



Vacunas

www.elsevier.es/vac



Original

Effect of a medical curriculum about the knowledge about immunization against tuberculosis in Jalisco, Mexico

Q1 Carlos Enrique Cabrera-Pivaral^{a,b,*}, Diego Ramos-Peña^a, David López-de-la-Mora^a, Ana Cecilia Méndez-Magaña^b, Marco Antonio Zavala-González^c

^a Health Sciences' School, Universidad Guadalajara LAMAR, Vallarta's Campus, Guadalajara, Jalisco, México

^b Public Health Department, Division of Disciplines for Develop, Promotion and Preservation of Health, Centro Universitario de Ciencias de la Salud, Universidad de Guadalajara, Guadalajara, Jalisco, México

^c Sciences of Population's Health Department, Division of Health Sciences, Centro Universitario de Tonalá, Universidad de Guadalajara, Tonalá, Jalisco, México

ARTICLE INFO

Article history:

Received 15 November 2019

Accepted 5 September 2020

Available online xxx

Keywords:

(MeSH

US-NLM)

Tuberculosis

BCG vaccine

Knowledge

Educational measurement

Non-randomized controlled trials as

topic

ABSTRACT

Introduction: Tuberculosis is a principal mortality causes in world, and vaccination with BCG is a key for your prevention.

Objective: To evaluate the effect of studies plan from Medicine Bachelor's Degree of Universidad Guadalajara LAMAR about the knowledge about immunization against tuberculosis.

Material and methods: Quasi-experimental study type pre-experimental of comparison with a static group. Emplacement: Vallarta's Campus. Temporality: January-May 2018. Universe: 267 students. Sample: Non-randomized, n = 230 students, 94 from 1st semester (G1, intervention moment "A"), 106 from 4th semester (G2, intervention moment "B") and 30 from 7th semester (G3, intervention moment "C") from Medicine Bachelor's Degree, more 37 students from 1st semester from Bachelor's Degree not related with health sciences (G0, control). Sampling: Propositive. Selection criteria: Any age and gender and answer the instrument. Variables: Age, gender and knowledge about management of immunization against tuberculosis. Instrument: Written test collegiate. Analysis: Comparison by mean of statistics non-parametric ($p \leq 0,05$).

Results: Levels "high" and "very high" of knowledges: G0 0%, G1 0%, G2 32% and G3 37% (χ^2 , $p < 0,05$). Levels "poor" and "none" of knowledges: G0 100%, G1 89%, G2 58% y G3 63% (χ^2 , $p < 0,05$). The knowledge level was higher to be expose to studies plan and increase your exposition time (χ^2 $p < 0,05$ in all cases).

Conclusion: The studies plan showed develops high knowledges about management of immunization against tuberculosis. There is a significant gap in this knowledge that does not vary substantially in advanced semesters.

© 2020 Elsevier España, S.L.U. All rights reserved.

* Corresponding author.

E-mail address: carlos_cabrera@prodigy.net.mx (C.E. Cabrera-Pivaral).

<https://doi.org/10.1016/j.vacun.2020.09.002>

1576-9887/© 2020 Elsevier España, S.L.U. All rights reserved.

Efecto de un plan de estudios de medicina sobre el conocimiento del manejo de la inmunización contra la tuberculosis en Jalisco, México

R E S U M E N

Palabras clave:
(DeCS
BIREME)
Tuberculosis
Vacuna BCG
Conocimiento
Evaluación educacional
Estudios cuasi experimentales

