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Editorial

The importance of strengthening the training of human talent for health research in El Salvador

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In a global context where scientific evidence is the fundamental basis for formulating effective public policies and improving health systems, it is essential to highlight the value of scientific publications. For all of the above, in this edition of Alerta, we seek to recognize the relevance of original articles, case reports, short communications, and reviews, the first of which is mostly derived from the National Health Survey, 2021.

The original articles based on the National Health Survey 2021 results represent an invaluable source for understanding the current state of the population's well-being and health conditions in El Salvador. These studies allow us to identify trends, evaluate possible interventions, and guide strategic decisions based on scientific evidence. The quality and rigor of the analysis provided by these studies are essential to advancing toward a more equitable, efficient, and comprehensive health system.

Likewise, the three case reports provide a detailed clinical view that can show little-known or emerging aspects of our health reality. Short communications, on the other hand, facilitate the rapid and innovative dissemination of preliminary findings or novel ideas, fostering a dynamic dialogue between researchers and health science professionals. A Narrative review offers a critical synthesis of specific topics, helping to consolidate existing knowledge and identify priority areas for future research.

Nevertheless, beyond the intrinsic value of the different types of publications, it is necessary to emphasize that the real engine of scientific progress in our country lies in strengthening specialized training, in this case, in epidemiology and research. That is why the National Institute of Health (INS) plays a transcendental role in this process: to train our future epidemiologists and scientists to face complex health challenges with technical and methodological rigor. Establishing the first non-clinical medical residency in the country is investing in the human talent necessary to create a fertile field for scientific knowledge.

Professional development in epidemiology not only improves research quality but also enhances the institutional capacity to respond to health emergencies, allows the design of effective interventions, and generates evidence contextualized to the national reality. INS is committed to continuous investment in specialized training to ensure its research is relevant, rigorous, and oriented to improve public health.

While we deeply value the scientific contributions derived from national surveys, clinical reports, and narrative reviews, we reaffirm that strengthening specialized human talent is fundamental to consolidating a robust research culture. Only through solid training can we transform data and ideas into concrete actions that benefit our entire population; proof of this is this issue where

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La importancia de fortalecer la formación de talento humano para la investigación en salud en El Salvador

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the new generation of INS researchers and epidemiologists present their initial contributions to the National Health System, a preamble for a better future in research, where this becomes an engine of change and a commitment to society, an act of collective responsibility, which has the power to transform lives in the country, we celebrate the first graduating class of the Specialty of Research and Epidemiology in the country!

From Alerta, we invite all actors, mainly academics in the health sector, to continue promoting scientific research committed to the country's social and health development. As well as to keep in mind the importance of training since investment in human capital is not only a strategy but an imperative need to build a healthier future for El Salvador.

Case report

Surgical treatment in a patient with ossifying fibroma in the left nostril

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Abstract
Case presentation. A 43-year-old female patient, with an 8-month history of presenting with a tumor on the nasal dorsum, which has been progressively increasing in size, presenting left rhinorrhea, and pain in the nasal dorsum region. Asymmetry is observed in the nasal dorsum, with a tumor in the left external nasal region measuring 2 x 2 cm, hard. In the computed tomography of the paranasal sinuses, a tumor is noted that affects the bone wall of the nasal fossa and the anterior and medial wall of the upper left jaw. **Treatment.** A facial degloving plus left medial maxillectomy was performed, as a finding, a left nasal tumor affecting the lateral wall of the left nostril, the bone of the nostril and the anterior and medial wall of the upper left maxilla. The biopsy described a benign osteofibrous proliferation with several osteoclast-like multinucleated giant cells, findings compatible with ossifying fibroma.. **Outcome.** In the immediate post-surgery, he presented a good evolution with a progressive decrease in facial edema and improvement in pain. A week later he was followed up with good clinical progress, a decrease in facial edema was observed and no nasal bleeding was evident.

Keywords
Fibroma, Ossifying, Nose, Paranasal Sinuses..

Resumen
Presentación del caso. Paciente femenina de 43 años, con historia de presentar un tumor en el dorso nasal de ocho meses de evolución, que ha incrementado de tamaño de forma progresiva, y se caracteriza por rinorrea izquierda y dolor en región nasal. Se observa asimetría y una tumoración en región nasal externa izquierda que mide 2 x 2 cm, de consistencia dura. En la tomografía computarizada de los senos paranasales, se observa una tumoración que afecta la pared del hueso propio de la fosa nasal y la pared anterior y medial del maxilar izquierdo superior. **Intervención terapéutica.** Se realizó un *degloving* facial más maxilectomia medial izquierda, como hallazgo, una tumoración nasal izquierda que afecta la pared lateral de fosa nasal izquierda, el hueso propio de fosa nasal y la pared anterior y medial de maxilar izquierdo superior. En la biopsia se describe una proliferación osteofibrosa benigna con varias células gigantes multinucleadas tipo osteoclastos, hallazgos compatibles con fibroma osificante. **Evolución clínica.** En el posquirúrgico inmediato, la paciente presentó buena evolución con disminución progresiva del edema facial y mejoría del dolor. A la semana, se le dio seguimiento con buena evolución clínica, se observó disminución del edema facial y no se evidenció sangrado nasal.

Palabras clave
Fibroma Osificante, Nariz, Senos Paranasales..

Introduction

Ossifying fibromas are benign fibro-osseous neoplasms that primarily affect the jaws and craniofacial skeleton.[i-ii] Ossifying fibromas are usually benign lesions in which normal bone is replaced by fibrous tissue containing varying amounts of mineralized material resembling bone.[iv] It occurs primarily in patients from the second to the fourth decade of life, with a higher prevalence among women, and it affects the mandible more than the maxilla, and rarely occurs in the paranasal sinuses.[iv]

Fibromas can be divided into the conventional form of ossification, also called cemento-ossifying fibroma, and two distinct juvenile ossifying fibromas: juvenile trabecular ossifying fibroma and juvenile psammomatoid ossifying fibroma.[ii]

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Tratamiento quirúrgico en una paciente con fibroma osificante en fosa nasal izquierda

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In the case of juvenile psammomatoid ossifying fibroma, it usually occurs in the maxilla, whereas juvenile psammomatoid ossifying fibroma has a predilection for the paranasal sinuses.[ii]

Among the most common locations are the frontal sinus and the ethmoid sinus.[v] In the study by Magb. oul *et al.*, where seven patients were evaluated, nasal obstruction was reported in all cases (100 %). Headache was present in five patients (71.4 %), while other clinical symptoms, including sneezing, snoring, periorbital swelling, proptosis, visual defects, and seizures, were detected in one case each.[v]

In the study by Dong D. *et al.*, 44 patients with ossifying fibroma were included, 20 were men (45.5 %) and 24 were women (54.5 %) with the age of onset being 24.5 (5-62) years.[vi] The patients had an age of onset younger than 20 years, in 38.7 %, and those with an age of onset younger than 30 years, accounted for 59.1 %. Thirty patients (68.2 %) were treated for craniofacial malformation, and eight patients (18.2 %) were treated for ocular symptoms.[vi]

It is important to note that juvenile psammomatoid ossifying fibroma is a rare benign fibro-osseous tumor that occurs in a wide range of age groups, with its most common sites being the orbital bones and paranasal sinuses, followed by the maxilla and mandible.[vii]

Even though ossifying fibromas are considered benign neoplasms, they can invade local structures, including the orbits, causing a variety of signs and symptoms depending on the compressed structures. Occasionally, visual loss may occur as a result of optic nerve compression due to the tumor spreading within the orbit, which can even aggressively extend to the jaw, especially the molar branch. Facial swelling and asymmetry are the most common clinical findings. The prognosis is good provided the tumor is completely removed, depending on the location and size of the mass.[viii-x]

Ossifying fibromas are mainly found in patients of European descent, followed by those of African descent. However, their pathogenesis remains unknown and congenital conditions, infections and trauma, mainly in childhood, are described as the main causative agents.[xi]

Computed tomography (CT) is the gold standard for the evaluation of sinonasal osteoma, where they appear well circumscribed, as dense masses that can be homogeneous or heterogeneous depending on the histological subtype.[xii] MRI findings are also influenced by the presence of fibrous tissue in the mass; for example, in ivory-type osteoma, hyperintense areas may appear on T1-weighted images, while mixed or mature subtypes may show a lack of signal in all sequences.[xii] The images allow some differentiation between osteomas and their two most common mimics, fibroma ossificans and fibrosa[xii] dysplasia. The ossifying fibroma, on the contrary, appears in CT well defined with a peripheral border, while a dense border and heterogeneous center can be distinguished.[xii]

Fibrous dysplasia may have a lytic or ground-glass appearance on CT, and hypointense on T1-weighted MRI with gadolinium contrast enhancement.[xii] On T1-weighted MRI, the ossifying fibroma will have a hypointense periphery and a hyperintense/intermediate core, while on T2-weighted MRI, the sequence will show a hyperintense signal throughout the entire zona.[xii]

Transnasal endoscopic surgical resection is the main treatment of nasal ossifying fibroma. Because of its location, the tumor has a rich blood supply, which increases the risk of intraoperative hemorrhage and makes it difficult to accurately localize the tumor and determine boundaries intraoperatively.[xiii] In children, the narrow nasal cavities make it difficult to achieve complete tumor resection.[xiv]

Endoscopic sinus surgery with image navigation and lateral nasal butterfly incision resection has been considered available as a therapeutic option.[xv] Lateral nasal butterfly incision has less bleeding and shorter operation time, but with slight swelling of the nasal face after surgery, and nasal endoscopy is a surgical method with less damage.[xv]

Case presentation

A 43-year-old female patient with a medical history of eight months due to the presence of a tumor on the nasal dorsum, with progressive increase in size, accompanied by left-sided rhinorrhea and pain in the nasal dorsum region, with no epistaxis. She was also diagnosed with stage 5 chronic kidney disease and was on ambulatory peritoneal dialysis.

Physical examination revealed an asymmetric nose at the nasal dorsum, with a firm, 2 x 2 cm tumor in the left external nasal region. The oral cavity revealed a hyperemic pharynx with no posterior drainage. There was no evidence of lesions. A nasopharyngolaryngoscopy was performed, which revealed no tumor in the left nasal fossa. A CT of the paranasal sinuses was also performed, revealing a tumor affecting the wall of the nasal fossa and the anterior and medial walls of the left maxilla (Figure 1).

Tests were indicated prior to the surgery (Table 1). She was evaluated by the nephrology specialty, who prescribed peritoneal dialysis the day before surgery.

A biopsy of a left nasal tumor was taken two days after the consultation. It was described bulging of the middle meatus and the lateral nasal wall above the inferior turbinate, from the nasal vestibule, of hard consistency, said tumor involving the nasal dorsum and the external lateral portion of the left nose (Figure 2). The frozen biopsy was positive for malignancy with diagnosis by paraffin.

A new review of the biopsy was requested, where a benign osteofibrous proliferation was subsequently reported with several multinucleated osteoclast-like giant cells, where there was no atypia, mitoses, or necrosis, the findings being compatible with ossifying fibroma in the left nasal fossa. component.

Treatment

The patient was scheduled for surgery and facial degloving plus left medial maxillectomy is performed six months after the consultation (Figure 3).

A nasolabial incision was made from canine to canine, columellar and intercartilaginous incision bilateral, with subperiosteal dissectionto expose the left nasal tumor, having as findings a tumor left nasal, affecting the lateral wall of the left nostril, the bone of the nostril and the anterior and medial wall of the left maxillary superior, with dimensions of 5 x 5 cm. (Figure 4).

