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Development of a Medical Toxicology Curriculum in Spanish with Content Informed by a Population Survey for Medical Trainees in the Dominican Republic

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Abstract

Introduction: The aim of this study is to develop a curriculum based on the American Board of Emergency Medicine (ABEM) core content toxicology category with emphasis on exposures prevalent in the Dominican Republic (DR) as informed by a population survey.

Methods: A survey was designed to identify common toxicological exposures, practices, and perceptions in community members and medical trainees in Santiago, DR. A toxicology curriculum was taught to medical residents using a curriculum made available online through the Global Educational Toxicology Uniting Project (GETUP).

Results: 175 people completed the survey and 34 medical residents completed the course.

The average percent of students/residents and community members reported the following, respectively: frequent substance abuse (12.2%, 44.0%), safe storage practices (21.7%, 13.7%), and traditional remedy use (15.2%, 21.8%). Community members answered 44%, medical students answered 61%, and residents answered 73% of the basic knowledge questions correctly. The mean pretest and posttest scores in the medical residents who took the toxicology course were 61% and 83%, respectively.

Conclusions: The results suggest this population would benefit from education regarding safe-storage practices, the potential dangers of traditional remedy use, as well as education on the sources and effects of common exposures like lead and pesticide poisoning. Many practice high risk behaviors including substance abuse, unsafe remedy use, as well as the use of products that are either illegal or improperly labeled/handled. The long-term goals of this project are to raise awareness and implement expanded toxicology training in this country.

Keywords: Education; Survey; Curriculum; Caribbean; Public health

Introduction

Substance abuse is a leading cause of death and disability in the Dominican Republic (DR), [1] yet there are no formal training in toxicology, no poison centers, and relatively little access to laboratory testing, antidotes, and specialty referral centers. Illicit drug abuse and drug trafficking in the DR is on a steep rise, with an 800% increase in the past two years [2]. Also the DR has a high rate of fatalities from alcohol-related road traffic accidents [3]. In addition to substance abuse certain toxins poste a particular public health threat in this region for a variety of reasons. Dominicans area increased risk for certain toxicological exposures due to insufficient or improperly enforced regulations, lack of public awareness campaigns or expert knowledge, insufficient toxicological training in the medical community, lack of poison control centers, and the popularity of certain traditional remedies or risky behavioral practices.

For example, poisonings from pesticides [4-6], lead [7,8], and camphor [9,10] are particularly common in Dominican communities. One notable example of pesticide poisoning occurred in 2002 when 153 textile workers in the DR were admitted to several hospitals throughout Santiago after paraquat was sprayed on nearby grounds [11]. A notable example for lead poisoning occurred in Haina, DR which according to the United Nations, was considered to have the highest level of lead contamination in the world, a determinant made after results of testing revealed that its entire population carried indications of lead poisoning due to the improper disposal practices of a battery recycling plant that potentially exposed a population of 80,000 [12]. In the DR camphor is used for homeopathic healing purposes as well as spiritual purposes and its potentially toxic effects are not well appreciated by the public [13]. In the US, over-the-counter

products are not allowed to contain more than 11% camphor, while it is common to find pure camphor sold in many Dominican stores [13].

In recognition of the impact of toxicological exposures on the public health of this region a survey and curriculum were designed in order to mitigate this problem. We performed a needs assessment survey to define future educational needs regarding toxicological exposures in this region. The 2nd part of this project was the creation of a toxicology curriculum written in Spanish for medical students and resident physicians. The long-term goal of this project is to raise both public awareness and medical training standards in toxicology, create community outreach programs, and implement more formal training in toxicology in the DR.