Introducción: La tuberculosis es una de las principales causas de mortalidad en el mundo, y la vacunación con BCG es una de las claves para su prevención.
Objetivo: Evaluar el efecto del plan de estudios de la Licenciatura en Medicina de la Universidad LAMAR de Guadalajara sobre el conocimiento del manejo de la inmunización contra la tuberculosis.
Material y métodos: Estudio cuasiexperimental tipo preexperimental de comparación con grupo estático. Emplazamiento: Campus Vallarta. Temporalidad: enero-mayo de 2018. Universo: 267 estudiantes. Muestra: no probabilística, n=230 estudiantes, 94 de 1er. semestre (G1, intervención momento «A»), 106 de 4.º semestre (G2, intervención momento «B») y 30 de 7.º semestre (G3, intervención momento «C») de Medicina, más 37 estudiantes de 1er. semestre de licenciatura no relacionada con salud (G0, control). Muestreo: propositivo. Criterios de selección: cualquier edad y sexo, y responder instrumento. Variables: edad, sexo y conocimiento del manejo de la inmunización contra la tuberculosis. Instrumento: examen escrito colegiado. Análisis: estadística no paramétrica ($p \leq 0,05$).
Resultados: Niveles «alto» y «muy alto»: G0 0%, G1 0%, G2 32% y G3 37% ($\chi^2 p < 0,05$). Niveles «pobre» y «ninguno»: G0 100%, G1 89%, G2 58% y G3 63% ($\chi^2 p < 0,05$). El nivel de conocimiento fue mayor al exponerse al plan de estudios, y aumentó a mayor exposición ($\chi^2 p < 0,05$).
Conclusión: El plan de estudios demostró desarrollar conocimientos elevados sobre el manejo de la inmunización contra la tuberculosis. Existe un vacío importante en estos conocimientos que no varía sustancialmente en semestres avanzados.

© 2020 Elsevier España, S.L.U. Todos los derechos reservados.

Introduction

Tuberculosis is a principal mortality causes in world considering that accord to World Health Organization (WHO), in 2018 occurred 1 451 000 deaths for this cause, 1 200 000 in HIV-negative persons and 251 000 in HIV-positive persons from a total of 10 000 000 persons diseased for tuberculosis that represent only 5 to 10% of persons' total infected for *Mycobacterium tuberculosis* that manifest this disease during your life.¹

Considering these ciphers tuberculosis is a public health problem relevant whose control is based on three pillars: 1) Cares, prevention and treatment focused in the patients, 2) Reinforcement of social and sanitary capacity for prevent the infection, and 3) Intensification of research.^{1,2} In this sense, accord to 2018 WHO's positioning about it, BCG vaccination of infants, at birth or as soon as possible after birth, is one of key components of Pillar 1 of the "Strategy for the End of Tuberculosis for the 2030" well it has been estimated that 90% or higher global coverage and widespread use of BCG vaccine in infant vaccination programs could prevent over 115 000 deaths by tuberculosis per birth cohort in the first fifteen years of life, and also there is evidence that this vaccine along with chemoprophylaxis with rifampicin can each provide a degree of primary prevention against leprosy, and exist limited data suggest that offers some protection against Buruli's ulcer and other non-tuberculosis mycobacterial infections.²

For this reason, in Mexico the BCG vaccine is part of national vaccination Scheme³ and have a documented coverage of 93.9% in children minor than one year-old.⁴

And for this reason, the knowledge about management of immunization against tuberculosis must be elevated among physicians and others health professionals, since the knowledge are the base that a professional need for perform your tasks effectively, so these are situated in the base of professional competence pyramid.⁵

In this order of ideas, during the last two decades it has been realized diverse studies for evaluate transversely the knowledge about tuberculosis in general and immunization against this disease in particular, in Bachelor's Degree students from diverse health sciences, especially in Latin-América and chiefly in nursing, which are shown poor knowledge about this theme in the diverse contexts where were explored, concluding that, among other things is necessary review the curricular contents about this in studies plans and programs from the different Bachelor's Degrees programs related with health, as well as the shape in which these are taught and developed these contents in the classrooms during the course of Bachelor's Degrees studies plans and programs.⁶⁻¹⁴

So that, among different publications available about knowledges of Bachelor's Degree students of diverse health sciences about tuberculosis in general, four points stand out, first, that the vast majority of studies are achieved in nursing students, second, that rarely emphasis is place in knowledge about prevention of this disease in general and the immunization against this in particular, third, that this theme has not been explored in Mexico, and fourth, that has not been evaluated how this knowledge evolve in the students during your course by the studies plans of your Bachelor's Degrees.⁶⁻¹⁴

In this context, we made this research with aim of evaluate the effect of studies plan from Medicine Bachelor's Degree of Universidad Guadalajara LAMAR on the knowledge about immunization against tuberculosis, with the pretention to know the knowledge level about this theme in your students in different stages during the develop of program, set a precedent documented about this in medical students from Mexico, and identify possible opportunity areas for improvement the studies plan about this by mean of qualitative and quantitative indicators of knowledges about this theme.

