The Mexican Consortium of Epidemiological Studies for the Prevention, Diagnosis, and Treatment of Chronic Kidney Disease: a review of collaborating studies

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Abstract

Objective. To harmonize participants' information from five epidemiological studies. **Materials and methods.** The Mexican Consortium of Epidemiological Studies for the Prevention, Diagnosis, and Treatment of Chronic Kidney Disease (RenMex, by its Spanish acronym) was established in 2018. RenMex is a consortium of five studies: The Mexican Teachers Cohort Study; the Mexico City Diabetes Study; the Health Workers Cohort Study; the Comitán Study; and the Salt Consumption in Mexico Study, which assessed baseline serum creatinine, albumin, and C-reactive protein, all per-

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Resumen

Objetivo. Armonizar la información de los participantes de cinco estudios epidemiológicos en México. **Material y métodos.** En 2018 se constituyó el Consorcio Mexicano de Estudios Epidemiológicos para la Prevención, Diagnóstico y Tratamiento de la Enfermedad Renal Crónica (RenMex). RenMex es un consorcio de cinco estudios –Cohorte de Maestras, Estudio de Diabetes de la Ciudad de México, Estudio de cohorte de trabajadores de la salud, Estudio Comitán y Estudio de Consumo de Sal en México– que evaluaron la creatinina, la albúmina y la proteína C reactiva, todos reali-

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formed with standardized techniques. **Results.** RenMex includes 3 133 participants, with a mean age of 44.8 years, 68.8% women, 10.8% with a previous medical diagnosis of type 2 diabetes, and 24.1% living with obesity. **Conclusions.** In the future, RenMex will work on more detailed analyses with each cohort allowed to opt in or out for each topic according to their individual data.

Keywords: Chronic kidney disease; cohort studies; adults

zados con técnicas estandarizadas. **Resultados.** RenMex incluye 3 133 participantes, con una edad media de 44.8 años, 68.8% mujeres, 10.8% con diagnóstico previo de diabetes y 24.1% viviendo con obesidad. **Conclusiones.** En el futuro, RenMex trabajará en análisis más detallados y cada cohorte podrá optar por entrar / salir de cada tema de acuerdo con sus datos individuales.

Palabras clave: Enfermedad renal crónica; estudios de cohorte; adultos

Why was the consortium set up?

Chronic kidney disease (CKD) is a growing and highly relevant public health problem. It is characterized by an impaired excretory kidney function and/or kidney damage, expressed by a reduced glomerular filtration rate (GFR) and elevated urinary albumin excretion, measured by the urinary albumin-to-creatinine ratio (ACR).[1-4] Of all chronic non-communicable diseases (NCD), CKD has had one of the most rapid recent increases worldwide.[5,6] In 2017, the global prevalence of CKD was 9.1% (95% uncertainty interval [UI] 8.5 to 9.8), which is roughly 700 million cases. CKD was responsible for 4.6% (UI: 4.3 to 5.0) of global deaths in 2017, making it the 12th leading cause, compared to the 17th in 1990. It is important to point out that there are large variations between regions and between countries in terms of CKD mortality; in central Latin America, central Asia, and North America, CKD mortality has increased by approximately 60%, which is significantly more than in other regions. There is also evidence suggesting that the global burden of CKD is high and increasing in low- and middle-income countries.[5] In Central America, CKD was the second cause of death in 2017.

Mexico has the 6th highest CKD mortality rate in the world. In 2017, CKD was the 2nd leading cause of death, only after coronary artery disease; while in 1990, it was the 11th cause of death. Although Mexico does not have a CKD registry, it is estimated that approximately 14.5 million people may have had this illness in 2017, with an incidence rate of 394.2/100 000. Excessive growth of CKD prevalence in Mexico could be related to multiple factors such as accelerated demographic, epidemiological changes, and changes in lifestyle (e.g. dietary patterns), among others.[7] Despite CKD's epidemiological significance, there is limited research in the field, in particular with respect to risk factors, disease behavior differences between men and women, and definition of scores to identify individuals at risk, in order to guide public health, prevention and clinical decision-making. Most available research has focused on specific subnational regions at certain points in time; therefore, the scarce information available provides a limited and partial view of the problem.