Methods

We developed the questionnaire guided by a methodological review of recent literature. It contains 8 sections consisting of 84 items (Table 1). The first section includes demographic data from the participants. The second section consists of substance abuse history and patterns of use. The third section lists a history of previous medical encounters either at a clinic, emergency room (ER), or pharmacy. The fourth section includes a history of traditional home remedies for overdose. The fifth section consists of storage practices of potentially hazardous substances. The sixth, seventh and eighth sections assess fund of knowledge and use of lead, camphor, and pesticide, respectively. Questions were asked using primarily closed-end questions; however open-end questions were also included in each section in order to capture responses not included in the closed-end answer choices. Questions regarding fund of knowledge used a 3-point rating scale, range being "1-Yes", "2-No", "3-Not Sure. Questions regarding history of substance use, history of medical encounters, and storage practices used a 2-point rating scale, with "1-Yes" and "2-No." Questions regarding substance abuse were taken from the Alcohol, Smoking and Substance Involvement Screening Test (ASSIST), which was available also in Spanish by the World Health Organization (WHO) [14]. Questions regarding the use of certain pesticides were adopted from a USAID report list of toxic pesticides [15] and from a list of pesticides banned from the Agricultural Ministry of Dominican Republic [16]. No validated questions regarding the use of traditional home remedies in the Dominican Republic or similar populations were available. The list of traditional home remedies were adopted from previously published cross-sectional survey of patients visiting a general practioner in Europe, however many of the remedies were excluded and others included based on the primary author's discretion [17]. There were no validated survey tools regarding the fund of knowledge regarding camphor, lead, or pesticide exposure so questions pertaining to these subjects were created by the primary author. There was also no validated tool regarding storage practices of potentially hazardous substances that would be relevant for this population so these questions were also created by the primary author.

Survey Section	Topic
1	Demographic data
2	Substance abuse history and patterns of use
3	History of previous medical encounters either at a clinic, emergency room (ER), or pharmacy
4	History of traditional home remedies for overdose
5	Storage practices of potentially hazardous substances
6	Fund of knowledge and use of lead
7	Fund of knowledge and use of camphor
8	Fund of knowledge and use of pesticides

Table 1: Eight survey topics covered in the questionnaire.

Eligible survey respondents were either 1) patients in the waiting room areas of the Emergency Departments (EDs) and clinics of Hospital Juan XXIII and Hospital Regional Universitario José María Cabral y Baez (HRUJMCB), 2) community members participating in a basic responder noncertification training course for lay persons held at Hospital Juan XIII 3) medical students enrolled in Pontificia Universidad Católica Madre y Maestra (PUCMM) 4) family medicine residents at Juan XXIII Hospital or 5) emergency medicine residents at HRUJMCB. PUCMM is a private medical school in Santiago, DR whereas Hospital Juan XXIII and HRUJMCB are both public hospitals in Santiago. Hospital Juan XXIII is considered more of a community hospital, whereas HRUJMCB is a main referral center for patients requiring intensive care, cardiac, head trauma, and orthopedic care. Respondents less than 18 years of age were excluded from participating in the survey. Written consent was obtained in Spanish. Institutional Review Board approval was obtained through both the Icahn School of Medicine at Mount Sinai and through PUCMM in Santiago, DR. None of the participants who completed the basic responder course declined participation in the survey. The lay person basic responder course was taught by the Dominican medical student volunteer who is a medical student at PUCMM and a NYC trained paramedic. None of the basic responder participants had formal medical training or medical certifications. Patients in the waiting rooms were approached by the medical student study volunteer and were asked to participate in a voluntary survey. Patients who declined study participation did so for many reasons. Cited reasons for declining participation included not having sufficient time to fill out the form, or feeling too unwell to fill out the survey. The survey was distributed by the primary author and the medical student volunteer who assisted the survey respondents fill out the forms as needed. For example, participants who either had visual impairments or were illiterate had the survey read out loud and filled out by the medical student volunteer. The survey respondents who were medical students, family medicine residents, or emergency medicine residents were chosen based on convenience (i.e. if they were physically present in the ER or clinic and if they had time to fill out the survey).

A 72-page curriculum was created by the primary author with Spanish translation assistance from Dominican medical students, a Spanish speaking medical toxicologist, and a Spanish language teacher. A written copy of the curriculum was distributed to all students and the course was made available online at http://www.acmt.net/Links.html. The content of the curriculum was based on the toxicology category of the American Board of Emergency Medicine (ABEM) core content [18] as well as the results from the survey described above. The survey was used to identify common exposures, perceptions, and assess the fund of knowledge of community members and medical trainees in Santiago, DR. Informal interviews and an informal literature search were also used to guide curriculum development. The coursework of the curriculum was taught over 15 days (Monday to Friday for 3 weeks) through morning rounds, lectures and PowerPoint presentations at the 2 hospital sites. The lectures and presentations

were the same at both hospital sites. The content covered during morning rounds varied depending on the patients who were physically present in the ERs. Nineteen emergency medicine residents at HRUJMCB and 15 family medicine residents at Hospital Juan XXIII completed the course. All the family medicine and emergency medicine residents from Hospital Juan XXIII and HRUJMCB, respectively, who were physically rotating in the ER during the 15 day study period, completed the course. A pretest and posttest was distributed to all residents who completed the course.