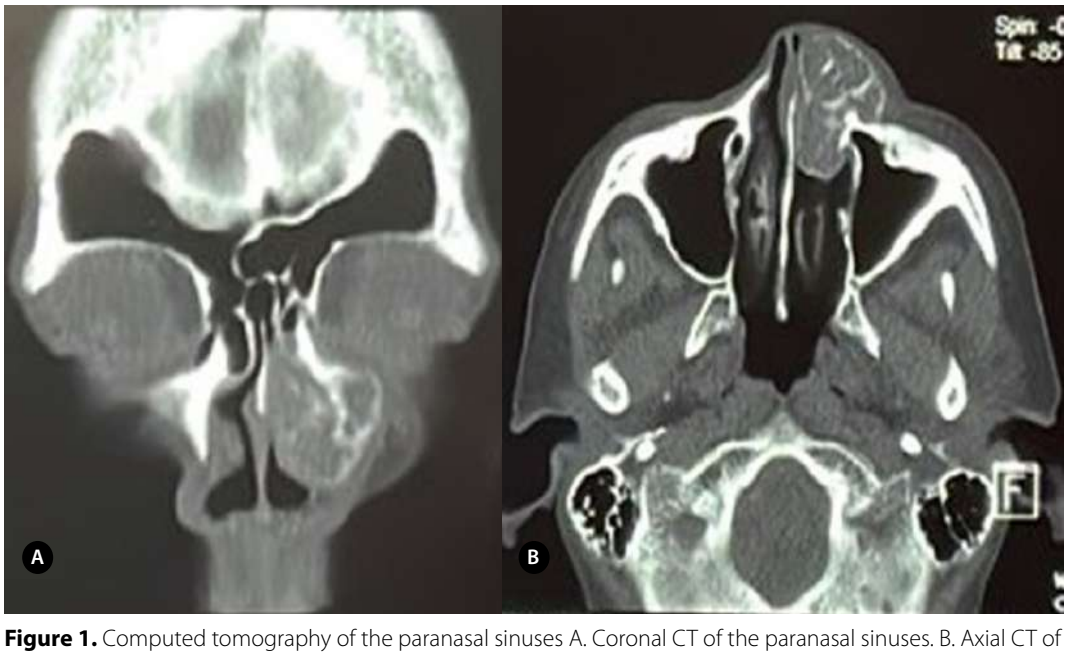

Figure 1. Computed tomography of the paranasal sinuses A. Coronal CT of the paranasal sinuses. B. Axial CT of the paranasal sinuses showing an ossifying fibroma in the left nostril

Table 1. Laboratory tests.

Laboratory tests	Result
Hemoglobin	10.3 g/dL
Leukocytes	6.74 x10^3/mm^3
Neutrophils	85.7 %
Platelets	214 x103/mm^3
Urea nitrogen	78 mg/dL
Creatinine	14.4 mg/dL
Glomerular filtration rate	2.7 mL/min/1.73

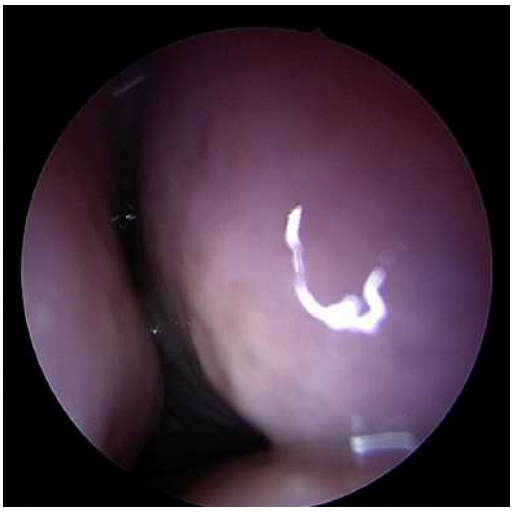

Figure 2. Endoscopic view of a tumor with bulging of the lateral wall of the left nasal fossa.

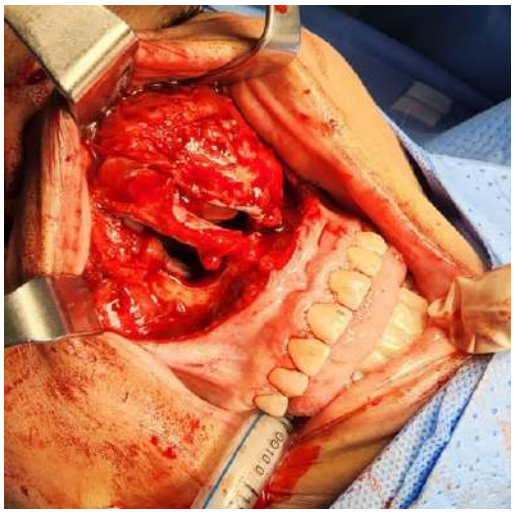

Figure 3. Facial degloving plus Left Medial Maxectomy with exposure of ossifying fibroma.

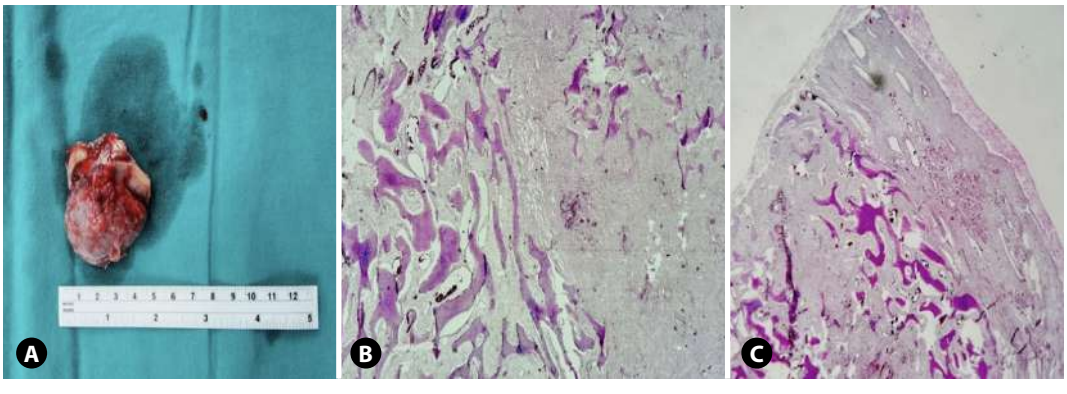

Figure 4. A. 5 x 5 cm tumor found during surgical procedure . B. Completely calcified multinodular fragment. C. Calcified sample with respiratory epithelium.

No abnormality was observed in the right nostril.It is concluded with the excision of the tumor in block plus left medial maxillectomy.

Outcome

In the immediate postoperative period, an anterior nasal packing was placed with wicks, for which he received hospital treatment with ceftriaxone 1 g every 12 hours, tramadol 50 mg every eight hours and dexamethasone 8 g every eight hours, all via intravenous and for two days, noting a progressive decrease in facial edema and improvement of pain.

Hospital discharge was indicated on the third day after the surgery. Then, one week later, the patient was scheuled for a control evaluation where she presented a good clinical evolution, in which a decrease of the facial edema was observed, and no bleeding was evidenced nasal.

She was followed up for one year at multiple controls, and to date, there is no presence of a tumor in the nasal dorsum.

Clinical diagnosis

Clinical evaluations through physical examination, imaging and histological studies allowed the diagnosis of ossifying fibroma in the left nasal fossa.

Discussion

Ossifying fibroma is a benign, well-circumscribed, slowly expanding fibro-osseous tumor characterized by a solitary lesion exhibiting focal replacement of normal bone by a variable mixture of dense connective tissue, mineralized tissue, and cementum.[xvi] It is important to note that the lesion usually develops in the third to fourth decade of life and has a predilection for females.[xvi]

Cases of ossifying fibroma have been described in a 12-year-old boy in the sphenoid sinus, where the tumor was removed by sphenoidotomy without median turbinectomy.[xiv] Postoperative imaging studies in this patient confirmed that the sphenoid sinus had cleared and the tumor did not recur for two years.[xiv]

The predominantly affected sites are the head and neck region, with the mandible being the most frequent (70 - 80 % of cases), followed by the maxilla, orbit and paranasal sinuses.[xvi] The literature mentions tion that the etiology of ossifying fibroma is unknown, but it is thought to arise from incomplete migration of blast cells multipotent mesenchymal cells which they give rise to the periodontal ligament.[xvi]

In the case of this patient, it is important to the presence of chronic kidney disease, which may predispose to the development of fibroma ossificans. Trauma is also mentioned that it could play an etiological role, at least in some cases.[xvi]

Computed tomography is the gold standard for the evaluation of os sinonasal theoma. They appear well circumscribed described as dense masses that can be homogeneous or heterogeneous depending on the histological subtype.[ii]

Transvasar endoscopic surgical resection is the main surgical procedure for nasal ossifying fibroma, taking into account that, due to its location, the tumor has a rich blood supply, which increases the risk of intraoperative hemorrhage.[xiii]

Fibro-osseous lesions are a differential diagnosis when evaluating a patient with long-standing otorhinolaryngological symptoms; in this case, the differential diagnoses of an ossifying fibroma are fibrous dysplasia, osteoma, osteoblastoma, osteosarcoma, among others; therefore, for proper management, it is important to have a preoperative image that reveals the involvement of the surrounding tissue when planning treatment, whether conservative management or surgery, being computed tomography of paranasal sinuses, the ideal tool.

These lesions should be managed according to clinical appearance, radiographic features, and related morbidity, all due to the intricate anatomical positions of such tumors within the orbits and skull base, as well as the increasing propensity surrounding nearby neurovascular pathways, making histopathologic examination and surgical excision of such tumors difficult.[iii]

It is important to mention that transnasal endoscopic surgical resection is the main treatment for the resection of nasal ossifying fibroma. Endoscopic surgery of the nasal sinuses with image navigation and resection with lateral nasal butterfly incision has been considered available; which assures the total tumor excision and at the same time maintains the patient's esthetics.[xv]

The prognosis of ossifying fibroma is good, and malignant transformation or metastasis has never been described. It is important to note that it has a recurrence rate of 30 % to 56 %, so close long-term clinical and radiological follow-up is essential, even in the case of microscopically confirmed complete resection.[xvi,xvii]

Ethical aspects

For the publication of this case, informed consent was obtained from the patient and the responsible person, both for the hospital care in which the physical examination was performed and for the publication of this article, with the commitment to maintain the patient's privacy, as established in the Helsinki Declaration.

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Case report

Autoimmune encephalitis due to anti-NMDAR antibodies following dog bite and dT vaccination

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Abstract
Case presentation. A 17-year-old male patient, following a dog bite and vaccination against diphtheria and tetanus, presented neuropsychiatric symptoms characterized by seizures, altered state of consciousness, right fasciobrachiocrural hemiparesis, dyskinesias, myoclonus, irritability, echolalia, euphoria, sialorrhea, progressive loss of speech, and dysautonomic syndrome. **Treatment.** We ruled out metabolic, toxicological, infectious, ischemic, hemorrhagic, and traumatic disorders. The electroencephalogram reported a generalized delta rhythm, and we determined the presence of pleocytosis and antibodies against the anti-N-methyl-D-aspartate receptor in the cerebrospinal fluid. We ruled out a paraneoplastic syndrome, and considered a possible adverse event related to vaccination against diphtheria and tetanus. We initiated specific treatment in the following consecutive order: immunoglobulin, methylprednisolone pulses, and plasmapheresis. Levetiracetam and phenytoin were administered as anticonvulsants; quetiapine and haloperidol were prescribed for the psychotic symptoms. The dysautonomic syndrome was treated with propranolol. **Outcome.** After the third plasma exchange session, the patient's alertness and level of attention improved, and the dyskinesias resolved. Psychiatric symptoms disappeared three days after the end of the plasma exchange sessions. Four months after hospital discharge, the patient had recovered all higher mental functions and was walking adequately; however, dysarthria persisted.
Keywords
Autoimmune Diseases of the Nervous System, Receptors, N-Methyl-D-Aspartate, Seizures.