For these reasons, the Mexican Consortium of Epidemiological Studies for the Prevention, Diagnosis, and Control of CKD (RenMex) was established. We expect that the evidence generated by RenMex will help guide public policy toward an effective reduction of CKD incidence, prevalence, and mortality. It may also provide decision makers with updated information to allocate resources where they are most needed.

Who is part of the consortium?

In 2018, researchers from the National Institute of Public Health (*Instituto Nacional de Salud Pública*, INSP) identified the need for high quality information and research focusing on CKD prevention, detection, and control, and supports policy implementation in Mexico. Therefore, several groups of researchers on a variety of disciplines (such as nephrology, internal medicine, epidemiology, health education, health systems, and public policy), were invited to form part of RenMex.

The institutions involved in this consortium and their functions are:

- INSP. General coordination of the consortium, direct participation, and contribution of data from the Mexican Teachers Cohort (MTC)[8] and the Mexico City Diabetes Study (MCDS).[9]
- Center for Research in Politics, Population, and Health; Faculty of Medicine, *Universidad Nacional Autónoma de México* (UNAM). Active participation in the consortium and contribution of data from the Health Workers Cohort Study (HWCS).[10]
- *Instituto de Oftalmología Conde de Valenciana* (Conval). Active participation in the consortium, contributing data from the Comitán Study.[11]

- *Instituto Nacional de Ciencias Médicas y Nutrición Salvador Zubirán* (INCMNSZ). Contribution of data from the Salt Consumption in Mexico Study (Salmex)[12] and provision of medical support [10]from experts in nephrology and internal medicine.
- Accessalud. Responsible for one of the project objectives, which is to implement and evaluate a training strategy at the primary healthcare level and provide support from medical experts in nephrology.
- Department of Health Services of the state of Tlaxcala (SS Tlaxcala). Provides access to hospitals and primary care staff at hospitals in the state of Tlaxcala, coordinating the training strategy on site.

Five studies (MTC,[8] MCDS,[9] HWCS,[10] the Comitán Study,[11] and Salmex[12]) were included in the RenMex cohort because they have information on risk factors associated with the metabolic syndrome (MetSyn), and the presence of type 2 diabetes (T2D), as well as and urine and blood samples to measure CKD biomarkers (C-reactive protein and albumin and creatinine in both serum and urine). The RenMex cohort was assembled from a random sample of 2 500 subjects of the consortium, stratified into four stages of metabolic alterations. This study population has diverse sociodemographic characteristics, constituting a rich database to evaluate the predictors and factors associated with the early stages of CKD.

Summary of the consortium studies

The Mexican Teachers Cohort (MTC):[8] Established in 2006-2008 and designed to last 30 years. Its main objective is to evaluate risk factors related to chronic disease development in Mexican women. All participants signed informed consent forms. A total of 115 307 female teachers from 12 states in Mexico responded a baseline questionnaire that included risk factors such as diet, physical activity, health status, and anthropometry. The general monitoring scheme consists of self-administered questionnaires that are sent to the participants to update information on risk factors associated with lifestyle and recent diagnoses. The first follow-up cycle was held from 2011 to 2014, with a response rate of 82.9% (n=94 527). The second follow-up started in 2014 and ended in 2021. In addition to this, from 2007 to 2017, a subcohort of 6 834 participants from six states was randomly selected for a clinical evaluation that included urine and blood samples, anthropometry and a clinical assessment of cardiometabolic risk factors.

The Mexico City Diabetes Study (MCDS):[9] Designed to estimate the prevalence, incidence, and natural history of T2D and cardiovascular risk factors in six low-income geostatistical areas located in the Álvaro Obregon municipality in Mexico City. All men and non-pregnant women between the age of 35 and 64 who permanently lived in the area were eligible to participate. All participants signed an informed consent form. They were interviewed at their homes and invited to a clinical and laboratory check-up. The baseline study took place between 1989 and 1990. A total of 3 319 participants were interviewed, out of whom 2 282 were included. The second follow-up was held four years after the baseline study, in which 2 055 participants were interviewed, and 1 773 had a checkup. The third follow-up was held four years after the end of the first one and 2 093 participants were interrogated, while 1 594 had a checkup. The fourth follow-up took place in 2008; 1 253 participants were interviewed, and 1 174 were examined. The MCDS is the only study with a long-term prospective follow-up (19 years) in this population.