Results

Pre-hoc determination of sample size was determined by using previously published estimates of substance abuse in similar populations. The incidence of daily heavy drinking has been estimated to be 33.9% in Hispanics in a National Institutes of Health (NIH) Study [19]. The incidence of daily alcohol consumption in a study published by the American Medical College Association in 4 U.S medical schools was found to be 8.9% [20]. The minimum sample size was calculated to be 96 (24 group 1, 72 group 2) for a study with a group 1 incidence rate of 33.9% and a group 2 incidence rate of 8.9% with an enrollment ratio of 3:1 (3 community members/lay persons: 1 medical student/resident), alpha of 0.05, and power of 80%. The total sample size in the current study was 175, which met the minimum sample size of 96 to sufficiently power this study. Post-hoc analysis of the study showed that the sample size was adequately powered in medical students/residents and patients/lay persons, respectively for the incidence of frequent substance abuse (12.2%, 44%: calculated post-hoc power 98.8%).

Demographics

175 surveys were completed from 134 community individuals, 22 medical resident physicians, and 19 medical students (Table 2). In the students/residents group the age range was 20-32 (average=25) years; 56.1% were female, 43.9% were male; 54.7% were medical students, 46.3% were residents; 26.8% live in suburban areas, 73.2% in an urban apartment or home, none lived on rural farms or ranches. In the patients/community group the age range was 20-54 (average=37) years; 59.0% were female, 41.0% were male; 32.1% never completed high school, 44.0% were in the process of completing a college or other advanced degree, 23.9% had completed a college or advanced degree (Figure 1); 21.6% live in suburban areas, 47.0% live in an urban apartment or home, 31.4% live in a rural area or ranch.

Survey Item	Students/ Residents (n=41)	Patients/Lay Persons (n=134)
Age	range 20-32 (mean=25 years)	range 20-54 (mean=37years)
Gender	Female 56.1%, Male 43.9%	Female 59.0%, Male 41.0%
Education Level		
Never completed high school	0%	32.10%
High school graduate or college/medical school/ advanced degree in process	54.70%	44.00%
College/medical school/ advanced degree completed	46.30%	23.90%
Residence		
Suburban apartment or home	26.80%	21.60%
Urban apartment or home	73.20%	47.00%
Rural or ranch dwelling	0%	31.40%

Table 2: Survey responses to demographic questions.

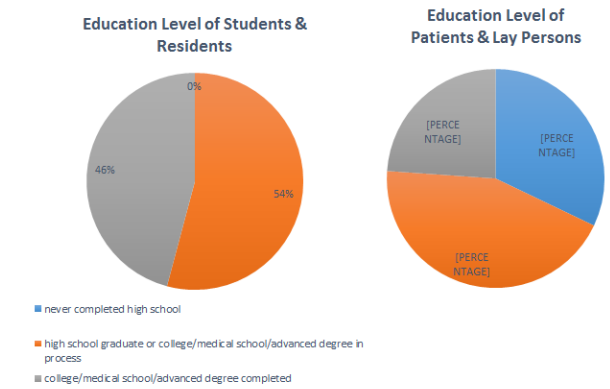

Figure 1: Education Level of Survey Participants.

Alcohol, illicit substances, and prescription pain or sedative medication abuse

In the previous year the use of alcohol was reported in 82.9% of students/residents, 62.7% of patients/lay persons (Table 3a). The annual use of prescription pain medications was 4.9% in students/residents and 22.4% in patients/lay persons. The annual use of illicit drugs was 7.3% in students/residents and 9.9% in patients/lay persons. A total of 12.2% of students/residents and 44.0% of patients/community members reported having regular (daily or almost daily) substance abuse. The percentage of students/residents and patients/community members that have had frequent substance abuse defined as daily or almost daily exposure to the following substances, respectively are: heavy alcohol use (more than 2 drinks per day or more than 7 drinks per week) 4.9%, 23.1%; prescription sedative or pain medication use 2.4%, 13.4%; illicit drug use (e.g. cannabis, cocaine, amphetamine, hallucinogens, opioids, other) 4.9%, 7.5% (Table 3b). None of the survey respondents reported past use or present abuse of inhalants (nitrous, glue, petrol, paint thinner, etc.) (Figure 2).