Material and methods

Design, emplacement and study period

We made a quasi-experimental study type pre-experimental of comparison with a static group, accord to Campbell & Stanley's classification,¹⁵ in the Vallarta's Campus of Universidad Guadalajara LAMAR from Jalisco, Mexico, during the scholar cycle 2018-A.

Universe, sample and sampling

The study's universe was 267 medical students,¹⁶ and from this we took a non-randomized sample of 230, 94 from first semester, 106 from fourth semester and 30 from seventh semester, more an additional group of 37 students from first semester of a Bachelor's Degree not related with health sciences area.

The participants' sampling was propositive, that is to say, with base in criteria defined by researchers for the impossibility to obtain a randomized sample, ensuring that relevant groups are represented.¹⁵ So, the four groups where selected with base in the number of students registered in each one, your exposition level to studies plan of Medicine Bachelor's Degree or other studies plans with content related to acquisition and development of knowledges about management of immunization against tuberculosis, and your regular presence inside the university campus, so that we selected the groups with higher number of students registered to the study moment, that received presential lessons in university campus by not performing practices or professional stays, and with null, poor, medium or high exposition, respectively, to studies plan.

We included students of any age and gender, regulars or irregulars, with valid enrollment at the evaluation moment, inscribed in the selected groups, and that were presented in the site, to the date and hour indicated for to be examined, likewise, who don't attend the appointment not had opportunity to be evaluated later and was excluded of study, and finally, accord to study's design applied¹⁵ we don't formulated elimination criteria.

Variables and measurement instruments

We collected information about age and gender of participants along with your precedence group for define the sample's characteristics, and we measured your knowledge about management of immunization against tuberculosis.

The knowledge was evaluated by mean of a written test made in a collegial way by all professors in charge of the subject-matters related with the theme inside the studies plan of Medicine Bachelor's Degree. This consist of 100 items with answers type "true", "false" or "I don't know", with values of 1 for each correct answer and 0 for each incorrect, "I don't know" or null answer, adding a maximum theoretical value of 100 points. The results of this instrument allowed situate to students in one of five knowledge levels: "none" or "defined by chance" ≤ 20 , "poor" 21-40, "medium" 41-60, "high" 61-80 and "very high" ≥ 81 points; whose class intervals were defined by mean of formula from Perez-Padilla & Viniegra-Velazquez to identify answers expected by chance and define strata in tests type "false, true, I don't know".¹⁷ The reliability of this instrument was determined by mean of Kuder-Richardson test obtaining a reliability coefficient of 93% (KR = 0,93).

Intervention's description

Accord to prescriptions of a pre-experimental design of comparison with a static group from Campbell & Stanley,¹⁵ the studies plan of Medicine Bachelor's Degree (Table 1) was considered the intervention whose effect was analyzed, so the students exposed to it were defined as groups of intervention related chronologically, so the students of first semester were appointed as Group 1 (G1) and received the intervention during the moment "A", of fourth semester were appointed as Group 2 (G2) and received the intervention during the moment "B", and of seventh semester were appointed as Group 3 (G3) and received de intervention during the moment "C", while the students of first semester of Bachelor's Degree not related with health sciences were appointed as control group (G0).

We selected as control group to students of a Bachelor's Degree not related with health sciences because inside this area is share curricular contents that could endow them of knowledges about the management of immunization against tuberculosis, so that compare students inside the same science area might not make evident the effect of your studies plans and programs about knowledges and competencies about similar themes.