The Health Workers Cohort Study (HWCS):[10] An ongoing prospective study conducted in central Mexico. Its objective is to examine the associations between the lifestyle and genetic factors with different health outcomes. The participants included are medical doctors and administrative and academic workers from three different institutions. Two are based in Cuernavaca, Morelos the *Instituto Mexicano del Seguro Social* (IMSS), and the INSP, and one is in Toluca, located in the State of Mexico *Universidad Autónoma del Estado de México* (UAEM). All the participants signed informed consent forms. The baseline evaluation was carried out with 10 729 volunteers from 2004 to 2006 and included a self-administered questionnaire at home. The participants were assigned locations for physical tests and collection of blood and urine samples. The second follow-up cycle took place between 2010 to 2013 from a subsample of 2 500 participants from the baseline evaluation. The third evaluation cycle was carried out from 2016 to 2018 and included 850 participants.

The Comitán Study:[11] A cross-sectional study whose objective is to estimate the prevalence of T2D, cardiovascular disease (CVD), and CKD, and their associated risk factors in indigenous and non-indigenous populations aged over 20 years in eight localities in the Municipality of Comitán de Domínguez, Chiapas. The participants were selected by convenience in the rural areas, whereas in urban locations they were selected randomly. All participants signed an informed consent form. The evaluation included self-reported questionnaires, physical tests (including visual function), and collection of blood and urine samples. The baseline measurement was carried

out from 2010 to 2012 (n= 1 940). The first follow-up took place from 2015 to 2017. Different questionnaires were applied in both the baseline measurement and the follow-up.

The Salmex:[12] A cross-sectional study whose objective is to evaluate the average intake of iodine, potassium, and salt in workers between 18 and 65 years old, from the INCMNSZ in Mexico City. It was carried out from 2010 to 2011, and a total of 1 009 men and non-pregnant women from different departments of the INCMNSZ were included in the study. The participants previously attended an informative session on sodium intake. Only those with a complete 3-day food record and an appropriate 24-hour urine collection were included. All the selected participants were subjected to clinical evaluation and to a full NCD related questionnaire, and blood samples were collected for a diversity of measurements.

Variables measured in the RenMex consortium

In general, the variables to be considered as part of the consortium were: Sociodemographic characteristics (age, sex, place, date of birth, place of residence, marital status, access to internet, access to public or private health services, income, occupation, and ethnicity). Also, anthropometric indicators (weight, height, waist circumference, and body mass index); clinical information (personal history of T2D, hypertension, hypercholesterolemia, kidney disease, previous stroke or myocardial infarction, cancer); and lifestyle attributes (tobacco consumption, alcohol consumption, scarce physical activity, poor sleep quality, poor diet, among others) were included. In addition, all the studies had urine and blood samples available in a biobank in order to measure CKD biomarkers like C-reactive protein (CRP) and serum levels of creatinine and albumin. Additionally, albumin and creatinine concentrations in urine were determined to validate the previous reviews, since they were measured using different techniques.

The MTC.[8] The self-administered questionnaires comprise information on socioeconomic status, reproductive history, risk factors for chronic diseases, medical history, and a semi-quantitative food frequency questionnaire (FFQ). Moreover, the following anthropometric and clinical measurements were obtained: blood pressure, height, weight, and waist and hip circumferences. Additionally, during the clinical sub-cohort evaluations (2007-2017), urine and blood samples were taken in order to measure such biomarkers as glucose, total cholesterol, low density lipoprotein cholesterol (LDL-c), high density lipoprotein cholesterol (HDL-c), and triglycerides, among others. A biobank was formed with blood and urine samples, which were stored at -70°C.

The MCDS.[9] The questionnaires used during home interviews included information about risk factors like overweight and obesity, hyperlipidemia, hypertension, consumption of tobacco, physical activity, diet, and self-care. The clinical evaluations included blood pressure, height and weight, waist and hip circumferences, and skin fold measurements. Urine and blood samples were taken for some biomarkers: glucose tolerance, lipid profile, and insulin and proinsulin levels, among others. The estimation of proteinuria and micro-albuminuria is available from both baseline evaluation and second follow-up.

The HWCS.[10] Included a self-reported questionnaire during its baseline and follow-up evaluations and compiled data about demographic characteristics, medical family history, and past and current medical history. It also included information about lifestyle, like FFQ, and a modified physical activity questionnaire. Moreover, the anthropometric and clinical measurements included weight, height, waist circumference, blood pressure, and body composition. Nonetheless, blood and urine samples were collected in order to carry out routine hematology tests (hemoglobin, hematocrit, among others) and chemistry tests (glucose, total cholesterol, HDL-c, LDL-c, aminotransferase, triglycerides, uric acid, creatinine, and others). Finally, a biobank was formed with blood and urine samples stored at -70°C.