Resumen
Presentación del caso. Paciente masculino de 17 años, que posterior a la mordedura de un perro y vacunación contra la difteria y tétanos, presentó síntomas neuropsiquiátricos caracterizados por convulsiones, alteración del estado de conciencia, hemiparesia fasciobraquiocrural derecha, discinesias, mioclonías, irritabilidad, ecolalia, euforia, sialorrea, pérdida progresiva del lenguaje y síndrome disautonómico. **Intervención terapéutica.** Se excluyeron alteraciones metabólicas, toxicológicas, infecciosas, isquémicas, hemorrágicas y traumáticas. El electroencefalograma reportó ritmo delta generalizado y se determinó pleocitosis y anticuerpos contra receptor N-metil-D-aspartato en el líquido cefalorraquídeo. Se descartó un síndrome paraneoplásico y se consideró un posible evento adverso a la vacunación contra la difteria y tétanos. Se instauró tratamiento específico en el siguiente orden consecutivo: inmunoglobulina, pulsos de metilprednisolona y plasmaféresis. Se administró levetiracetam y fenitoína como anticomiciales y quetiapina con haloperidol para el estado psicótico. El síndrome disautonómico fue tratado con propanolol. **Evolución clínica.** A partir de la tercera sesión de plasmaféresis, mejoraron el estado de vigilia, el nivel de atención,y cesaron las discinesias. A los tres días de finalizar las sesiones de recambio plasmático se ausentaron los síntomas psiquiátricos. A los cuatro meses del egreso hospitalario había recuperado todas sus funciones mentales superiores y ejecutaba adecuadamente la marcha; sin embargo, persistía la disartria.
Palabras clave
Encefalitis Autoinmune, Receptores de N-Metil-D-Aspartato, Crisis Convulsivas.

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Encefalitis autoinmune por anticuerpos anti–NMDAR posterior a mordedura de perro y vacunación con dT

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Introduction

Anti-N-methyl-D-aspartate receptor antibody (anti-NMDAR) encephalitis is a rare autoimmune disease that is often underdiagnosed. The pathophysiology is due to the binding of autoantibodies that cause neuronal dysfunction.[i] The mortality rate of autoimmune encephalitis is arround eight to 18.5 %[ii] and approximately 20 % of survivors have sequelaes.[iii] The clinical presentation includes psychiatric disturbances, cognitive impairment, seizures, focal neurological deficits, movement disorders, loss of consciousness

and dysautonomia.[iii,iv] Early diagnosis and targeted treatment can lead to better outcomes in most patients.[iv] First-line treatment is based on the administration of immunoglobulin, corticosteroids and/or plasmapheresis.[iii,v] The aetiology of autoimmune encephalitis is largely unknown, but it is often associated with a tumour or a previous infectious nexus (post-infectious encephalitis).[v,vi] Isolated cases have been reported in which vaccination has been implicated as the triggering event for anti-NMDAR encephalitis.[vi]

The differential diagnosis of autoimmune encephalitis includes primary psychiatric disorders, drug abuse, infectious encephalitis and even rabies.[vii] In this study, we report a case of anti-NMDAR autoimmune encephalitis with an aetiological and differential diagnostic challenge due to a history of dog bite and vaccination against diphtheria and tetanus. The aim of this work was to describe the therapeutic and multidisciplinary approach to make timely decisions that affected the patient's prognosis.

Case presentation

Seventeen-year-old male patient with no relevant medical history who received dT vaccine (diphtheria and tetanus) four days after being bitten by a dog on the right foot. Three hours after vaccination, he presented with generalised tonic-clonic seizures with posictal phase, somnolence and right fasio-brachio-crural hemiparesis. He was admitted to a second-level hospital for seven days, where serology (HIV, VDRL, hepatitis B and C, febrile agglutination tests) and drug toxicology (marijuana, cocaine, barbiturates, opioids, amphetamines, methamphetamines) were negative. No conclusive diagnosis was made and he was discharged with home treatment of carbamazepine 400 mg every 12 hours. However, the patient did not recover his baseline neurological status, and also presented psychiatric changes (irritability, echolalia, inattention, abulia, euphoria), abnormal orofacial movements, limb dystonia and progressive loss of speech.

Fourteen days after vaccination, the patient again presented with generalized tonic-clonic seizures that did not resolve with diazepam and did not respond to a loading dose of phenytoin, requiring additional levetiracetam impregnation and induction. He was admitted to intensive care for deterioration of consciousness, seizures and dysautonomic syndrome (fever, tachycardia, tachypnea, profuse diaphoresis and hypotension). Physical examination revealed horizontal nystagmus, sialorrhea, hyperreflexia, myoclonus of the right upper and lower limbs, and dyskinetic movements of the mouth and extremities.

Complementary tests were ordered, including haemogram, renal and liver profile, ionogram, thyroid hormones and vitamin B12 levels, which were normal. Cerebrospinal fluid (CSF) analysis, meningitis-encephalitis panel, imaging studies and electroencephalogram were also performed. CSF polymerase chain reactions for bacteria, viruses and fungi were negative. CSF cytochemistry at 14 and 19 days after symptom onset showed pleocytosis, adequate CSF albumin/serum ratio, protein, glucose and lactate dehydrogenase (LDH) within normal limits (Table 1), and culture without bacterial growth.

Table 1. Cytochemical study of cerebrospinal fluid

Date: 06/07/2024: (14th day following the initial onset of the clinical condition)	**Date: 10/07/2024: (19th day following the initial onset of the clinical condition)**
pH: 8	pH: 8
WBC: 32 000	WBC: 14 000
Neutrophils: 9 %	Neutrophils: 14 %
Lymphocytes: 91 %	Lymphocytes: 86 %
Protein: 16.7 mg/dL	Protein: 29.8 mg/dL
Albumin: 10.9 mg/dL	Albumin: 18.8 mg/dL
Glucose: 70.9 mg/dL	Glucose: 79.3 mg/dL
LDH: 11.8 u/L	LDH: 9.78 u/L
RBC: ++	RBC: abundant

WBC: White blood cells
LDH: Lactate dehydrogenase
RBC: Red blood cells

We did not identified alterations on cranial tomography and magnetic resonance imaging of the brain, both simple and contrasted. The 15-minute electroencephalogram (performed 48 hours after admission for logistical reasons), with the patient in a waking state and with anti-commitment treatment in place, reported a generalized delta rhythm of greater amplitude in the left hemisphere and bilateral frontal regions.

During the consultation with the neurology specialty, the possible diagnosis of autoimmune encephalitis was suggested on the basis of the following criteria: CSF pleocytosis, abnormal electroencephalogram (slow activity), altered mental status, psychiatric symptoms, cognitive alterations and exclusion of other etiologies (infectious, metabolic, traumatic, ischemic, hemorrhagic and toxicological).

In consideration of the established association between autoimmune encephalitis and preneoplastic syndromes, we conducted studies to identify extracranial neoplasms. These studies involved the utilisation of computed axial tomography of the thorax, abdomen and pelvis, in addition to the assessment of tumour markers. The results of these studies were normal. Testicular ultrasound revealed a simple cyst of the left epididymis, which was deemed to be of no clinical significance. We suspected that autoimmunity was triggered by the dT vaccine.

Treatment

The patient was initiated on a course of specific treatment involving human immunoglobulin (20 grams daily, calculated to a body weight of 50 kg) for a duration of five days. However, this treatment did not result in any clinical improvement. Consequently, a prescription of one gram of methylprednisolone was issued for a period of three days, followed by six sessions of plasmapheresis. In response to the seizures observed during the initial admission, treatment with phenytoin and levetiracetam was initiated to address the periods of irritability and psychomotor agitation, antipsychotics such as quetiapine and haloperidol were administered. The dysautonomic syndrome was managed with the administration of propanolol.

Outcome

During his stay in intensive care, his mental state fluctuated between hypersomnia and periods of psychomotor agitation with verbigeration and abnormal postures. Dyskinetic movements, myoclonias and oculogyric crises were frequent.

After a lack of response to immunoglobulin, corticoid pulses and plasmapheresis were indicated. From the third plasma exchange session onwards, a significant clinical progress was observed, with improvement of attention state, gradual cessation of dyskinesias and improvement of wakefulness.

At 72 hours after the end of the six plasmapheresis sessions, he showed behavioural control with no psychiatric symptoms, he interacted with the environment and carried out simple commands, but he still had gait ataxia and speech recovery was slow. Four weeks after hospitalisation, he was discharged with treatment of prednisone 50 mg daily (with gradual tapering), azathioprine 50 mg daily, quetiapine 50 mg three times a day, risperidone 1 mg one hour before bedtime and physiotherapy.

We did outpatient monitoring, and four months after discharge from hospital, he had preserved higher mental functions and normal gait, but continued to have dysarthria.

Clinical diagnosis

The diagnosis was confirmed by CSF antibody analysis by indirect immunofluorescence technique, which was positive with a titer greater than 1/10 for anti-NMDAR antibodies.

Discussion

Anti-NMDAR encephalitis is the most studied form of autoimmune encephalitis, affecting one in 1.5 million people per year,[iii,v] tiene predilección has a female predilection with a female to male ratio of 4:1,[viii] and although it predominates in young people, the age of the affected population ranges from two months to 85 years.[viii,ix]

In its paraneoplastic aetiology it is associated with tumours such as ovarian teratoma, lung cancer, breast cancer, testicular tumours, thymic carcinoma, pancreatic cancer, prostate cancer, Hodgkin's lymphoma, pineal dysgerminoma, neuroblastoma, and other benign and precancerous lesions.[x] In men and young people, the tumour relationship is less frequent,[x] but after the diagnosis of encephalitis by anti-NMDAR, it is indicated to rule out the above neoplasms.[iii]

Clinical manifestations of autoimmune encephalitis include neuropsychiatric signs and symptoms such as apathy, anxiety, fluctuating consciousness, bizarre behaviour, dyskinesias, aphasia, amnesia, apraxia, sleep-wake cycle disorder, irritability and delirium, focal or generalised seizures, and dysautonomic disturbances.[xi]

The diagnosis of anti-NMDAR autoimmune encephalitis is complex. Infectious, toxic, metabolic, psychiatric, rabies, demyelinating disorders, gliomas, lymphomas, prion illnesses and other autoimmune diseases must be excluded.[xii-xiv]

Proposed criteria for considering a possible autoimmune encephalitis include: rapid onset of symptoms (less than three months), psychiatric symptoms, movement disorders, decreased level of consciousness, cognitive impairment, seizures, signs of neurological focalization, speech dysfunction, dysautonomia, abnormal electroencephalogram, pleocytosis or oligoclonal bands in CSF, and exclusion of other causes.[xiii-xv] This patient fulfilled all of the above criteria.

IgG anti-NMDAR antibodies are detected by indirect immunofluorescence in serum and CSF,[iii] with analysis in CSF being more cost-effective due to its higher sensitivity.