The studies plan that we considered the intervention consists of 67 subject-matters that cover 441 credits distributed in 8 scholar cycles that encompass 4 588 class hours, of which 10 subject-matters have curricular contents related with immunization against tuberculosis (Table 2) and cover 61 credits that are intended 704 class hours.¹⁸ In this sense, the students of first semester (G1) had not taken subject-matters with curricular contents related with the theme, of fourth semester (G2) had taken the subject-matters "Occupational health", "Microbiology I" and "Child and adolescent health", and of seventh semester (G3) had taken the subject-matters "Health in the community II", "Infectology clinic", "Pneumology clinic", "Pediatrics of the newborn and the infant", "Preschool and school pediatrics" and "Health in the community IV".¹⁸ These subject-matters were taught by professionals specialized in the different disciplines using the participative method and incorporating thought-action process accord to institutional norms from university, considering to students as critics and creatives subjects, and encouraging in every moment the dia-

Table 1 – Studies plan of Medicine Bachelor’s Degree from Universidad Guadalajara LAMAR.				
Semester	Subject-matters	Training area	Total hours	Credits
First	Communication and information technologies	BCO	32	3
	Investigation methodology	BCO	64	7
	Public health	BCO	64	7
	Human anatomy and dissections	BPO	170	17
	Medical biochemistry	BPO	170	18
	Embryology	BPO	68	7
	Histology	BPO	102	10
Second	Bioethics and University	BCO	64	7
	Psychology	BCO	64	7
	Human sexuality	BCO	48	5
	Society and health	BCO	48	4
	Inferential biostatistics	BPO	68	6
	Basic molecular biology	BPO	68	7
	Medical physiology	BPO	170	20
Third	Occupational health	BPO	34	3
	Public health II	BPO	68	6
	Epidemiology	BPO	64	6
	Medical pathophysiology	BPO	136	15
	Medical genetics	BPO	100	10
	Medical genetics	BPO	68	7
	Microbiology I	BPO	102	11
Fourth	Pathology	BPO	136	15
	Environmental health	BPO	40	3
	Health economics	BPO	34	3
	Medical pharmacology	BPO	68	9
	Legislation and health	BPO	34	3
	Evidence based medicine	BPO	34	3
	Microbiology II	BPO	68	7
Fifth	Nutrition and society	BPO	34	3
	Promotion of healthy lifestyles	BPO	32	3
	Propaedeutic and medical semiology	BPO	204	20
	Child and adolescent health	BPO	68	5
	Health in the community I	BPO	34	2
	Thanatology	OO	34	3
	Cardiology clinic	BPO	68	7
Fifth	Dermatology clinic	BPO	34	3
	Gerontogeriatrics clinic	BPO	34	3
	Ophthalmology clinic	BPO	34	3
	Otolaryngology clinic	BPO	34	3
	Urology clinic	BPO	34	3
	Medical clinic	BPO	170	18
	Surgical clinic	BPO	170	18
Sixth	Health in the community II	BPO	34	2
	Basic-clinical integration seminar	BPO	34	2
	Prevention and family diagnosis	SP	34	3
	Family health	SP	34	3
	Alternative medicine	OO	34	3
	Coloproctology Clinic	BPO	34	3
	Infectology clinic	BPO	34	3
Seventh	Nephrology and cardiovascular risk clinic	BPO	68	6
	Pneumology clinic	BPO	34	3
	Psychiatry clinic	BPO	68	7
	Chest and cardiovascular clinic	BPO	34	3
	Clinical research	BPO	34	3
	Health in the community III	BPO	34	2
	Surgical techniques	BPO	68	6
Seventh	Pharmacological therapeutics	BPO	102	11
	Molecular biology in the clinic	BPO	34	3
	Oncology clinic	BPO	34	3
	Sex medicine	BPO	34	3
	Pediatrics of the newborn and the infant	BPO	102	10
	Preschool and school pediatrics	BPO	102	10
	Health in the community IV	BPO	34	2

– Table 1 (Continued)				
Semester	Subject-matters	Training area	Total hours	Credits
Eighth	Gynecology and obstetrics clinic	BPO	170	12
	Pediatric clinic	BPO	160	12
	Forensic medicine	BPO	34	3
	Medical emergency	BPO	34	3
Total	67 subject-matters		4 588	441
BCO = Baric common obligatory. BPO = Basic particular obligatory. OO = Open optative. SP = Specializer. Source: Web of Universidad Guadalajara LAMAR, available on https://bit.ly/384hsdR .				