The Comitán study.[11] The questionnaire included sociodemographic variables like age, sex, education level, occupation, speaker of an indigenous language, and alcohol and tobacco consumption. The clinical evaluation included height, weight, waist circumference, blood pressure, and ophthalmic examination. In addition, the medical history was obtained, and physical, and laboratory tests were performed. Also, biomarkers including glucose, glucose tolerance test, total cholesterol, triglycerides, LDL-c, HDL-c and creatinine were measured. Proteinuria and microalbuminuria were measured by urine dipstick. A biobank was formed with blood and urine samples stored at -70°C.

The Salmex study.[12] A self-administered questionnaire and a face-to-face interview were conducted in order to obtain information about dietary intake, physical

activity, and the medical history. Additionally, a physical examination that included anthropometric measures (weight and height), blood pressure, and collection of blood and 24-hour urine samples was carried out. The biomarkers obtained were urinary and serum creatinine, sodium, and potassium, as well as plasma glucose, among others.

Ethics

The principal investigators from each cohort, as well as members of the institutions listed above, agreed to participate in the RenMex consortium. The Institutional Review Boards of Ethics, Research and Biosafety from the INSP approved the study protocol.

How was the data harmonization process conducted?

Before pooling the data, we defined a set of socioeconomic, clinical, and lifestyle variables that were necessary to achieve the RenMex consortium goals. Each study provided its database, data dictionary, and the applied questionnaires. A single, limited-access data repository was utilized to store all available data.

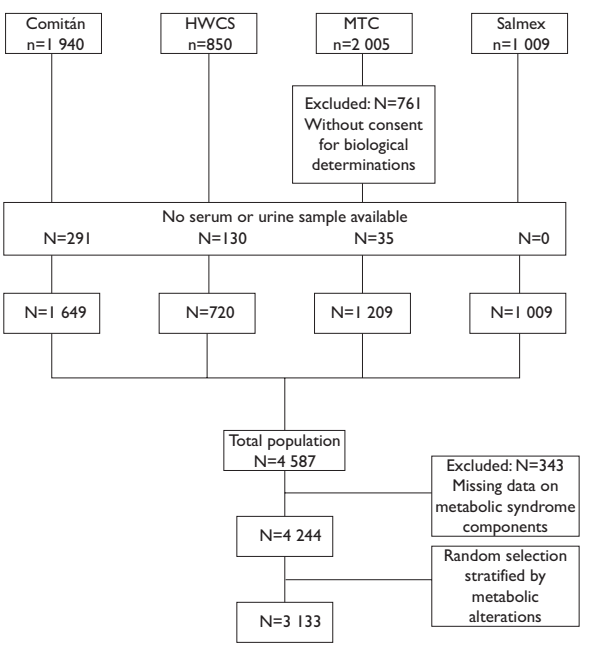
From the three initial studies (N = 4 587), data from 4 244 participants was available after exclusions. A random subsample of 2 500 participants from MTC, HWCS and the Comitán Study was selected and stratified into four stages of metabolic alterations including:

- 30% of the population with T2D and/or hypertension, identified through clinical evaluation (regardless of other alterations);
- 30% of the population with metabolic alterations, but not MetSyn;
- 30% of the population with MetSyn (three or more disturbances);
- 10% of the participants without any metabolic disorder.

Due to the limited number of men in the population, they were all kept in the subsample (N=710), and women were randomized. MetSyn was defined using the harmonized criteria for MetSyn. For the Salmex study (N=1 009), which was incorporated after selecting the initial subsample, the same data harmonization and selection was performed according to the distribution of the stages of metabolic disorders in the initial subsample. The total population of the consortium is 3 133 participants (figure 1).

