et al reported that good knowledge of leprosy was associated with positive attitude.¹⁰ Likewise, a study in Nigeria found that good knowledge correlate with favourable attitude towards leprosy.²²

There was a significant improvement in participants' knowledge of leprosy post-video lecture intervention. Consistent with our findings, interns in Nigeria who attended clinical demonstration on leprosy had better knowledge.¹⁰ A study of healthcare providers in Bangladesh demonstrated an increase in knowledge after leprosy training.²³ Similarly, there was improvement in knowledge and confidence level among family medicine physicians in Malaysia after a 3-day lecture and hands-on training course.⁴ Doctors working in

dermatology field in China demonstrated improvement in knowledge and attitude after a lecture and training workshop.¹¹ On the contrary, our study found no significant improvement in doctors' attitude post-video lecture intervention. This may be because attitude change takes time. Annually, the Sabah health department organises a one-day physical course with lectures on leprosy for the doctors and medical assistants working in government clinics and hospitals. Despite that, only a small proportion of the doctors in our study had good knowledge and attitude. This is probably because of the nature of physical course that only allows limited numbers of participants each time.

As our study was conducted during the covid pandemic, online video lecture on leprosy was done as an intervention to improve knowledge of leprosy. Post-test questionnaire was done immediately post-video lecture and we were not able to assess long term improvement in knowledge and attitude. We recommend regular video lecture training conducted by the dermatologists for the medical officers and specialists from all levels of care for exposure and revision to improve knowledge of leprosy. Teledermatology consultation is cost effective, time efficient, and will be helpful to increase knowledge among the doctors and thus optimise patients' care. Future studies to assess the impact of hands-on training workshop involving leprosy patients on knowledge and attitude towards leprosy will be valuable.

CONCLUSION

The proportion of medical doctors in Sabah and Labuan with good knowledge and good attitude towards leprosy was low. Position as a specialist, experience with leprosy patients and recent education in leprosy were associated with good knowledge and attitude. Knowledge of leprosy improved significantly post-intervention. This highlights the need for educational and training programmes to improve doctors' knowledge of leprosy.

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