History of Any Substance Use in the Previous Year		
Survey Item	**Students/ Residents**	**Patients/Lay Persons**
Alcohol use	82.90%	62.70%
Prescription pain medication use	4.90%	22.40%

Illicit drug use (marijuana, cocaine, heroin, ecstasy, LSD, acid, PCP, opioids, amphetamines etc)	7.30%	9.90%
Total sum of respondents who reported use of alcohol, prescription pain medications, or illicit drug use at any point in the previous year	95.10%	95.00%
History of Frequent (Daily or Almost Daily) Substance Abuse		
Survey Item	**Students/ Residents**	**Patients/Lay Persons**
Heavy alcohol use (more than 2 drinks per day or more than 7 drinks per week)	4.90%	23.10%
Prescription pain medication use	2.40%	13.40%
Illicit drug use (marijuana, cocaine, heroin, ecstasy, LSD, acid, PCP, opioids, amphetamines etc)	4.90%	7.50%
Total sum of respondents who reported frequent alcohol, prescription pain medications, or illicit drug use	12.20%	44.00%

Table 3a and 3b: Survey responses to history of substance use in the past year or daily use.

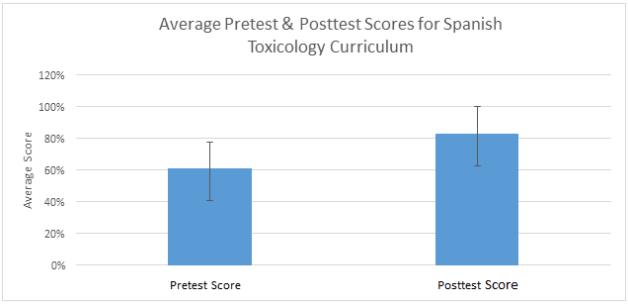

Figure 2: Improvement of posttest scores after toxicology curriculum.

Use and storage practices of potential household toxins

An average of 21.7% of students/residents and 13.7% of patients/community members practice safe storage practices of potential household toxins (Table 4). The percentage of students/residents and patients/community members that practice safe storage practices of the following products, respectively are: cosmetics: 2.4%, 3.7%; over the counter medications or prescriptions: 36.6%, 17.2%; cleaning products: 4.9%, 4.5%; automobile products: 7.3%, 3.0%; water filtration products: 7.3%, 2.2%; roach or insect spray: 43.9%, 31.3%; rat venom, powder, pellets or other traps 41.4%, 26.9%; weed killer or other gardening/farming products: 31.7%, 21.6%; and anti-mold products 19.5%, 12.7%.

Safe Storage Practices (locked cabinets, high location out of reach for children, hidden, etc)		
Survey Item	**Students/ Residents**	**Patients/Lay Persons**
Cosmetics such as nail polish, nail polish remover, makeup remover, hairspray	2.40%	3.70%
Over-the-counter or prescription medications (pain killers, steroids, malaria pills, etc.)	36.60%	17.20%
Disinfectants/cleaning products for the bathroom, kitchen, etc. including bleach	4.90%	4.50%
Automobile Products (anticoagulants, antifreeze, or windshield fluid)	7.30%	3.00%
Water Filtration Products (Pools, Wells)	7.30%	2.20%
Insect repellent (roach or mosquito spray)	43.90%	31.30%
Rat venom, powder, pellets, or other traps	41.40%	26.90%
Herbicides/pesticides-weed killer or other gardening products	31.70%	21.60%
Anti-Mold Products	19.50%	12.70%
*Average Score for Safe Storage Practices	21.70%	13.70%

Table 4: Survey responses to safe storage practices for household products.

Previous medical encounters related to toxic exposures

A total of 7.3% of students/residents and 10.5% of patients/community members reported history of a previous medical encounter associated with a toxic exposure (Table 5a). The percentage of students/residents and patients/community members that have had a previous medical encounter related to the following toxins, respectively are: accidental substance overdose 4.9%, 5.2%; intentional substance overdose 0%, 0.75%; accidental prescription drug overdose 0%, 1.5%; intentional prescription drug overdose 0%, 0%; accidental exposure to household products 2.4%, 3.0%; and intentional exposure to household products 0%, 0%.