Table 2 – Curricular contents related with immunization against tuberculosis inside of Studies plan of Medicine Bachelor’s Degree from Universidad Guadalajara LAMAR.				
Semester	Subject-matters	Total hours	Credits	Curricular contents related with immunization against tuberculosis
Second	Occupational health	34	3	Tuberculosis as occupational disease
Third	Microbiology I	102	11	Bacteria of medical importance: <i>Mycobacterium tuberculosis</i> , <i>leprae</i> , <i>avium</i> . General characteristics, virulence mechanisms, pathogeny, epidemiology, diagnosis, treatment and prevention
Fourth	Child and adolescent health	68	5	Characteristics and special cares of newborn to term: Immunizations Characteristics and special cares of infant: Immunizations
Fifth	Health in the community II	34	2	Functioning and performance of priority programs: Vaccination
Sixth	Infectology clinic	34	3	Specific infectious syndromes: Tuberculosis and other micobacteriosis
Seventh	Pulmonology clinic	34	3	Infectious lung disease: Pulmonary tuberculosis
	Pediatrics of the newborn and the infant	102	10	Infant: Immunizations, national vaccination scheme and vaccines not-included in the national scheme
	Preschool and school pediatrics	102	10	Most frequents infectious pathologies: Pulmonary tuberculosis, rheumatic fever, post-streptococcal glomerulonephritis
Octavo	Health in the community IV	34	2	Functioning and performance of priority programs: vaccination
	Pediatric clinic	160	12	Immunizations Healthy child evaluation Newborn pathologies Infant pathologies
Total	10 subject-matters	704	61	14 curricular contents
Source: Programs of subject-matters of Studies plan of Medicine Bachelor’s Degree from Universidad Guadalajara LAMAR.				

logue and ideas exchange among peers, as well as the planning and organization of own learning.

Procedures and analysis

The knowledge about management of immunization against tuberculosis was evaluated to the term of scholar cycle 2018-A after that students concluded the corresponding courses. For this, the students were cited collectively to be evaluated in a class-room designated for this purpose where the anonymous evaluation lasted 1 hour maximum.

The data obtained were analyzed using descriptive statistic to characterize the groups, and the knowledges were compared among these quantitatively and qualitatively, using Ji to

square (χ^2) to compare the proportions of the different knowledge levels among groups, and Kruskal-Wallis test to compare the medians of knowledge among these, both test were made with 95% of confidence ($p \leq 0,05$) using the Epidat© 3.1 software.

Ethical considerations

The study was classified as “research without risk for participants” accord to Mexican legislation valid to the moment of your accomplishment,¹⁹ because we used documentary research methods and techniques and don’t made intentional interventions about physiological, psychological or social variables from students, neither we identified or treated sensitive

Table 3 – Demographic characteristics of participants.

Demographic characteristics	G0 (N = 37)	G1 (N = 94)	G2 (N = 106)	G3 (N = 30)	p-Value*
Age in years					
≤ 18	14 (39%)	49 (52%)	47 (44%)	0 (0%)	< 0,05
> 18	23 (61%)	45 (48%)	59 (56%)	30 (100%)	
Gender					
Female	23 (61%)	53 (56%)	59 (56%)	16 (54%)	< 0,05
Male	14 (39%)	41 (44%)	47 (44%)	14 (46%)	

* Accord to χ^2 test. Source: Made by the authors.

Table 4 – Knowledges levels about management of immunization against tuberculosis.