In a recent study, the sensitivity for detecting the presence of anti-NMDAR antibodies in blood was 68-73 %, whereas the sensitivity in CSF was 99 %; in both cases, the specificity is 99 %.[xvi] Anti-NMDAR antibody titers in CSF and blood may vary depending on the time of diagnosis (they are always present in CSF but only 13.2 % in serum);[xvii] association with paraneoplastic processes (high serum titers are more often associated with teratomas); finally, high antibody titers are associated with poor prognosis.[xvi,xvii]

The electroencephalogram may show non-specific findings such as generalised slowing with theta or delta waves, focal or generalised seizures, excessive beta activity, extreme brush delta.[xiii,xviii]

Regarding imaging studies, magnetic resonance imaging (MRI) shows changes in only 20-50 % of patients and is often normal or with mild changes even in comatose patients with anti-NMDR encephalitis.[xi] In the early stages, MRI shows normal images; however, three to six months after clinical onset, hyperintense lesions can be observed in the temporal lobe, occipital and hippocampal areas, particularly on Fluid Attenuated Inversion Recovery (FLAIR) sequence.[xix]

The primary treatment for autoimmune encephalitis includes corticosteroids (1 g of methylprednisolone IV for 3-5 days), intravenous immunoglobulins (0.4 g/kg/day for five days) and plasmapheresis.[iii] Initial immunotherapy has been shown to produce improvement in 53 % of patients within the first four weeks, and 97 % show favourable results at 24 months.[x] A significant recovery (absence of sequelae or minimal disability) is observed in 75 % of patients with NMDA receptor antibody encephalitis, while the remaining 25 % may exhibit severe deficits or eventual mortality.[x]

In relation to long-term immunosuppressive therapies, such as rituximab, cyclophosphamide, mycophenolate mofetil and azathioprine, there is a lack of substantial data regarding their efficacy. Nonetheless, these therapies are typically recommended with the objective of attenuating disease severity, minimising chronic corticosteroid utilisation, ensuring prolonged disease management and mitigating the risk of recurrence.[xx]

In the analysis of this case, it is necessary to consider the differential diagnosis with rabies encephalitis. Firstly, rabies is known to produce significant psychiatric alterations, including extreme agitation, altered levels of consciousness, abnormal movements, hypersalivation and other autonomic alterations that are similar to those seen in anti-NMDAR encephalitis;[xxi] However, rabies presents with aerophobia and hydrophobia, elevated CSF protein levels,[xxii] and, in contrast to anti-NMDAR encephalitis, brain MRI is frequently normal. Conversely, MRI of rabies patients often reveals symmetric grey matter involvement of the dorsal brainstem, thalamus, basal ganglia, or central region of the spinal cord.[xxiii,xxiv] Once symptoms have manifested, there is no treatment for rabies.[xxi] In this patient, the diagnosis of rabies encephalitis was excluded on the basis of a comprehensive analysis of the clinical and radiological data. This determination was made in light of the patient's history of rabies immunization, the absence of any suspicious signs exhibited by the dog, and the absence of any documented cases of rabies in humans in Ecuador over the past 14 years.[xxv]

Although autoimmune encephalitis can be idiopathic, the most common triggers are viral and paraneoplastic diseases.[xxvi] However, cases of autoimmune encephalitis have been reported in association with a history of recent vaccination. In the study on disproportionality conducted by Martin *et al.*,[xxvii] which utilised pharmacovigilance data from the World Health Organization, 51 vaccines were identified as potentially associated with the occurrence of anti-NMDAR encephalitis, including: The following vaccines are recommended: human papillomavirus (HPV), diphtheria/pertussis/tetanus/polyomyelitis (DTP-polio), influenza, varicella-zoster, pneumococcal, *Haemophilus influenzae* type b, SARS-CoV-2, yellow fever, rabies, typhoid, hepatitis A and B. The median time to onset of illness following vaccination was found to be four days (range: 0-730). The most probable vaccines associated with anti-NMDAR encephalitis were HPV (15.7 %), DTP-polio (15.7 %), and influenza (13.7 %), with the likelihood ratio demonstrating a higher probability with DTP-polio.[xvii]

One hypothesis that aims to explain the pathophysiology of vaccines as triggers of anti-NMDAR autoimmune encephalitis is the molecular mimicry of the microRNA of the viral or bacterial particles used in vaccines and the proteins of the NMDA receptor.[xxviii] While the development of anti-NMDAR encephalitis in this patient cannot be directly attributed to vaccination, the existence of a temporal relationship, in addition to the exclusion of other potential causes, raises the possibility of a post-vaccination event. The aforementioned fact was communicated to the National Health System of Ecuador.

Autoimmune encephalitis has been observed to result in neuropsychiatric symptoms, often accompanied by frequent and disabling sequelae that may persist for weeks or months. The early initiation of and response to first-line treatment were found to be valuable predictors of prognosis in this patient. Consequently, the implementation of meticulous monitoring post-discharge facilitates the identification of persistent cognitive, psychiatric, motor, or linguistic impairments, which necessitate rehabilitation and/or pharmacological interventions.

Differential diagnoses of autoimmune encephalitis include viral encephalitis, such as rabies, however, clinical and epidemiological knowledge guide the diagnosis.

Although autoimmune encephalitis may be idiopathic, the observed relationship between vaccination and the onset of this disease, as well as the documented case reports that link these two factors, give rise to the hypothesis of an anti-NMDAR encephalitis that manifests in the aftermath of vaccination, particularly in instances involving the dT vaccine. Nevertheless, that the causal relationship between these two factors remains unconfirmed.

Vaccines have been shown to have a significant impact on the reduction of morbidity and mortality associated with infectious diseases. However, it is important to acknowledge the minor adverse effects that have been observed. The timely identification of these effects enables the implementation of necessary measures, which can contribute to achieving optimal recovery rates. In order to improve upon and validate these findings, it is necessary to conduct large-scale, prospective, randomized, controlled studies that establish a causal relationship between autoimmune encephalitis and vaccination.

Ethical aspects

Informed consent was obtained from the patient's legal representative (the mother) for the use of clinical data and the publication of results. It is asserted that the ethical guidelines for human research established by the Ministry of Public Health of Ecuador and the Helsinki Declaration were adhered to in their entirety throughout the course of the study.

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Case report

Longitudinal transverse myelitis as a clinical manifestation of Neuropsychiatric Systemic Lupus Erythematosus

DOI: 10.5377/alerta.v8i2.20135

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Abstract
Case presentation. A 22-year-old woman with a history of systemic lupus erythematosus, depression and epilepsy, allergic to hydroxychloroquine, who consulted for diarrhea, arthralgias, eyelid oedema, retro auricular pain and odynophagia. She was hospitalized for an infectious condition but requested voluntary discharge on the third day. She consulted again a week later with symptoms of ascending paraparesis, dysphagia, difficulty in urination and defecation, purplish macules on the legs, continuous fever, disorientation and psychomotor agitation. **Treatment.** She was admitted to the critical care unit. Cerebrospinal fluid, nerve conduction velocity (severe acute axonal motor polyneuropathy), and magnetic resonance imaging compatible with longitudinal myelitis were performed. **Outcome.** The patient was hospitalized for 140 days. Her evolution was monitored and physiotherapy and training for her relatives was coordinated for three days before her discharge from hospital. One month after home care, the patient was readmitted to hospital with sepsis of urinary origin and died.
Keywords
Transverse Myelitis, Lupus Erythematosus, Systemic, Autoimmune Diseases.

Resumen
Presentación del caso. Se presenta el caso de una mujer de 22 años, con antecedentes de lupus eritematoso sistémico, depresión y epilepsia, alérgica a la hidroxicloroquina, que consultó por diarrea, artralgias, edema palpebral, dolor retro auricular y odinofagia. Fue hospitalizada por un cuadro infeccioso, pero solicitó el alta voluntaria al tercer día. Regresó, una semana después con un cuadro de paraparesia ascendente, disfagia, dificultad para micción y defecación, máculas violáceas en piernas, fiebre continua, desorientación y agitación psicomotriz. **Intervención terapéutica.** Fue admitida en la Unidad de Cuidados Críticos. Se realizó estudio de líquido cefalorraquídeo, velocidad de conducción nerviosa que indica una polineuropatía motora axonal aguda severa; y resonancia magnética compatible con mielitis longitudinal. **Evolución clínica.** La paciente estuvo hospitalizada durante 140 días. Se monitoreó su evolución y se coordinó fisioterapia y entrenamiento para sus familiares durante tres días antes de su alta hospitalaria. Un mes después de recibir cuidados en casa, la paciente reingresó al hospital con un cuadro de sepsis de origen urinario y falleció.

Palabras clave
Mielitis Transversa, Lupus Eritematoso Sistémico, Enfermedad Autoinmune.

Introduction

Neuropsychiatric lupus (NPSLE) is an ongoing challenge in both diagnosis and therapeutic management. NPSLE occurs in up to 50-60 % of patients with systemic lupus erythematosus (SLE),[i] within this broad spectrum, myelopathies account for only 0.5-1 % of cases and are often associated with other neuropsychiatric disorders.[ii,iii]

Acute transverse myelitis is a potentially devastating neurological syndrome characterized by acute inflammation of the spinal cord resulting in motor, sensory and/or autonomic dysfunction. When it involves more than three spinal segments, it is referred to as longitudinally extensive transverse myelitis (LETM). Clinical presentation is variable and may manifest as lower motor neuron syndrome with flaccidity and hyporeflexia or upper motor neuron syndrome with spasticity and hyperreflexia. Up to 80 % of cases present with paraparesis, paraplegia, quadriparesis, or quadriplegia, which may even lead to the death of the patient. Approximately 70 % of cases present with autonomic disturbances such as sphincter dysfunction, bowel motility disorders, thermoregulatory abnormalities, and cardiac arrhythmias.[ii,iii,iv]

Transverse myelitis associated with systemic lupus erythematosus (SLE-TM) is a rare but serious complication of SLE, occurring in 0.5 % to 1 % of patients. However, it may manifest in up to 30-60 % of cases.[ii] Therefore, the present case was selected for description.

Generally, these tumors do not present symptoms and are incidental findings. The presence of metastatic lesions is infrequent, and there is no consensus as to the ideal management in these cases since these solid pseudopapillary tumors of the pancreas do not respond adequately to chemotherapy or radiotherapy, so surgical resection is the ideal curative treatment, even in the presence of metastatic lesions.[vi] Due to the infrequent nature of the pathology, this case is considered to be of interest, as only isolated cases have been reported.

Case presentation

A 22-year-old woman, whose primary occupation was domestic work, presented with a history of systemic lupus erythematosus (SLE) diagnosed in 2017. The patient reported a history of allergy to hydroxychloroquine and a medical history significant for depression and epilepsy, for which she had been receiving treatment with fluoxetine and carbamazepine, respectively, for the past three years. However, in 2020, she ceased her medical follow-up due to the COVID-19 pandemic. Her obstetric history included two miscarriages, one at 20 weeks and another at ten weeks of gestational age, both of which occurred in 2022.

The patient initially sought medical attention for diarrhea. She presented to the emergency department of the Rosales National Hospital with a 15-day history of generalized arthralgias, bilateral eyelid edema, profuse diarrhea, retroauricular pain, and odynophagia. She was admitted to the hospital with a diagnosis of acute gastroenteritis and received intravenous (IV) fluids and ciprofloxacin 200 mg IV every 12 hours. On the third day of hospitalization, the patient requested voluntary discharge.

A week later, the patient returned to the emergency department with a four-day history of ascending paraparesis, dysphagia, urinary and fecal retention, and the appearance of purplish macules on both legs. She also exhibited continuous fever for three days, along with one day of disorientation and psychomotor agitation.

Upon admission, the patient's vital signs were as follows: blood pressure of 107/56 mmHg, heart rate of 110 beats per minute, respiratory rate of 22 breaths per minute, and axillary temperature of 40°C. The patient exhibited symptoms consistent with hypoactivity, disorientation, and dehydration. Notable findings on physical examination included malar erythema, bilateral eyelid edema, dry mucous membranes, decreased bowel sounds, and multiple irregular purplish macules located on the distal thirds of both legs (Figure 1). The osteotendinous reflexes were graded as 3+/4 in all four extremities, and muscle strength was assessed as 3/5 in both lower limbs according to the Daniels scale.

Laboratory tests revealed non-hemolytic anemia without evidence of bleeding or melena, leukocytosis with neutrophilia, elevated transaminase levels, and nephrotic-range proteinuria, with fluctuations observed throughout the clinical course (Table 1). On May 20, 2023, a C-reactive protein (CRP) test was conducted, yielding a result of 136.65 mg/dL, which remained elevated during the course of treatment (Table 1). On May 12, 2023, the patient's C-reactive protein (CRP) levels increased to 177.51 mg/dL, accompanied by an increase in aspartate aminotransferase (AST) to 193 U/L, alanine aminotransferase (ALT) to 150 U/L, and lactate dehydrogenase (LDH) to 541 U/L.

The patient was admitted to the Critical Care Unit on April 21, 2023, where a cerebrospinal fluid (CSF) analysis was performed. The CSF sample was colorless, containing 280 red blood cells, 30 leukocytes, a glucose level of 39.7 mg/dL, and a protein concentration of 85.8 mg/dL. These findings were consistent with an infectious or inflammatory process of the central nervous system, such as vasculitis. Consequently, the patient underwent further laboratory and imaging studies. Nerve conduction studies revealed a severe acute motor axonal polyneuropathy. (Figure 2).