Survey Item	**Students/ Residents**	**Patients/Lay Persons**
Accidental substance overdose	4.90%	5.20%
Intentional substance overdose	0%	0.80%
Accidental prescription drug overdose	0%	1.50%
Intentional prescription drug overdose	0%	0%

Accidental exposure to household products	2.40%	3.00%
Intentional exposure to household products	0%	0%
Total sum with positive history of medical encounter associated with any substance	7.30%	10.50%

Table 5a: Survey responses to type of previous toxicological medical encounter and location of medical treatment. Positive History of Previous Medical Encounter Associated with Toxic Exposure.

If exposed to a dangerous potential toxin, the percentage of students/residents and patients/community members, respectively, who would seek treatment at the following areas are: clinic: 85.4%, 97.0%; emergency room: 100%, 98.5%; local pharmacy/medicinal store: 2.4%, 17.9% (Table 5b).

Survey Item	Students/ Residents	Patients/Lay Persons
a) clinic	85.40%	97.00%
b) emergency room	100%	98.50%
c) local pharmacy/medicinal store	2.40%	17.90%

Table 5b: Location of medical treatment sought if exposed to a dangerous potential toxin (multiple responses allowed).

Home or traditional remedy practices

An average of 15.2% of students/residents and 21.8% of patients/community members would practice various home or traditional remedies after ingesting a toxin (Table 6). The percentage of students/residents and patients/community members that would practice the following remedies, respectively are: induce vomiting 26.8%, 34.3%; drink water 36.5%, 55.2%; drink milk 14.6%, 21.6%; drink saltwater 31.7%, 36.6%, drink juice 9.8%, 10.4%, drink herbal or spice teas 0%, 9.0%; drink baking soda and water 17.0%, 8.21%; drink camphor and water 12.2%, 16.4%; or consume foodstuffs (oatmeal, rice, bread, etc.) 0%, 8.2%.

Home Remedies Practiced if Exposed to a Potential Toxin		
Survey Item	**Students/ Residents**	**Patients/Lay Persons**
Induce vomiting	26.80%	34.30%
Drink water	36.50%	55.20%
Drink milk	14.60%	21.60%
Drink saltwater	19.50%	32.80%
Drink juice	9.80%	10.40%
Drink herbal or spice teas (honey, cinnamon, chamomile, mint, etc.)	0%	9.00%
Drink baking soda and water	17.00%	8.21%
Drink camphor and water	12.20%	16.40%
Consume foodstuffs (oatmeal, rice, bread, etc.)	0%	8.20%
Average use of traditional home remedy	15.20%	21.80%

Table 6: Survey responses to the type of home remedies practiced if exposed to a toxin.

Lead knowledge

An average of 67.5% of students/residents and 44.0% of patients/community members correctly answered questions regarding potential symptoms of lead poisoning (Table 7). An average of 56.9% of students/residents and 52.6% of patients/community members gave correct responses for each source of lead poisoning.

Percentage of Correct Responses Regarding Potential Symptoms of Lead Poisoning		
Survey Item	**Students/ Residents**	**Patients/Lay Persons**
Neurological problems or learning impairment	95.10%	73.10%
Cardiovascular damage	70.70%	32.80%
Kidney problems	36.60%	26.10%
Average % answered correctly	67.50%	44.00%
What are potential sources of lead?		
a) Gasoline	85.40%	76.90%
b) Paint	92.70%	67.90%
c) Batteries	19.50%	29.10%
d) Cosmetics	22.00%	20.10%
e) Litargio	46.30%	55.20%
f) Water	90.20%	66.40%
Average % who gave correct responses for each source of lead poisoning	56.90%	52.60%

Table 7: Survey responses to lead knowledge toxicity.

Uses for camphor

The percent of students/residents and patients/community members who use camphor report using it in the following ways, respectively: ritual/spiritual use for camphor (repel evil spirits, spiritual protection, religious practices) 7.3%, 8.2%; aerosol camphor for respiratory infection in infants 4.9%, 15.7%; camphor use topically on infants 4.9%, 26.1%; camphor use in the crib to protect infant 2.4%, 8.2%; camphor dissolved in liquid as medication (e.g. to treat respiratory infection, upset stomach, fever) 9.8%, 24.6%; and camphor used topically as pest repellant 17.1%, 29.1% (Table 8a). An average of 7.7%

of the students/residents and 18.6% of the patients/lay persons use camphor for any of the above methods.