Knowledges levels (score interval)	G0 (N = 37)	G1 (N = 94)	G2 (N = 106)	G3 (N = 30)	p-Value*
None/defined by chance (0 – 20)	30 (78%)	72 (76%)	53 (50%)	17 (57%)	< 0,05
Poor knowledge (21 – 40)	7 (22%)	12 (13%)	9 (8%)	2 (6%)	
Medium knowledge (41 – 60)	0 (0%)	10 (11%)	11 (10%)	0 (0%)	
High knowledge (61 – 80)	0 (0%)	0 (0%)	33 (32%)	11 (37%)	
Very high knowledge (81 – 100)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	

* Accord to χ^2 test. Source: Made by the authors.

Table 5 – Knowledges medians and intervals about management of immunization against tuberculosis.

Knowledges	G0 (N = 37)	G1 (N = 94)	G2 (N = 106)	G3 (N = 30)	Valor de p*
Median(interval, rank)	14 (8 – 32, 24)	17 (13 – 45, 32)	37 (16 – 61, 45)	29 (6 – 66, 60)	< 0,05

* Accord to Kruskal-Wallis test. Source: Made by the authors.

aspects of your conduct that could make them targets of discrimination, so the protocol was approved by the Ethical and Research Committee of the Universidad Guadalajara LAMAR, who gave you the registration number 02-09-2018-LAMAR.

Results

We studied 230 students, 37 in group G0, 94 in G1, 106 in G2 and 30 in G3, without exclusions respect to expected number. In the Table 3 we exposed demographic characteristics of students and your distribution by group, where is observed that the majority were majors than 18 years-old ($p < 0,05$), and of female gender ($p < 0,05$).

In the Table 4 we shown the knowledge levels about management of immunization against tuberculosis by group, where is observe that the levels “none/defined by chance” and “poor” decreased as the studies plan progresses, at the same time that the level “high” increased as progress is made in it, and that the differences among the frequencies of different knowledge levels where significant statistically among the

groups ($p < 0,05$). However, the levels “poor” and “none/defined by chance” occur in more than 50% of students, even in advanced semesters of the studies plan under assessment.

Finally, in the Table 5 we presented the medians of knowledges about the management of immunization against tuberculosis by group, where is observed that the medians increased progressively at same time that the rank of these increased your amplitude as the studies plan progresses in a statistically significant way ($p < 0,05$).

Discussion

This is the first study known by the authors in which it is examined the effect of a studies plan of a Medicine Bachelor’s Degree about the knowledges of your students about the management of immunization against tuberculosis. In this sense, the results showed that, in absence of any training about theme (G0) the persons lack of this knowledges, while as it progresses in the studies plan and increase the exposition time to professional training in the subject-matter (G1, G2 y

G3), this knowledge increase gradually and significantly in a significant number of students, but also, it becomes present and increases gradually a gap in this knowledges, persisting an important number of students (half or more) that shown poor or null knowledge about the theme, that seem not variate substantially in advanced semesters (G2 y G3). In this order of ideas, given the impossibility of gathering students from the last semesters and recent graduates, don't was possible determinate the knowledge level of this at the moment of consider covered the contents of the studies plan, however, given the observed trend, is plausible to assume that the number of students with poor or null knowledges remain stable.

Notwithstanding the foregoing regarding the lack of researches about the effect of studies plans of Medicine Bachelor's Degree about the knowledges about immunization against tuberculosis, within due proportions, the results obtained as for the effect of the Medicine Bachelor's Degree from the Universidad Guadalajara LAMAR about knowledges about the management of immunization against tuberculosis, coincide with the observed previously by the work group in relation to the effect of the same studies plan about the competency for health promotion and social participation,²⁰ being that in both cases this showed a positive effect in the professional training of your students.