Treatment

Given the high suspicion of a coexisting infectious process, it was decided to initiate therapy with human immunoglobulin for five consecutive days, at a dose of 0.4 g/kg/day. Furthermore, a course of antibiotic therapy was initiated, comprising ceftriaxone 2 g IV daily and Metronidazole 500 mg IV every eight hours for a duration of three days. This was followed by piperacillin/tazobactam 4.5 g IV every eight hours until a total of ten days had elapsed. The results of blood cultures and bronchial secretion culture were negative, prompting the decision to initiate treatment with three days of methylprednisolone pulses at a dose of 1 g daily.

Figure 1. Evolution of macular lesions to deep ulcers from the date of admission to the intensive care unit.

Table 1. Laboratory tests throughout evolution

Date	14/04/23	26/04/23	01/06/23	12/06/23	11/07/23
Hb	13.1 g/dL	6.8 g/dL	7.2 g/dL	8.4 g/dL	9.8 g/dL
Platelets	333 000 /L	288 000/L	155 000/L	435 000/L	195 000/L
WBC	15 600/mm^3	18 400/mm^3	18 320/mm^3	21 600/mm^3	5740/mm^3
Neutrophils	12 640//mm^3	16 280/mm^3	15 720/mm^3	18 220/mm^3	3200/mm^3
Lymphocytes	1840/mm^3	1070/mm^3	2120/mm^3	2690/mm^3	2020/mm^3
Creatinine	0.81 mg/dL	0.41mg/dL	0.44 mg/dL	0.35 mg/dL	0.42mg/dL
Glucose	103 mg/dL	92 mg/dL	122 mg/dL	89 mg/dL	95 mg/dL
Total biblirubin	0.57 mg/dL	-	-	0.76 mg/dL	-
Direct biblirubin	0.19 mg/dL	-	-	0.19 mg/dL	-
Albumin	4.15g/dL	2.26g/dL	-	2.94g/dL	3.77g/dL
Others	**GUT: Protein: 15 mg/dL. leukocyte esterase 75 Leu/µL. red cells: 1xField. leukocytes: 5per Field. no casts.	Procalcitonin (central med lab):2.15 ng/m	PCR: 227.57mg/dL	PCR: 135.92mg/dL	PCR: 8.51mg/dL

*GUT: General urine test.

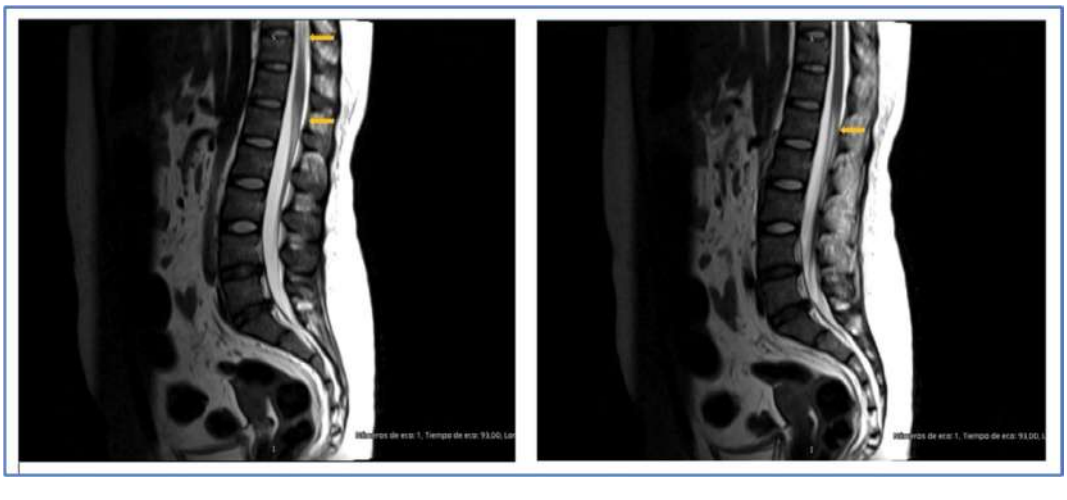

Figure 2. MRI shows hyperintense dorsolumbar spinal cord segments corresponding to demyelinating lesions involving more than three segments (T10-T11, T12-L1, and L1-L2).

Afterwards, the patient exhibited a healthcare-associated superinfection in the lower limb ulcers, caused by *Pseudomonas aeruginosa*. Consequently, glucocorticoid pulses were discontinued, and intermediate doses of hydrocortisone (100 mg every eight hours) were maintained. The administration of antibiotics was guided by an antibiogram, which revealed sensitivity to carbapenemics. This led to the completion of a ten day course of Meropenem 1 g every eight hours.

Approximately four weeks after admission to the intensive care unit and subsequent receipt of the MRI report, plasmapheresis therapy was initiated for a duration of five days.

Outcome

The patient remained hospitalized for a total of 140 days. Despite initial management with human immunoglobulin, there was no improvement in neurological manifestations or laboratory tests. Subsequent to a five-day course of plasmapheresis, the patient's condition was closely observed. This monitoring revealed the persistence of paresis in the upper limbs, paraplegia, and hyperalgesia in both legs. The patient was discharged from the hospital after three days of physiotherapy and training for her relatives. She was clinically stable.

One month after the initiation of home care and treatment, which included a daily dosage of 15 mg/day of prednisone, 100 mg/day of acetylsalicylic acid, and indomethacin administered on an as-needed basis for arthralgias, the patient continued to receive physiotherapy and assisted feeding. However, the patient was readmitted to the hospital for sepsis of urinary origin, a complication stemming from chronic bladder catheterization. The patient was treated with meropenem; however, her condition deteriorated, and she expired 72 hours after admission due to septic shock secondary to urosepsis.

Clinical diagnosis

The diagnosis was based on the clinical suspicion of a demyelinating condition associated with neuropsychiatric lupus, which was confirmed by magnetic resonance imaging.

Discussion

Demyelinating syndromes represent a minor proportion of the neuropsychiatric manifestations associated with SLE. However, following cases of trauma and infection, autoimmune diseases have been identified as the third most significant cause of demyelinating myelopathy.[iv]

The manifestation of extensive longitudinal myelitis can vary significantly, often resulting in a lower motor neuron picture characterized by flaccidity and hyporeflexia, or an upper motor neuron picture marked by spasticity and hyperreflexia.[ii] Myelitis is generally understood to be the result of a complex pathophysiological mechanism, which is typically triggered by a combination of factors, including but not limited to, trauma or infection. However, in the context of SLE, it has been postulated that its etiology may be associated with ischemia or thrombosis.[v] Despite the uncertainty surrounding the pathophysiological mechanisms, several theories have been postulated. These include dysfunction of the blood-brain barrier, de novo production of BAFF (B-cell activating factor, belonging to the TNF family) in the central nervous system, mechanisms mediated by autoantibodies (including antiphospholipid, antimyelin, and anti/Ro antibodies), and the vascular theory (presence of vasculitis).[ii]

Myelopathies in SLE typically manifest approximately five years following diagnosis, with symptoms including fever in up to 57 % of patients, leukopenia in 48 %, and hypocomplementemia in 75 % of cases. A frequent association has been observed between the condition and antiphospholipid antibody positivity.vi In the case described, myelopathy manifested six years after diagnosis and was accompanied by fever. However, no evidence of an infectious cause was identified from the onset of symptoms until the administration of plasmapheresis.

An adequate diagnosis of transverse myelitis necessitates the performance of a nuclear magnetic resonance, which is regarded as the optimal diagnostic modality in this clinical context. This technique not only allows visualization of the spinal lesions, but also to rule out other treatable causes, such as tumors, abscesses and other lesions, helping to delimit the origin of the myelopathy.[vii] In select cases, it may also be necessary to measure specific antibodies in cerebrospinal fluid (CSF).

In this particular case, MRI revealed hyperintense T2 images at the level of the T10 T11, T12-L1, and L1-L2 segments. These findings are consistent with those reported in the extant literature. In patients diagnosed with SLE, this particular type of involvement is often characterized by its extensive nature, which can manifest as either longitudinal or centromedullary myelitis.[vii]

Treatment of transverse myelitis in the context of SLE involves the administration

of methylprednisolone pulses at a dose of 1 g/day for three days. In the absence of immunosuppression, the recommended dosage of cyclophosphamide is 0.75 1 g/m^2 body surface area, administered monthly for six months, followed by quarterly pulses of cyclophosphamide for up to two years.[viii,ix]

Plasmapheresis has been observed to be an effective option, particularly when initiated within the first 20 days from the onset of symptoms and in cases that do not respond to the use of high-dose corticosteroids.[vii] However, no change in prognosis has been demonstrated with the use of the latter therapy.[viii]

Patients diagnosed with transverse myelitis frequently experience prolonged complications. The recovery period following transverse myelitis typically commences two to twelve weeks after the onset of symptoms and can extend up to two years. However, in the absence of improvement over a period of three to six months, a substantial recovery is improbable, resulting in a range of prognoses. 1) Favorable (if recovery in 3-6 months): The treatment of young patients with early intervention has been demonstrated to yield positive outcomes. 2) Intermediate: The persistence of mild-to-moderate motor deficits has been observed. 3) Poor: patients exhibiting extensive involvement, defined as more than six segments affected, in conjunction with an inadequate response to corticosteroids or seropositivity for anti-aquaporin-4 (NMO).

Approximately one-third of individuals afflicted with transverse myelitis demonstrate a positive or complete recovery, which encompasses the restoration of ambulatory function and minimal urinary, bowel, or paresthesia-related complications. Another third exhibit moderate recovery, accompanied by persistent deficits, including spastic gait, sensory dysfunction, and substantial urinary urgency or incontinence.

The remaining third of patients demonstrate no improvement, remaining bedridden or wheelchair-bound and dependent on others for basic daily living functions. Patients who spend extended periods in bed are vulnerable to infections, the development of decubitus ulcers, and an elevated risk of deep vein thrombosis.[vi] This risk is exemplified by this clinical case in which a patient died after one month of home care due to a bladder infection. Unfortunately, there are no specific treatments to avoid or prevent these complications; however, all those related to invasive methods such as bladder catheterization can be prevented through intermittent use, prophylaxis in case of prolonged use, and adequate hygiene.[x,xiii]

In the case of extensive longitudinal transverse myelitis in a young woman, an early diagnosis or the disease is imperative. This can be achieved through MRI and lumbar puncture, which help rule out etiologies such as NMO and MOGAD.

Early treatment with corticosteroids and immunotherapy has been shown to improve prognosis; however, recovery may vary depending on the underlying cause.[ii-vi,viii-x,xiii]

Ethical aspects

The present report was formulated in accordance with the principles established in the Declaration of Helsinki and the international ethical guidelines for health-related research. Informed consent was obtained from the patient for the publication of the clinical case, thereby ensuring respect for autonomy, confidentiality, and privacy.

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Original Article

Risk Factors Associated to Chronic Kidney Disease in Chalatenango, El Salvador

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Abstract
Introduction. In El Salvador, chronic kidney disease affects an important group of economically productive population, being the department of Chalatenango especially vulnerable due to multiple risk factors, such as its prevalence of non-communicable diseases, agricultural activities and occupational exposures. **Objective.** To determine the risk factors associated with chronic kidney disease in the population over 20 years of age in the department of Chalatenango. **Methodology.** It is a matched case-control study, 174 persons participated, 58 cases and 116 controls. People from the department of Chalatenango were included and two controls were matched for each case. **Results.** Of the cases, 63.8 % were men and the mean age was 59.3 years. A significant association was found between the disease and various risk factors, such as harmful alcohol consumption (OR 32.25 CI95 % 1.1-942.19), not exercising (OR 18.30 CI95 % 2.74-49.39), being an agricultural worker (OR 17.03 CI95 % 1.43-204.27), recurrent urinary tract infection (OR 16.07 CI95 % 2-128.99), inadequate consumption of fruits and vegetables (OR 11.65 CI95 % 2.74-49.4), high blood pressure (OR 7.57 CI95 % 1.74-32.88), exposure to pesticides (OR 6.79 CI95 % 1.1-41.88) and diabetes *mellitus* (OR 6.38 CI95 % 1.47-27.71), with a p value < 0.05. **Conclusion.** The study identified multiple traditional risk factors, such as hypertension and diabetes, along with non-traditional factors such as exposure to pesticide, alcohol consumption and lack of exercise.