Main characteristics of the RenMex consortium

Table I shows the characteristics of the Consortium population. The mean (SD) age in the population, of which 69.4% were women, was 45.8 (± 14.1) years. The population with the greatest representation was from the central region (46.3%), while the rest of the participants were from the south. On average, approximately a third of the population had graduate or postgraduate studies; however, there were important differences between studies, with Comitán having the smallest proportion of people in this category. Approximately 19.4% of the population, mainly belonging to the states of Chiapas and Yucatán, reported speaking an indigenous language. We found that 10.7% of the participants reported a previous medical diagnosis of T2D; 17.3%, of hypertension, and 40.1%, of overweight, and 24.5%, of obesity. The T2D and overweight prevalences are similar to the ones reported in the National Health and Nutrition Survey in 2018 (Ensanut 2018), of 10.3% and 39.1%, respectively, although this was not the case for obesity prevalence (36.1% reported in Ensanut 2018).



HWCS: The Health Workers Cohort Study
MTC: The Mexican Teachers Cohort
Salmex: Salt Consumption in Mexico Study

Figure 1. Study flow-chart

Table I

SOCIODEMOGRAPHIC AND LIFESTYLE CHARACTERISTICS OF PARTICIPANTS IN THE CONSORTIUM, BY STUDY AND SEX (N=3 133)

Variable	*Total*			*Comitán*			*HWCS*			*MTC*		*Salmex*	
N	*3 133*			*1 286*			*566*			*648*		*633*	
	Total	*Women*	*Men*	*General*	*Women*	*Men*	*General*	*Women*	*Men*	*Women*	*General*	*Women*	*Men*
	3 133	*2 174*	*959*	*1 286*	*728*	*558*	*566*	*414*	*152*	*648*	*633*	*384*	*249*
Age, years	45.8 ± 14.1	46.4 ± 13.2	44.4 ± 15.8	42.7 ± 15.4	41.8 ± 14.7	43.8 ± 16.1	57.4 ± 14.1	57.4 ± 14.3	57.4 ± 13.8	48.4 ± 5.0	39.3 ± 10.6	40.0 ± 10.3	38.1 ± 11.0
State of residency													
Chiapas	50.4	46.8	58.3	100.0	100.0	100.0	0.0	0.0	0.0	44.6	0.0	0.0	0.0
CDMX	25.9	27.5	22.3	0.0	0.0	0.0	0.0	0.0	0.0	38.9	88.2	89.8	85.5
State of Mexico	2.3	1.7	3.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	11.2	9.6	13.7
Morelos	18.1	19.0	15.9	0.0	0.0	0.0	100.0	100.0	100.0	0.0	0.6	0.5	0.8
Yucatán	3.4	4.9	0.0	0.0	0.0	0.0	0.0	0.0	0.0	16.5	0.0	0.0	0.0
Marital status*													
Single	18.0	18,9	15.9	9.9	9.9	9.9	15.8	18.0	9.5	16.4	37.9	40.9	33.3
Married/Domestic partnership	68.5	63.8	79.1	81.3	76.9	86.9	58.6	52.3	76.2	66.4	53.4	47.1	63.1
Divorced/Sepa-rated/Widowed	13.5	17.3	5.0	8.8	13.2	3.2	25.6	29.7	14.3	17.2	8.7	12.0	3.6
Access to health services*													
IMSS	16.3	15.6	18.0	13.6	13.0	14.5	58.6	57.3	62.1	1.3	0.0	0.0	0.0
ISSSTE	36.0	39.7	27.7	1.5	0.8	2.4	0.0	0.0	0.0	72.8	100.0	100.0	100.0
SS	15.7	14.1	19.3	38.0	41.7	33.2	0.0	0.0	0.0	0.2	0.0	0.0	0.0
Private	10.5	11.4	8.3	9.3	8.7	10.1	10.7	9.1	15.2	22.9	0.0	0.0	0.0
Other	21.5	19.2	26.7	37.5	35.7	39.9	30.7	33.6	22.7	2.9	0.0	0.0	0.0
Education‡													
None	12.3	12.9	11.0	27.5	34.4	18.5	0.0	0.0	0.0	1.3	0.8	1.0	0.4
Basic and secondary education	53.9	46.7	69.5	72.4	65.6	81.3	48.6	51.3	41.0	15.1	53.2	49.8	58.6
Undergraduate and graduate	33.8	40.2	19.5	0.1	0.0	0.2	51.4	48.7	59.0	83.6	46.0	49.2	41.0

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(continuación)