Survey Item	Students/ Residents	Patients/Lay Persons
Ritual/spiritual use for camphor (repel evil spirits, spiritual protection, religious practices)	7.30%	8.20%
Aerosol camphor for respiratory infection in infants	4.90%	15.70%
Camphor use topically on infants	4.90%	26.10%
Camphor use in the crib to protect infant	2.40%	8.20%
Camphor dissolved in liquid as medication for respiratory infection, upset stomach, fever, etc.	9.80%	24.60%
Camphor used topically as pest repellant	17.10%	29.10%
Average % who use camphor for any of the above methods	7.70%	18.60%

Table 8a: Survey responses to camphor use practices and toxicity knowledge. Uses for camphor.

Camphor toxicity knowledge

An average of 71.9% of students/residents and 27.0% of patients/community members correctly answered questions regarding potential symptoms of camphor ingestion (Table 8b). Twenty two percent of students/residents and 11.9% of patients/community members correctly answered that only a small amount of camphor (less than one camphor tablet) can cause poisoning in children.

Survey Item	Students/ Residents	Patients/Lay Persons
a) nausea and vomiting	46.30%	23.10%
b) organ damage (lung, liver, kidney, brain)	90.20%	46.30%
c) neurological effects (delirium, seizures, memory loss)	80.50%	28.80%
d) death	70.70%	9.70%
Average % who correctly answered organ symptoms questions correctly	71.90%	27.00%
% of respondents who correctly answered that less than 1 cube can cause illness in a child	22.00%	11.90%

Table 8b: Percentage of Correct Responses Regarding Potential Symptoms of Camphor Poisoning.

Pesticide use

95.2% of students/residents and 85.0% of patients/lay persons use legal over-the-counter substances as pesticide or insect repellant. The most common types of pesticides or insect repellants used by students/residents and patients/lay persons, respectively, were Essential Oils (36.6%, 12.7%), DEET containing products (22.0%, 18.6%), and Baygon® (19.5%, 24.6%) (Table 9a).

Survey Item	Students/ Residents	Patients/Lay Persons
Baygon®	19.50%	24.60%
DEET containing products (ex. OFF!)	22.00%	18.60%
Camphor (powder, tablet, cube, oil, vapor, etc)	17.10%	29.10%
Essential oils (Citronella, Eucalyptus, Tea Tree, Lemon, Lavender, Rosemary, Clove, Soybean Oil, etc)	36.60%	12.70%
Total % who use either Baygon, DEET, Camphor, or Essential Oils	95.20%	85.00%
Chinese chalk or Miraculous Chalk (deltamethrin, cypermethrin)	2.40%	3.00%
Paraquat (Gramoxone®)	2.40%	6.00%
Tres Pasitos (aldicarb, Temik®)	7.30%	17.90%
Total % who use either Chinese chalk, Paraquat, or Tres Pasitos	12.10%	26.90%

Table 9a: Survey responses to types of insecticide/pesticide/rodenticide used, use of personal protective equipment, and toxicology knowledge. Most common type of insect, pest, or rodent repellant used.

The most commonly reported illegal pesticides used in students/residents and patients/community members, respectively, were: Chinese Chalk or Miraculous Chalk (deltamethrin, cypermethrin) 2.4%, 3.0%; Paraquat (Gramoxone®) 2.4%, 6.0%; and Tres Pasitos (aldicarb, Temik®) 7.3% and 17.9%. The total percent who use illegal pesticides like Chinese Chalk, Paraquat, or Tres Pasitos in students/residents and patients/community members, respectively was 12.1% and 26.9%. The percentage of residents/students and patients/lay persons who immediately was their hands afterwards with soap and water are 80.5% and 66.4%, respectively (Table 9b). The consistent use of personal protective equipment is done in an average of 45.5% of residents/students and 26.9% of patients/lay persons when handling insecticides, pesticides, or rodenticides.

Survey Item	Students/ Residents	Patients/Lay Persons
Wash hands with soap and water immediately afterwards	80.50%	66.40%
Use of gloves	31.70%	17.90%

Wear eyewear while using spray products	26.8.%	14.20%
Use a face mask	24.30%	9.00%
Average % who either wear gloves, eyewear, or mask while handing insecticides, pesticides, or rodenticides	45.50%	26.90%

Table 9b: Consistent use of personal protective equipment with insecticide/pesticide/rodenticides.