Keywords
Renal Insufficiency, Risk Factors, Chronic Kidney Diseases of Uncertain Etiology, Case-Control Studies.

Resumen
Introducción. En El Salvador, la enfermedad renal crónica afecta a un grupo importante de población económicamente productiva, el departamento de Chalatenango es especialmente vulnerable debido a múltiples factores, como su prevalencia de enfermedades no transmisibles, actividades agrícolas y exposiciones ocupacionales. **Objetivo.** Determinar los factores de riesgo asociados con la enfermedad renal crónica en la población mayor de 20 años de edad del departamento de Chalatenango. **Metodología.** Estudio de casos y controles, participaron 174 personas, 58 casos y 116 controles. Se incluyeron personas residentes del departamento de Chalatenango y se emparejaron dos controles por cada caso. **Resultados.** El 63,8 % de los casos fueron hombres y la media de edad fue de 59,3 años. Se encontró una asociación significativa entre la enfermedad y diversos factores de riesgo, tales como el consumo nocivo de alcohol (OR 32,25 IC95 % 1,1-942,19), no realizar ejercicio (OR 18,30 IC95 % 2,74-49,39), ser agricultor (OR 17,03 IC95 % 1,43-204,27), infección recurrente de vías urinarias (OR 16,07 IC95 % 2-128,99), consumo inadecuado de frutas y verduras (OR 11,65 IC95 % 2,74-49,4), hipertensión arterial (OR 7,57 IC95 % 1,74-32,88), exposición a plaguicidas (OR 6,79 IC95 % 1,1-41,88) y diabetes *mellitus* (OR 6,38 IC95 % 1,47-27,71), con un valor de p < 0,05. **Conclusión.** El estudio identificó múltiples factores de riesgo tradicionales, como hipertensión y diabetes, junto con factores no tradicionales como exposición de plaguicidas, consumo de alcohol y no realizar ejercicio.

Palabras clave
Enfermedad Renal Crónica, Factores de Riesgo, Enfermedades Renales Crónicas de Etiología Incierta, Estudios de Casos y Controles..

Introduction

Chronic kidney disease (CKD) has become a significant public health challenge worldwide. By 2022, the global prevalence was 10%; however, this figure varies considerably among different geographic regions.[i] In Central America, CKD presents specific social, epidemiological, and clinical characteristics that differentiate it from traditional disease behavior. It has a high incidence in young people, a rapid progression, and a history of work in the agricultural sector.[ii,iii] In El Salvador, CKD affects a significant

segment of the population of economically productive age. According to 2015 data, the documented prevalence of CKD was 12.6 %, while by 2020, CKD category G5 ranked as the second leading cause of death in adults of both sexes.[iv]

Chalatenango is a department located in the north of El Salvador, sharing a northern border with Honduras and covering an area of 2017 square kilometers. This region is especially vulnerable due to multiple risk factors for CKD, including a high prevalence of noncommunicable diseases, occupational exposures, and risky behaviors, which have favored the development of this disease.[v,vi]

The traditional factors that contribute to the high prevalence of CKD in Chalatenango are mainly comorbidities that are recognized worldwide, such as diabetes *mellitus* and arterial hypertension, whose rates are among the highest in the country, with a prevalence of 12.4 and 33.6 per 100 000 inhabitants, respectively. These risk factors are considered traditional because they are the most common and recognized causes of CKD worldwide, and their negative impact on renal function is well documentedd.[ii,iii]

On the other hand, non-traditional factors include environmental and occupational exposures. These include the use of pesticides, lack of access to quality drinking water, and adverse working conditions. These factors are considered non-traditional because they are specific to certain geographic areas and occupations.[ii,iii] In this regard, Chalatenango has one of the highest rates of pesticide poisoning at the national level, reaching 20.6 %, significantly higher than the national average of 12.6 %.[iv,vii]

According to the Ministry of Health of El Salvador, by 2022, mortality due to CKD in Chalatenango was 102.9 per 100 000 inhabitants, considerably higher than the national rate of 60.1 per 100 000 inhabitants.[vii]

All of the above raises the question of the factors that influence the development of CKD in the Chalatenango population. Therefore, this research aims to identify and analyze these factors to understand the elements that contribute to its high prevalence and delve into the particularities of this region.

Methodology

An analytical case-control study was carried out for a population over 20 years of age in the department of Chalatenango. The Elsevier Fisterra calculator was used to calculate the sample.i A confidence level of 95 % and a power of 80 % were considered. A ratio of two controls for each case was established, a hypothetical exposure proportion of 50 % was assumed, and a minimum detectable odds ratio of 2.5 was considered. The sample size was 174 participants, 58 cases, and 116 controls. Case selection was performed using the CKD database from the department of Chalatenango. This database, generated from the El Salvador Family Records Information System, includes patients diagnosed with CKD in that territory. A case was defined as any person diagnosed with CKD in any of its stages and registered in the database. Since 2010, a digital registry of the population began, and all persons over 20 years of age who were natives and residents of the department and diagnosed between 2010 and 2022 were included.

Persons under medical control in any of the health facilities of the department and who had attended their medical control between January and June 2023 were included. Case selection was done using a simple randomization process of the records in the database of patients with CKD.

A control was defined as any person with a glomerular filtration rate > 60 ml/min/1.73 m^2, proteinuria less than 30 mg/dL in a general urine test, and no history of CKD. The controls were selected from the randomization of persons registered in the Integrated Health System who had been screened by creatinine, glucose, cholesterol, triglycerides, and a general urine test.

Matching was performed according to the municipality of origin of each case, selecting controls without restrictions on comorbidities. The aim was to control for geographic variations that could influence disease prevalence, such as access to medical care, socioeconomic factors, population density, environmental conditions, or cultural practices.

Persons who did not wish to participate, who were clinically incapacitated, or who had died were excluded from the study. Also excluded were those with congenital malformations of the kidney, erroneously registered in the department's CKD database, and those in the evaluation process to confirm CKD.

Recurrent urinary tract infection was defined as more than three infections diagnosed with positive laboratory results and recorded in one year. Nutritional status was assessed by calculating body mass index. For cases, the weight and height recorded in the patient's clinical records at the time of diagnosis of CKD were used since not all cases had a historical weight record. For the controls, weight and height were measured before the interview.

Health habits were investigated and tested using a visual guide and portion meters

representing the recommended amount of consumption. Adequate consumption of fruits and vegetables was considered, as the consumption of at least 400 grams daily. To assess harmful alcohol consumption, more than 40 grams per day was considered for men and more than 20 grams per day for women, taking into account the equivalences of different types of alcoholic beverages. Harmful tobacco consumption was defined as the consumption of ten or more cigarettes or two or more cigars daily during a period of five years or more. Excessive salt consumption was defined as exceeding six grams per day or 2.4 grams of sodium.

Adequate water consumption was considered when it exceeded 2.5 liters per day. The practice of physical exercise involved activities in addition to daily or work activities, with thresholds of more than 150 minutes per week for moderate activity and more than 75 minutes for intense activity. Regarding pesticide exposure, reference was made to continuous exposure for more than five years. Regarding chronic use of nonsteroidal analgesics (NSAIDs), it was evaluated whether it exceeded the recommended daily dose for more than five years, with specific limits for each drug.

To collect the information, a structured questionnaire was developed in digital format using KoboToolbox, an open-source platform for creating, collecting, and managing digital forms. For data capture, a visit to the facility was scheduled, and participants were summoned by the local health team. The technique used was the interview, and the sources of information were the clinical record and the Integrated Health System.

The Kolmogórov-Smirnov normality test was performed for continuous variables, obtaining a p-value greater than 0.05, so the mean and standard deviation were used. To analyze the association between variables, the odds ratio (OR), chi-square test, and Fisher's exact test were used, as required. Ninety-five percent confidence intervals (95 %CI) and p-values were calculated with a 0.05 threshold to determine statistical significance. To compare means between cases and controls, the z-test was used, and for differences in proportions of categorical variables, the chi-square test was applied.

To construct the logistic regression model, a correlation matrix with a cut-off point between -0.7 and 0.7 was prepared to select the variables to be included in the model, excluding those with high correlation to avoid multicollinearity. The goodness of fit was assessed using the Likelihood Ratio test and the Wald test, which determined the effectiveness of the model and the significance of the variables, respectively. In addition, the ROC curve and the confusion matrix were used to evaluate the model's discriminative ability. Data processing and analysis were performed using Microsoft Excel 365 and RStudio version 4.3.2.

The effect of confounding or effect-modifying variables was identified by correlating variables and using logistic regression with crude effect estimates and effect estimates adjusted for occupation, urban/rural origin, and pesticide exposure.

This research was conducted using the Helsinki principles for research on human subjects. The participants underwent the informed consent process and were approved by the Research Ethics Committee of the Central Health Region, with act number 05-2023. The database was stored and codified to maintain the confidentiality of the participants.

Results

Descriptive analysis

A total of 174 participants were included, of which 58 (33.3 %) were cases and 116 (66.7 %) controls. Of the total, 52.3 % were from rural areas. The Kolmogorov-Smirnov normality test had a p-value > 0.05. The mean age of the participants was 51.1 years (SD: 15.1). According to the group, the mean age of the cases was 59.3 years (SD: 13.2), while the mean age of the controls was 46.5 years (SD: 13.9). No statistically significant differences were found between their means by z-test ($p > 0.05$).
The distribution of cases by year of diagnosis revealed that 34.4 % of cases were identified in 2022, followed by 2021 with 13.8 %, and 2015 and 2016, each accounting for 10.3 % of the cases. The disease stage at diagnosis was categorized as follows: 31 % of cases were classified as category G3b, 25.9 % as category G2, and 1.7 % as categories G1 and G5, respectively.

Demographics

Tabla 1shows the distribution of the participants according to their variables.

Regarding sex, a higher proportion of women was observed in the control group, 78.4 %, compared to the case group, 36.2 %, $p < 0.01$; however, there was a higher proportion of male cases, 63.8 %, $p < 0.01$. Of the participants, 52.3 % were from rural areas, $p = 0.68$.
Obesity was present in a higher proportion in the control group, 43.1 %, compared to the case group, 24.1 %, and this difference

was significant (p = 0.02). The proportion of participants with normal weight was similar between both groups, with 22.4 % of cases and 21.6 % of controls, p = 0.9.

Regarding educational level, most participants in both groups had formal education, with 72.4 % for cases and 84.5 % for controls, p = 0.33. According to educational level, basic education from first to sixth grade was the most frequent in both groups, with 50 % in cases and 38.8 % in controls, p = 0.23. A higher proportion of controls with a high school level was observed at 21.6 % versus cases 6.9 %, p = 0.01.

Regarding occupation, 43.1 % of the cases and 7.8 % of the controls were farmers, p < 0.01. On the other hand, 55.2 % of the controls and 29.3 % of the cases were homemakers, p < 0.01. Concerning the cases, there were no statistically significant differences according to their occupation, p > 0.05.

Tobacco and alcohol consumption

Higher harmful tobacco use was found in cases (15.5 %) compared to controls (1.7 %), p < 0.01. In addition, there was a higher proportion of cases (20.7 %) of alcoholics compared to controls (0.9 %), p < 0.01.