Speaks indigenous language	19.4	15.4	28.5	42.5	37.5	48.9	0.0	0.0	0.0	9.6	0.0	0.0	0.0
Smoking status*													
Non-smoker	73.3	84.2	48.9	73.4	96.4	43.4	64.1	71.2	44.2	78.8	75.8	83.6	63.9
Past smoker	12.6	8.9	20.8	11.3	1.9	23.4	29.1	22.9	46.3	13.3	0.0	0.0	0.0
Current smoker	14.1	6.9	30.3	15.3	1.7	33.2	6.8	5.9	9.5	7.9	24.2	16.4	36.1
Previously diagnosed T2D	10.7	11.5	9.0	5.7	6.3	4.8	13.0	12.9	13.3	13.0	16.6	17.2	15.7
Previously diagnosed HTN§	17.3	18.5	14.5	9.8	11.8	7.2	27.5	25.8	32.0	17.6	23.2	25.0	20.5
BMI, kg/m^2	27.3 ± 6.0	27.7 ± 6.5	26.2 ± 4.2	26.4 ± 4.5	27.1 ± 4.7	25.5 ± 4.1	27.3 ± 4.8	27.4 ± 5.1	26.8 ± 4.2	29.0 ± 9.2	27.3 ± 4.7	27.2 ± 5.0	27.4 ± 4.3
Waist circumference, cm	90.5 ± 11.1	90.2 ± 11.2	91.2 ± 11.0	89.1 ± 10.4	90.0 ± 10.7	88.0 ± 10.0	93.2 ± 11.2	91.4 ± 10.9	98.1 ± 10.4	92.0 ± 11.0	89.4 ± 12	86.3 ± 11.7	94.1 ± 10.8
Systolic blood pressure, mmHg	120.2 ± 17.5	119.1 ± 18.3	122.6 ± 15.4	116.5 ± 14.9	115.1 ± 16.0	118.3 ± 13.2	121.8 ± 19.0	119.7 ± 19.3	127.3 ± 16.9	123.8 ± 20.4	122.4 ± 16.5	117.9 ± 15.3	129.4 ± 15.9
Diastolic blood pressure, mmHg	76.0 ± 10.5	74.7 ± 10.5	78.9 ± 9.9	76.6 ± 9.5	75.5 ± 9.7	78.1 ± 9.0	75.2 ± 10.7	73.5 ± 10.1	80.0 ± 10.8	74.7 ± 11.8	76.8 ± 10.6	74.8 ± 9.8	79.9 ± 11.0
Glucose, mg/dL	99.4 ± 38.0	100.0 ± 37.2	98.2 ± 39.8	98.5 ± 43.2	99.7 ± 43.8	97.0 ± 42.4	108.3 ± 37.0	106.0 ± 32.9	114.6 ± 45.9	102.8 ± 36.5	90.1 ± 24.7	89.5 ± 25.0	91.0 ± 24.2
HDL cholesterol mg/dL	42.2 ± 14.2	44.3 ± 14.6	37.4 ± 12.0	34.5 ± 12.8	34.4 ± 12.9	34.7 ± 12.7	51.1 ± 13.0	53.2 ± 13.2	45.1 ± 10.6	48.4 ± 12.6	43.5 ± 10.9	46.6 ± 11.1	38.7 ± 8.6
Triglycerides mg/dL	185.9 ± 116.0	174.4 ± 101.2	212.0 ± 140.0	204.3 ± 125.5	197.2 ± 119.2	213.6 ± 133.0	161.9 ± 101.4	156.1 ± 84.9	178.0 ± 135.8	170.1 ± 90.8	185.7 ± 124.8	157.9 ± 87.9	228.7 ± 157.1
eGFR ml/min/1.73m$^{2\#}$	101.3 ± 20.6	101.2 ± 20.0	101.4 ± 21.9	106.4 ± 20.8	107.3 ± 19.5	105.2 ± 22.5	82.9 ± 20.1	83.0 ± 20.2	82.7 ± 19.7	103.3 ± 10.3	106.1 ± 15.2	107.4 ± 15.4	104.2 ± 14.2

Values are means ± standard deviation or percentages.
* <2% Missing values
‡ <5% missing values
§ Data not available for Salmex
# <10% missing values
T2D: Type 2 diabetes; HTN: Hypertension; BMI: Body Mass Index; HDL-c: High-density lipoprotein cholesterol; eGFR: Estimated Glomerular Filtration Rate (CKD-EPI).
IMSS: *Instituto Mexicano del Seguro Social*; ISSSTE: *Instituto de Seguridad y Servicios Sociales de los Trabajadores del Estado*; SS: *Secretaría de Salud*.
HWCS: Health Workers Cohort Study; MTC: Mexican Teachers Cohort; Salmex: Salt Consumption in Mexico Study