By other side, as to knowledges level about the management of immunization against tuberculosis we don't find direct referents about theme among researches that integrated the referential frame of this study,⁶⁻¹⁴ since this is usually treated secondarily as part of knowledges about tuberculosis prevention that integrate other actions further of vaccination, so the approach closest to the present is the report from Ponce-Huache about the knowledge of nursing students about post-vaccinal reactions,¹² among those listed the BCGitis and disseminated infections as adverse effects to vaccination with BCG. However, within due proportion, the preexisting studies⁶⁻¹⁴ and this coincide in that about half of medicine and others health sciences students of Bachelor's Degree level in the world demonstrate poor knowledges about themes related with tuberculosis, what it shows a global problem in the teaching-learning process about curricular contents related with this important disease, that in opinion of the researchers seem to go beyond the design of curricula, and could have origin in the teaching techniques used during your implementation, the students' attitudes toward curricular contents, the motivations of students and teachers during the performance of their roles, and the selection of applicants to take the Medicine Bachelor's Degree programs, among other educative and administrative process whose influence and effects about the training of future Physicians must be investigated later through the appropriate methods.

Conclusions

So finally in answer to the objective of this research we can conclude that study the studies plan of Medicine Bachelor's Degree from Universidad Guadalajara LAMAR provides and increase in your students knowledges about the management of immunization against tuberculosis, but the majority remain in ignorance respect to theme during the course of this, what

reveals a severe problem that require research-action since that only research of this could see your contributions exceeded by the persistence of the problem.

Study's emplacement

Universidad Guadalajara LAMAR, Vallarta's Campus. Guadalajara, Jalisco, México.

Funding

This research was achieved with resources from your authors.

Declaration of conflict of interest

CECP, DRP, and DLM perform academic functions in the higher education institution to which they belong the medical curriculum and students studied.

Acknowledgments

The authors thanks to Jennifer Aylin Espinoza-González, Mayra Guadalupe Ayala-González, Diana Valeria Bustos-Martínez, and Verónica Denise de-Alba-Hernández, students of the Medicine Bachelor's Degree in the "Dolphin" Program from Universidad Guadalajara LAMAR, by your valuable contribution in the data harvest. Likewise, we thanks to anonymous reviewers assigned to this document by your valuable contributions for improve the quality of research report for achieve your publication.

Appendix A. Supplementary data

Supplementary data associated with this article can be found, in the online version, at [doi:10.1016/j.vacun.2020.09.002](https://doi.org/10.1016/j.vacun.2020.09.002).

REFERENCES

1. Organización Mundial de la Salud. Informe mundial sobre la tuberculosis. Sinopsis 2019. [Internet]. Geneve: Organización Mundial de la Salud, 2019. [Consulted: February 25, 2020]. Available in: <https://bit.ly/32sGdiF>.

2. World Health Organization. BCG vaccines: WHO position paper – February 2018. Weekly Epidemiological Record. [Internet]. 2018;(93):73-96. [Consulted: February 25, 2020]. Available in: <https://bit.ly/387ZRS0>.

3. Secretaría de Salud. Esquema de vacunación. [Internet]. Mexico City: Gobierno de México, 2015. [Consulted: February 25, 2020]. Available in: <https://bit.ly/2w7EJhN>.

4. Díaz-Ortega JL, Cruz-Hervet LP, Ferreira-Guerrero E, Ferreyra-Reyes LD, Delgado-Sánchez G, García-García ML. Cobertura de vacunación y proporción de esquema de incompleto en niños menores de siete años en México. Salud Publica Mex. [Internet]. 2018;60:338–46 [Consulted: February 25, 2020]. Available in: <https://bit.ly/2TmrTnK>.