Dietary habits and physical activity

Higher salt consumption was observed among cases (39.7 %) compared to controls (14.7 %), p < 0.01. However, no differences were found in adequate water consumption between the groups, p = 0.26. On the other hand, 19 % of cases reported adequate consumption, compared to 56 % of controls, p < 0.01. According to physical activity, it was reported that 60.3 % of the cases and 67.2 % of the controls reported performing physical exercise, p = 0.54.

Medical history

Concerning medical history, cardiovascular risk factors such as diabetes presented a proportion of 50 % in cases versus 15.5 % of controls, p < 0.01. Dyslipidemia was present in 62.1 % of cases versus 39.7 % of controls, p = 0.03, and arterial hypertension was present in 65.5 % of cases versus 31.9 % of controls, p<0.01. About cases, differences were found between being hypertensive p < 0.05, but not in being diabetic, p > 0.05. Recurrent urinary tract infection was more frequent in cases 17.2 % than in controls 6 %, p< 0.05.

No statistically significant differences were found between the groups in renal lithiasis and family history of cardiovascular or renal disease. The family history of various conditions also showed no significant differences between the two groups (all p values > 0.05).

Occupational, pesticide, and NSAID exposure

Occupational exposure to high temperatures was more frequent in the case group, 55.2 % versus 15.5 % of the controls, p < 0.01.

Tabla 1. Distribution of cases and controls according to demographic variables, lifestyle, medical, and family history of disease.

Variable		Casos	%	Controles	%	Total	%	Valor p
Demográficas								
Sex	Female	21	36.2	91	78.4	112	64.4	< 0.01
	Male	37	63.8	25	21.6	62	35.6	< 0.01
Nutritional statusl	Underweight	2	3.4	0	0	2	1.1	0.07
	Normal	13	22.4	25	21.6	38	21.8	0.9
	Obesity	14	24.1	50	43.1	64	36.8	0.02
	Overweight	29	50	41	35.3	70	40.2	0.11
Area	Rural	32	55.2	59	50.9	91	52.3	0.68
	Urban	26	44.8	57	49.1	83	47.7	0.66
Educación formal	Yes	42	72.4	98	84.5	140	80.5	0.33
	No	16	27.6	18	15.5	34	19.5	0.07
Educational level	1st - 6th grade	29	50	45	38.8	74	42.5	0.23
	7th- 9th grade	7	12.1	21	18.1	28	16.1	0.27
	10th- 12th grade	4	6.9	25	21.6	29	16.7	0.01
	Higher technical educationr	0	0	2	1.7	2	1.1	0.19
	University	2	3.4	5	4.3	7	4	0.75
	None	16	27.6	18	15.5	34	19.5	0.07

Variable		Casos	%	Controles	%	Total	%	Valor p
Demographics								
Marital statusl	Married	31	53.4	48	41.4	79	45.4	0.22
	Living with couple	12	20.7	30	25.9	42	24.1	0.45
	Single	5	8.6	23	19.8	28	16.1	0.04
	Widowed	6	10.3	10	8.6	16	9.2	0.7
	Separated/Divorced	4	6.9	5	4.3	9	5.2	0.44
Occupation	Housewife	17	29.3	64	55.2	81	46.6	< 0.01
	Farmer	25	43.1	9	7.8	34	19.5	< 0.01
	Employee	5	8.6	19	16.4	24	13.8	0.12
	Merchant	5	8.6	10	8.6	15	8.6	1
	Other	5	8.6	7	6	12	6.9	0.5
	Unemployed	1	1.7	5	4.3	6	3.4	0.29
	Student	0	0	2	1.7	2	1.1	0.19
Habits								
Tobacco	Yes	9	15.5	2	1.7	11	6.3	< 0.01
	No	49	84.5	114	98.3	163	93.7	0.31
Alcohol consumption	Yes	12	20.7	1	0.9	13	7.5	< 0.00
	No	46	79.3	115	99.1	161	92.5	0.14
Salt consumption	Sí	23	39.7	17	14.7	40	23	< 0.01
	No	35	60.3	99	85.3	134	77	0.04
Adequate water consumption	Yes	25	43.1	63	54.3	88	50.6	0.26
	No	33	56.9	53	45.7	86	49.4	0.27
Adequate consumption of fruits and vegetables	Yes	11	19	65	56	76	43.7	< 0.01
	No	47	81	51	44	98	56.3	< 0.01
Exercise	Yes	35	60.3	78	67.2	113	64.9	0.54
	No	23	39.7	38	32.8	61	35.1	0.42
Medical history								
Diabetes	Yes	29	50	18	15.5	47	27	< 0.00
	No	29	50	98	84.5	127	73	0
Dyslipidemia	Yes	36	62.1	46	39.7	82	47.1	0.03
	No	22	37.9	70	60.3	92	52.9	0.02
Hypertension	Yes	38	65.5	37	31.9	75	43.1	< 0.01
	No	20	34.5	79	68.1	99	56.9	< 0.01
Obesity	Yes	13	22.4	46	39.7	59	33.9	0.03
	No	45	77.6	70	60.3	115	66.1	0.14
Recurrent UTI	Yes	10	17.2	7	6	17	9.8	0.02
	No	48	82.8	109	94	157	90.2	0.4
Renal lithiasis	Yes	7	12.1	7	6	14	8	0.15
	No	51	87.9	109	94	160	92	0.65
Occupational exposure and NSAID use								
High temperature activity	Sí	32	55.2	18	15.5	50	28.7	< 0.01
	No	26	44.8	98	84.5	124	71.3	< 0.01
Chronic exposure to pesticides	Sí	31	53.4	11	9.5	42	24.1	< 0.01
	No	27	46.6	105	90.5	132	75.9	< 0.01
Chronic consumption of NSAIDs	Sí	2	3.4	1	0.9	3	1.7	0.23
	No	56	96.6	115	99.1	171	98.3	0.86
Total		58	100	116	100	174	100	

NSAIDs = Nonsteroidal analgesics., UTI= Urinary tract infection, CKD= Chronic kidney disease, CVA= Cerebrovascular accident, AMI= Acute myocardial infarction.

About exposure to pesticides, 53.4 % exposure was found in the case group and 9.5 % in the control group, $p < 0.01$. NSAID consumption was low in both groups with no significant differences, $p = 0.23$.

In the bivariate analysis (Table 2), harmful alcohol consumption (OR 30), exposure to pesticides (OR 10.96), harmful tobacco use (OR 10.47), being a farmer (OR 9.01), working in high temperatures (OR 6.7), male sex (OR 6, 41), inadequate consumption of fruits and vegetables (OR 5.45), diabetes (OR 5.44), hypertension (OR 4.06), recurrent urinary tract infection (OR 3.24) and dyslipidemia (OR 2.49) showed a significant association with increased risk of CKD. Other variables, such as area of residence, formal education, salt intake, physical exercise, renal lithiasis, and NSAID use, showed no association.

To evaluate the association between the variables, a logistic regression model was constructed that included the variables identified in the correlation matrix, and a specific model was developed for occupation and pesticide exposure. The results showed that pesticide exposure was a main and independent factor in the development of CKD, even when considering the occupation variable ($p > 0.05$). Both correlation test and occupation-specific logistic regression analysis by occupation and pesticide exposure confirmed that pesticide exposure was associated with the development of CKD and was independent of occupation ($p < 0.05$).

The results showed that being a farmer presented an independent association (OR 17.1) and harmful alcohol consumption (OR 32.3). Other factors such as history of diabetes *mellitus* (OR 6.38), arterial hypertension (OR 7.57), recurrent urinary tract infections (OR 16.07), exposure to pesticides (OR 6.79), inadequate consumption of fruits and vegetables (OR 11.65), and lack of regular physical exercise (OR 18.30), all had significant associations, $p < 0.05$, (Table 3).

Discussion

The study provides evidence of the multiple risk factors associated with CKD in Chalatenango. The results highlight the multifactorial nature of this pathology and describe medical and behavioral determinants, as well as sociodemographic and occupational factors.[viii]

Among the most relevant findings of this study, a strong independent association was found between CKD and cardiovascular comorbidities such as diabetes and arterial hypertension.[ix-xi] These results are consistent with the available evidence, which describes these pathologies as important risk factors for the development of CKD, independently of the presence of other sociodemographic, regional, or economic variables.[xii] In the bivariate and multivariate models, being diabetic was significantly associated with the development of CKD, which is consistent with what has been reported in other studies. For example, in the United States, it is estimated that approximately 1 % of people with diabetes *mellitus* have CKD category G5 and that increases to 40 % have some category of CKD;[xii] furthermore, in some developing countries, diabetes *mellitus* was directly related to the burden of renal patients in health systems.[xiv]

Arterial hypertension was also statistically associated with CKD, as reported by a systematic review with meta-analysis that included six countries and 12 studies. The review associated arterial hypertension as an important cause of chronic kidney damage and as the leading cause of the prevalence of CKD14; nevertheless, the pathophysiological mechanisms for CKD are multiple, which together converge to initiate and continue kidney damage.[viii]

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Agricultural occupation was an independent risk factor for CKD, even after adjusting for covariates. This finding is consistent with a study involving 261 major cities in China and a cross-sectional study involving 47 204 people who reported an increased risk of CKD due to occupational exposure, heat stress, inadequate hydration, and exposure to pesticides with nephrotoxic potential.[xvi,xvii] Furthermore, in various agricultural communities in Central America, excess mortality due to renal causes has been observed, reinforcing these factors' importance in the region.[xviii,xix]

This study also identified that adequate fruit and vegetable consumption and physical activity are independent protective factors against CKD.[xvi] These findings are consistent with extensive scientific evidence, including a systematic review with meta-analysis combining 18 cohort studies and 630 108 adults, concluding that a healthy dietary pattern can prevent CKD and albuminuria. In addition, it has been shown that

Table 2. Bivariate analysis of factors associated with chronic kidney disease

Variable	Cases (N 58)	% Cases	Controls (N 116)	% Controls	OR	CI95 %		p-value
Alcohol consumption	12	20.7	1	0.9	30	3.79	237.38	< 0.01
Exposure to pesticides	31	53.4	11	9.48	10.96	4.89	24.57	< 0.01
Tobacco consumption	9	15.5	2	1.7	10.47	2.18	50.24	< 0.01
Farmer	25	43.1	9	7.8	9.01	3.83	21.2	< 0.01
Work in high temperatures	32	55.2	18	15.52	6.7	3.26	13.79	< 0.01
Male sex	37	63.8	25	21.5	6.41	3.2	12.85	< 0.01
Inadequate consumption of fruits and vegetables	47	81	51	43.9	5.45	2.57	11.55	< 0.01
Diabetes	29	50	18	15.5	5.44	2.65	11.18	< 0.01
NSAID consumption	2	3.4	1	0.8	4.11	0.36	46.26	0.258
Hypertension	38	65.5	37	31.9	4.06	2.08	7.91	< 0.01
Recurrent UTI	10	17.2	7	6	3.24	1.17	9.03	0.019
Dyslipidemia	36	62.1	46	39.7	2.49	1.3	4.76	< 0.01
Renal lithiasisl	7	12.1	7	6	2.14	0.71	6.42	0.278
No formal education	42	72.4	98	84.5	2.07	0.97	4.45	0.058
Inadequate consumption of water	33	56.9	53	45.9	1.57	0.83	2.96	0.163
Sedentary lifestyle	23	39.6	38	32.7	1.35	0.7	2.59	0.369
Rural area	32	55.2	59	50.9	1.19	0.63	2.24	0.592
Obesity	14	24.1	50	43.1	0.42	0.21	0.85	0.014

UTI = Urinary tract infection. NSAIDs = Non-steroidal analgesics.