Pesticide toxicity knowledge

An average of 69.7% of students/residents and 27.3% of patients/community members correctly answered questions regarding potential symptoms of pesticide ingestion (Table 9c).

Survey Item	Students/ Residents	Patients/Lay Persons
a) gastrointestinal effects (nausea, vomiting)	46.30%	23.10%
b) organ damage (lungs, liver, kidney, CNS, heart)	90.20%	46.30%
c) Cardiovascular effects (irregular rhythms, failure, shock)	61.00%	43.30%
d) Neurological effects (delirium, seizures)	80.50%	14.20%
e) death	70.70%	9.70%
Average % who correctly answered organ symptoms questions correctly	69.70%	27.30%
% of respondents who correctly answered that less than 1 teaspoon of certain pesticides can cause illness in an infant	58.50%	51.50%

Table 9c: Percentage of correct responses regarding potential symptoms of insecticide poisoning. *Baygon contains the pyrethroids cyfluthrin, transfluthrin, prallethrin and the carbamate propoxur and organophosphorus chlorpyrifos, as active ingredients.

Awareness or participation in previous education initiatives

There was a large range in exposure to previous educational campaigns. The following are the percent of students/residents and patients/community members who had previous participation in educational campaigns on the following topics, respectively: alcohol or substance abuse 100%, 73.9%; prescription drug abuse 70.7%, 18.7%; household hazards 46.3%, 12.7%; and traditional/home remedy use 36.6%, 11.9%; lead awareness 75.6%, 62.7%; pesticides 61.0%, 9.0%, and awareness of the disaster that occurred in Haina 9.8%, 3.7%. The average percent with previous exposure of any of the educational campaigns above was 57.1% in students/residents and 27.5% in patients/lay persons (Table 10).

Survey Item	Students/ Residents	Patients/Lay Persons
Alcohol or illicit substance abuse	100%	73.90%
Prescription drug abuse	70.70%	18.70%
Household hazards	46.30%	12.70%
Traditional home remedies	36.60%	11.90%
Lead	75.60%	62.70%
Pesticides	61%	9.00%
Awareness of the disaster that occurred in Haina	9.80%	3.70%
Average percent with previous exposure to any of the educational campaigns above	57.10%	27.50%

Table 10: Survey responses regarding previous exposure to educational campaigns on various toxicological exposures. previous exposure to educational campaigns (school, news, tv, internet, social media, community outreach, etc).

Curriculum assessment

Nineteen emergency medicine residents at HRUJMCB and 15 family medicine residents at Hospital Juan XXIII completed the toxicology course. The mean pretest score was 61% (range 40-88%) and posttest score was 83% (range 63-100%).

Discussion

Our study attempted to fulfill the first step in the development of a medical toxicology curriculum, which is in the Kern model, the identification of a problem through a general needs assessment [21]. The problem we sought to define was the educational needs regarding overdose and toxicological exposures in this study population. The aim of the survey was to characterize this problem in order to develop goals and objectives which in turn may help focus the curriculum's educational and evaluation strategies. The toxicology curriculum we developed for medical trainees was broad and included the essential components as defined by the American Board of Emergency Medicine (ABEM) core content with emphasis on the toxicological exposures that are more particular to this cultural group as identified by the survey. The results of the survey suggest that this community would benefit from education regarding safe-storage practices, when to seek medical attention, the potential dangers of traditional home remedy use, as well as sources, signs and symptoms of common exposures like lead and pesticide poisoning.

A total of 7.3% of students/residents and 10.5% of patients/community members have had a previous medical encounter associated with a toxic exposure. Additionally, after exposure to a potential toxin, more patients/community members (17.9%) would seek treatment at a medicinal store or pharmacy as compared to students/residents (2.4%), which could lead to inappropriate management and delay further definitive care at a medical setting. A total of 12.2% of students/residents and 44.0% of patients/community members have a positive history of frequent (daily or almost daily) alcohol (4.9%, 23.1%), prescription pain medicine (2.4%, 13.4%), or illicit drug use (4.9%, 7.5%), respectively. Other studies in similar populations have yielded roughly similar estimates. For example, the

incidence of daily alcohol consumption in a study published by the American Medical College Association in 4 U.S medical schools was found to be 8.9% [20]. The incidence of daily heavy drinking has been estimated to be 33.9% in Hispanics in a National Institutes of Health (NIH) Study [19]. The annual incidence of illicit substance abuse in this study population was slightly above the globally reported average. Globally, it is estimated that in 2010, 3.4-6.6 percent of the world's population in the age group 15-64 years had used an illicit substance at least once in that year [22]. In this study 7.3% of residents/students and 9.9% of patients/community members reported use of any illicit substance in the past year.