5. Miller GE. The assessment of clinical skills/competence/performance. Acad Med. [Internet].

- 1990;65(Sup9):563–7 [Consulted: February 25, 2020]. Available in: <https://bit.ly/2Vt14AP>.
6. Orret FA, Shurland SM. Knowledge and awareness of tuberculosis among pre-university students in Trinidad. *J Community Health*. [Internet]. 2001;26:479–85 [Consulted: February 25, 2020]. Available in: <https://bit.ly/2T2eeDq>.
 7. Jackson M, Harritty S, Hoffman H, Catanzaro A. A survey of health professions students for knowledge, attitudes, and confidence about tuberculosis, 2005. *BMC Public Health*. [Internet]. 2007;219 [Consulted: February 25, 2020]. Available in: <https://bit.ly/32vqLCm>.
 8. Quispe-Huamán YL. Conocimientos sobre reacciones adversas postvacunales de los estudiantes de enfermería de la UNMSM. [Thesis]. Lima: Universidad Nacional Mayor de San Marcos; 2012 [Consulted: February 25, 2020]. Available in: <https://bit.ly/2Tj868I>.
 9. Behnaz F, Mohammadzade G, Mousavi-e-Roknabadi RS, Mohammadzade M. Assessment of knowledge, attitudes and practices regarding tuberculosis among final year students in Yazd, Central Iran. *J Epidemiol Glob Health*. [Internet]. 2014;4:81–5 [Consulted: February 25, 2020]. Available in: <https://bit.ly/32w9ed2>.
 10. Ortega-Barón GL, Rodríguez-Quezada PA, Jiménez-Beltrán EC, Muñoz-Sánchez AI. Conocimientos sobre tuberculosis en estudiantes de enfermería de una universidad colombiana. *Rev Univ Ind Santander Salud*. [Internet]. 2015;47:261–70 [Consulted: February 25, 2020]. Available in: <https://bit.ly/3caKQ5c>.
 11. Wilches-Luna EC, Hernández NL, Hernández OM, Pérez-Vélez CM. Conocimientos, actitudes, prácticas y educación sobre tuberculosis en estudiantes de una facultad de salud. *Rev Salud Publica*. [Internet]. 2016;18:129–41 [Consulted: February 25, 2020]. Available in: <https://bit.ly/2VAII15>.
 12. Ponce-Huache YC. Conocimientos sobre las reacciones postvacunales de los estudiantes de enfermería de la universidad de Huánuco – 2016. [Thesis]. Huanuco: Universidad de Huánuco; 2017 [Consulted: February 25, 2020]. Available in: <https://bit.ly/2vajhbT>.
 13. Rojas-Ribera KN. Conocimientos sobre la tuberculosis, en estudiantes de medicina de la Universidad Nacional de Loja. [Thesis]. Loja: Universidad Nacional de Loja. 2017 [Consulted: February 25, 2020]. Available in: <https://bit.ly/2uwrSVK>.
 14. Rodríguez-Castro AI, Ríos-González CM. Conocimientos, actitudes y prácticas sobre tuberculosis en médicos internos de pregrado de diecisiete países latinoamericanos, 2018. *Rev Hisp Cienc Salud*. [Internet]. 2018;4:159–65 [Consulted: February 25, 2020]. Available in: <https://bit.ly/39eIIra>.
 15. Campbell DT, Stanley JG. Diseños experimentales y cuasiexperimentales en la investigación social. Buenos Aires: Amorrortu Editores. 1966:19–30.
 16. Universidad Guadalajara LAMAR. Informe de actividades 2018. Lic. Luis López Villaseñor. Rector. Guadalajara: Universidad Guadalajara LAMAR, 2019.
 17. Pérez-Padilla JR, Viniegra-Velázquez L. Método para calcular la distribución de las calificaciones esperadas por azar en un examen del tipo falso, verdadero, no sé. *Rev Invest Clin*. 1989;41:375–9.
 18. Universidad Guadalajara LAMAR. Lic. en Medicina. Plan de estudios. [Internet]. Guadalajara: Universidad Guadalajara LAMAR, 2020. [Consulted: February 25, 2020]. Available in: <https://bit.ly/384hsdR>.
 19. Reglamento de la Ley General de Salud en Materia de Investigación para la Salud. [Internet]. Mexico DF: Diario Oficial de la Federación de los Estados Unidos Mexicanos, 1982. [Consulted: February 25, 2020]. Available in: <https://bit.ly/2VrrjI4>.
 20. Cabrera-Pivaral CE, Crócker-Sagástume RC, Carmona-Ruvalcaba J, López-de-la-Mora DA, Sánchez-Toscano YG, Zavala-González MA. Efecto de un plan de estudios de medicina sobre las competencias para la promoción de la salud y la participación social. *Educ Med*. [Internet]. 2019;20(S2):129–35 [Consulted: February 25, 2020]. Available in: <https://bit.ly/2T2wvAk>.