Table II
Prevalence of metabolic syndrome disorders in the Consortium, by study and sex (n=3 133)

	Total			*Comitán*			*HWCS*			*MTC*		*Salmex*	
	Total 3 133	*Women 2 174*	*Men 959*	*General 1 286*	*Women 728*	*Men 558*	*General 566*	*Women 414*	*Men 152*	*Women 648*	*General 633*	*Women 384*	*Men 249*
Metabolic syndrome*	50.7	55.2	40.7	47.3	58.7	32.4	53.8	54.0	53.3	59.0	46.6	43.5	51.4
Large waist circumference	70.0	83.5	39.4	58.1	82.4	26.3	81.3	87.8	63.3	89.7	64.0	70.3	54.2
High triglycerides	54.8	51.6	62.0	60.1	57.4	63.6	49.7	47.9	54.7	52.6	50.6	42.7	62.7
Low HDL-c‡	65.7	67.5	61.7	81.0	89.3	70.3	39.8	41.9	34.0	60.3	63.0	65.6	59.0
High blood pressure	32.7	31.0	36.8	22.9	21.7	24.6	42.4	36.5	58.7	39.8	36.8	27.6	51.0
High fasting glucose	26.3	28.2	22.2	19.7	21.7	17.0	46.7	44.3	53.3	33.3	14.7	14.6	14.9
Without metabolic syndrome factors	6.2	5.3	8.4	5.1	2.2	8.8	5.5	5.6	5.3	5.4	10.0	10.4	9.2

Values are percentages
* Metabolic syndrome was defined as follow: Large waist circumference: women ≥80cm, men ≥94cm; high triglycerides: ≥150mg/dL; low
‡ High density lipoprotein cholesterol: women <50 mg/dL, men <40 mg/dL; high blood pressure: systolic ≥130 and/or diastolic ≥ 85 mm Hg; high fasting glucose: ≥100 mg/dL.
HWCS: Health Workers Cohort Study; MTC: Mexican Teachers Cohort; Salmex: Salt Consumption in Mexico Study

Table II describes the prevalence of MetSyn and metabolic disorders. In RenMex, the prevalence of MetSyn is 50.7%, which is lower than the general Mexican population (Ensanut 2018: 60.6%). It was highest in MTC (59.0%) and lowest in Salmex (46.6%). Only 6.2% of the population did not present any metabolic syndrome disorder. The most common metabolic disorder was large waist circumference (83.5% of women and 39.4% of men). In men, the most prevalent disturbance was dyslipidemia (62.0% had high triglycerides, and 61.7%, reduced HDL-c).

What are the main strengths and weaknesses?

One of the main strengths of the consortium is its population-based design. Also, the entire population has serum and urine samples in a biobank, as well as standardized analytical determinations for albumin and creatinine to estimate kidney damage. The stratification with which the initial subsample was selected has the capacity to identify four stages of metabolic disorders, in addition to having a wide variability of harmonized risk factors. On the other hand, the consortium has pseudonymized information for linking records with other databases. Linking data would allow us to identify risk factors and other outcomes in addition to the vital status.

The Comitán and Salmex studies have only a baseline evaluation. However, we expect to obtain follow-up data in the near future. Also, the study population is middle-aged, and a higher proportion are women and from central and southern Mexico, so it may not be nationally representative.

What is next?

As part of the objectives of the RenMex consortium, a training strategy for medical doctors and nutritionists working at the SSA Tlaxcala will be launched to build multidisciplinary teams that can improve detection and treatment of CKD, as well as help doctors detect it in the early stages. In this respect, online training has proven to be a very useful refresher tool for healthcare professionals.

During the first phase (2018-2021), RenMex has focused on (randomly) selecting subjects to be included in the consortium, harmonizing databases, and, given that all cohorts have serum and urine samples, determining creatinine, albumin, and CRP.

Can I access the data? Where can I find out more?

RenMex has agreed with collaborating studies not to share data outside the Consortium. Each participating study has its own policy for data sharing.

The datasets of the current study are not publicly available in order to protect participant confidentiality,

but are available upon reasonable request from Edgar Denova-Gutiérrez at edgar.denova@insp.mx.

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