The report of practice of traditional home remedies is relatively common in our survey population. Over one-quarter of students/residents and one-third of patients/community would induce vomiting after a potential toxin exposure. More than half of the survey respondents in both groups would try drinking either water, milk, baking soda, camphor, spices, or oatmeal as a remedy for a potential ingestion. In case of ingestion of a household toxin or caustic this could be especially detrimental. Orally ingesting another substance after a caustic ingestion could worsen symptoms by inducing emesis of a caustic chemical. Also in the case of ingestion of a substance with acidic properties, ingesting a basic substance, like baking soda, could result in an exothermic reaction and create more damage.

57.1% of students/residents and 27.5% of patients/community members reported previous exposures to educational campaigns (e.g. school, news, TV, internet, social media, community outreach) on overdose. Students/residents and patients/community members had fewer exposure to educational campaigns on household hazards (46.3%, 12.7%), and traditional/home remedy use (36.6%, 11.9%) as compared to alcohol and illicit substance abuse (100%, 73.9%), respectively. Patients/community members had notably less exposure to educational campaigns on pesticides (9%) as compared to students/residents (61%).

There is room for improvement in both groups regarding the fund of knowledge of various toxicological exposures that are common in the DR. The following are the average percent of correct responses for various exposures in students/residents and patients/community members, respectively: camphor ingestion 71.9%, 27.0%; lead poisoning 67.5%, 44%; and pesticide poisoning 69.7%, 27.3%. There are also a large proportion of individuals who would use dangerous and illegal pesticides like Chinese Chalk, paraquat, or Tres Pasitos; 12.1% of students/residents and 26.9% of patients/community members reported having used these pesticides. A pretest and posttest was given to assess the efficacy of the course. In the students and residents who completed the course there was a considerable improvement in their pretest scores (mean 61%, range 40-88%) and their posttest scores (mean 83%, range 63-100%). Their improvement in test scores is promising and is a positive indicator that the course was effective.

Conclusions

Certain limitations are evident in our survey, which intentionally limited open-ended questions and used either a 3-point or 2-point rating scale for the closed-ended questions. This closed-ended format does not attain outlying response options nor does it allow for qualitative data analysis. The questions that were asked in the survey may not be completely representative of the fund of knowledge or the behaviors practiced by the respondents due to limitations in length of the survey. Due to limitations in time we limited the questions so they could be reasonably answered within 10-15 minutes. Although we did not pilot test the survey instrument in this population, we did informally pilot the survey within the study team itself and extensive edits were made using native Dominican speakers to ensure clarity of the survey language within this study population. It is possible that survey respondents may not have completely understood the questions, although medical students who were native Dominicans and who were familiar with the content of the survey were available to answer any questions during the survey. Respondents also were not randomly selected, instead they were chosen based mainly on convenience. Using survey respondents who were mostly patients or have an interest in first response may impose bias towards people who have underlying medical conditions or who are perhaps related to those who do. The survey itself is novel and has not been previously validated or field tested. The pre-tests and post-tests that were used to evaluate the effectiveness of the curriculum in teaching the residents and medical students were also novel, and not previously validated or tested. Currently the study team is working with the American College of Medical Toxicology (ACMT) in creating new curriculum material including pretests and posttests that have been previously used in both domestic and other international settings.

Future steps in the identification of the problem are to develop a comprehensive definition of the problem, which includes consideration of epidemiology, impact on patients, health care professionals and society. The Kern model for curriculum development [21] highlight 3 requirements as being necessary for developing a comprehensive definition of the problem: 1) review of available information using comprehensive chart reviews, published literature, governmental or public health reports, public health statistics, etc. 2) use of experts in the field through organized societies of health care professionals who have proper training, in this case in toxicology and public health and 3) collection of new information using surveillance programs through governmental public health agencies or in this case, local poison control centers. The ability to develop a comprehensive definition of this problem is at this time still limited due to the lack of published literature, standardized medical records, surveillance programs such as poison control centers, and medical professionals with formal training in toxicology and public health in this region. Future collaborative international efforts and local participation are further needed to support these goals.

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