Table 3. Multivariate analysis of factors associated with chronic kidney disease

Variable	OR	Coefficient	IC95 %	IC95 %	Standard Error	z-value	p-value
Intercept	0.03	-10.21	0	1.06	2.443	-4.18	0.054
Harmful alcohol consumption	32.25	3.474	1.1	942.19	1.722	2.017	0.044
No exercise	18.3	2.907	2.74	49.39	0.970	2.995	<0.001
Farmer	17.09	2.838	1.43	204.27	1.266	2.242	0.025
Recurrent UTI	16.07	2.777	2	128.99	1.063	2.614	0.009
Inadequate fruit and vegetable consumption	11.65	2.456	2.74	49.4	0.736	3.333	<0.001
Hypertension	7.57	2.025	1.74	32.88	0.749	2.703	0.007
Pesticide exposure	6.79	1.916	1.1	41.88	0.928	2.064	0.039
Diabetes	6.38	1.853	1.47	27.71	0.749	2.474	0.013
Male sex	4.52	1.508	0.3	67.55	1.38	1.092	0.275
Inadequate water consumption	3.59	1.278	0.87	14.81	0.723	1.768	0.077
Excessive salt consumption	3.23	1.172	0.77	13.48	0.729	1.607	0.108
Harmful tobacco consumption	2.48	0.909	0.18	34.9	1.348	0.675	0.5
Rural area	1.35	0.301	0.36	5.1	0.677	0.445	0.657
Chronic NSAID use	1.14	0.135	0.02	82.01	2.179	0.062	0.951
Age	1.04	0.038	0.98	1.1	0.027	1.383	0.167
Formal education	1	0.000	0.17	5.94	0.909	0	1
Working in high temperatures	0.59	-0.528	0.03	12.71	1.566	-0.337	0.736
Obesity	0.56	-0.581	0.12	2.55	0.774	-0.751	0.452

UTI = Urinary tract infection. NSAIDs = Non-steroidal analgesics. Likelihood ratio < 0.01. Wald test < 0.01

a diet low in potassium can cause fibrosis and kidney damage, accelerate the progression of CKD, and is common in patients with endemic nephropathy in Mesoamerica.[xx,xxi]

A recent systematic review with meta-analysis that included 12 cohorts with 1 281 727 participants and evaluated the benefits of physical activity as a protective factor for CKD determined that more active people had a lower prevalence of CKD. [xxii] It is believed that physical exercise would reduce markers of endothelial dysfunction and oxidative stress and decrease the risk of developing other diseases directly related to CKD, such as arterial hypertension, diabetes *mellitus*, dyslipidemia and obesity.[xxiii,xxiv]

This investigation identified that harmful alcohol and tobacco consumption are risk factors for CKD, even after adjusting for possible confounding variables. These findings are consistent with existing evidence linking smoking and alcoholism with CKD by inducing alterations in lipid metabolism, blood pressure, insulin sensitivity, and prothrombotic and proinflammatory markers.[xxv,xxvi] In addition, a systematic review with meta-analysis that included 17 articles and 149 958 participants found a significant association between excessive alcohol consumption and an increased risk of developing CKD.[xxi]

Regarding sex, a higher proportion of CKD was observed in men, a finding that coincides with the majority of reports suggesting a greater susceptibility in this sex. [viii] This result is in agreement with other epidemiological reports at a global level, which document a greater susceptibility and risk in the male sex.[xxvii] Similar findings have been reported in the United States, Europe, and most Asian and Latin American countries.[xxviii,xxix]

Likewise, a meta-analysis that included data from six cohorts, with 2 382 712 individuals and 6856 incident CKD events, found that the occurrence of CKD or CKD category G5 was 23 % lower in women compared to men.[xxx] Another study estimates that 60 % of patients with CKD are men.[xvi] Although the exact mechanism is unknown, it has been related to hormonal differences associated with estrogens, greater muscle mass and metabolism, a more atherogenic lipid profile, and differential blood pressure regulation in men.[viii]In this study, the area of rural or urban residence did not show a significant association, unlike other studies that indicate a greater risk of CKD in rural areas due to limited access to drinking water, greater occupational exposure in agricultural workers, and insufficient sanitary infrastructure.[xxxi,xxxii] However, a systematic review that included countries in Africa, America, Asia, and Europe reported a higher prevalence of CKD in urban areas, mainly associated with diseases such as diabetes, hypertension, and obesity. The differences in exposures in the different regions explain this discrepancy.[xxxiii]

Recurrent urinary tract infections were identified as an independent risk factor for CKD, coinciding with other studies that report an accelerated decrease in glomerular filtration rate and a higher incidence of CKD in patients with recurrent pyelonephritis.[xxxiv] It has been proposed that these repeated episodes cause renal scarring, tubular atrophy, and chronic nephropathy, in addition to the risk of nephrotoxicity due to the use of antibiotics to treat these infections.[xxxiv,xxxv]

Excessive salt consumption was not statistically significant, contrasting with what has been reported in the literature and other meta-analyses that indicate detrimental health effects, including the development of arterial hypertension and CKD due to high sodium consumption.[xxxvi] This discrepancy could be explained by the low proportion of people who confirmed high salt consumption, even though the 2015 National Survey of Chronic Noncommunicable Diseases (ENECA) indicated that Chalatenango has the highest prevalence of salt consumption in El Salvador.[iv]

The presence of renal lithiasis and chronic use of NSAIDs did not show a significant association with CKD. The results contrast with other studies that have reported an accelerated decrease in glomerular filtration rate and an increased risk of CKD category G5 in patients with a history of renal lithiasis or prolonged use of NSAIDs.[xxxvii,xxxviii] Mechanisms such as obstruction and recurrent infections have been suggested in lithiasis, while NSAIDs could directly affect renal perfusion and cause tubular damage.

As for weight, overweight was not significantly associated with a greater risk of CKD. Even in the bivariate analysis, obesity behaved as a protective factor, contrasting with other studies that link a higher body mass index with the development of CKD.[xxxiv] This finding could be explained by limitations in the sample size or by differences in the population studied in comparison with other studies and should, therefore, be interpreted with caution, given that the evidence suggests that obesity is a risk factor for CKD.[xvi,xxxix,xl] However, in the multivariate analysis, obesity did not show a statistically significant association, which could indicate that other confounding variables influenced this variable during the initial analysis.

Finally, in the study of variables such as formal education level, family history of

CFD or cardiovascular disease, and dietary factors such as water intake, in contrast to some previous studies, CKD is not represented as a risk factor.[ix,xii,xli]

Conclusion

Multiple risk factors were identified, both traditional, such as arterial hypertension and diabetes mellitus, and non-traditional, such as chronic pesticide use, excessive alcohol consumption, lack of physical activity, agricultural occupation, recurrent urinary tract infections, and insufficient fruit and vegetable consumption. All these factors showed a significant association with the development of CKD in the population analyzed.

Despite the study's limitations, the findings highlight chronic kidney disease's complex and multifactorial nature, evidencing the need for future research with a more robust design and tighter control of bias to confirm and extend these results.

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Original article

Epidemiology of suspected typhoid fever cases from 2020 to 2022

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Abstract
Introducción. Typhoid fever is a potentially fatal infectious disease caused by the bacterium Salmonella typhi, transmitted through contaminated food or water. Symptoms include fever, fatigue, headache, nausea, abdominal pain, and constipation or diarrhea. **Objetive.** Characterize epidemiologically the suspected cases of typhoid fever in the years 2020 to 2022. **Methodology.** A descriptive cross-sectional design was used with data from the National Epidemiological Surveillance System of El Salvador, considering epidemiological variables such as sex, age, area, department, municipality, incidence rate, and case notification. Absolute frequencies, ratios, and cumulative incidence per 100 thousand inhabitants were used, and tables and graphs were generated. **Results.** Twenty-six percent of the cases were registered in 2020, 38 % in 2021, and 37 % in 2022. Fifty-one percent were male. The median age was 23 years. The highest incidence rate in age groups was found from 20 to 29 years, with 25 cases per 100 thousand inhabitants in 2021. The urban/rural ratio was 3:1. The incidence rate in 2022 was 11.6 cases per 100 thousand population, that for 2021 was 12.1 cases, and that for 2020 was eight cases. **Conclusion.** The highest notification was in the capital city in age groups 19 to 29 years of age in the male gende.

Palabras clave
Salmonella typhi, Typhoid Fever, Disease Notification.

Resumen
Introducción. Typhoid fever is a potentially fatal infectious disease caused by the bacterium Salmonella typhi, transmitted through contaminated food or water. Symptoms include fever, fatigue, headache, nausea, abdominal pain and constipation or diarrhea. Objectivo. To characterize epidemiologically the suspected cases of typhoid fever in the years 2020 to 2022. **Metodología.** Se utilizó un diseño transversal descriptivo con datos del Sistema Nacional de Vigilancia Epidemiológica de El Salvador, se tomaron en cuenta variables epidemiológicas como sexo, edad, área, departamento, municipio, tasa de incidencia y notificación de casos. Se utilizaron frecuencias absolutas, razones e incidencia acumulada por cada 100 mil habitantes y se generaron tablas y gráficos. **Resultados.** El 26 % de los casos se registró en el 2020, para 2021 el 38 % y 2022 el 37 %. El 51% fue del sexo masculino. La mediana de edad fue de 23 años. La mayor tasa de incidencia en grupos de edad se encontró de 20 a 29 años con 25 casos por 100 mil habitantes para el año 2021. La razón urbana/rural fue de 3:1. La tasa de incidencia del año 2022 fue de 11.6 casos por 100 mil habitantes, la del 2021 fue de 12.1 casos y la del 2020 fue de ocho casos. **Conclusión.** La mayor notificación fue en la capital en grupos de edad de 19 a 29 años del género masculino.

Palabras clave
Salmonella typhi, Fiebre Tifoidea, Notificación de Enfermedad.

Introduction

Typhoid fever (TF) is an infectious disease caused by *Salmonella typhi*, transmitted mainly through contaminated food or water.[i,ii] Symptoms include persistent fever, fatigue, headache, nausea, abdominal pain, and gastrointestinal problems. The disease can be fatal and is difficult to treat due to antibiotic resistance; confirmatory diagnosis is through PCR or cultures.[iii,iv] In industrialized countries, TF has declined due to better living conditions and antibiotics; however, it remains a problem in Africa and Southeast Asia[v] The global burden of disease is approximately nine million cases and 110 000 deaths annually.[vi]

People without access to clean water and adequate sanitation are most at risk, mainly affecting children.[vii-ix]

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Epidemiología de casos sospechosos de fiebre tifoidea de 2020 a 2022

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In Latin America, the incidence of TF varies from ten to 120 cases per 100 000 inhabitants per year, with low mortality. In the United States and other industrialized countries, cases are rare and generally imported.[x] El Salvador recorded about 866 cases per year from 2011 to 2019, with a decrease in the trend from 2018. During this period, epidemiological surveillance of this disease allowed only a general analysis of this disease, as information was only collected on the number of cases per epidemiological week, age groups, and stratified by department.[xi,xii] The need was identified to collect more information on TF cases in order to determine the probable source of infection and conduct a timely investigation of the case. For this reason, in 2020, individual surveillance was implemented, which involves adding other variables of epidemiological interest and reporting suspected cases within the first 24 hours, thus guiding prevention and control strategies.[xi]

Surveillance of the disease aims to detect acute changes in the occurrence of the disease that help to identify, quantify and monitor the occurrence of the disease.[xi] Therefore, the objective of the present study is to characterize epidemiologically the suspected cases of typhoid fever in the years 2020 to 2022.

Methodology

The study design was descriptive cross-sectional with data from the National Epidemiological Surveillance System of El Salvador (VIGEPES), where patients who met the definition of a suspected case of TF were registered: "any person with fever of more than seven days and two or more of the following symptoms: headache, abdominal pain, diarrhea, vomiting, anorexia, nausea, progressive worsening of the general condition, or any case epidemiologically linked to a confirmed case of typhoid fever, regardless of the time of onset of symptoms."[xi] Inclusion criteria were cases with symptom onset dates from January 2020 to December 2022; cases of patients residing in foreign countries were taken as exclusion criteria.

The data were obtained from the VIGEPES digital platform and downloaded to a Microsoft Excel spreadsheet; subsequently, quality control of the information was performed to eliminate duplicate cases and those that did not meet the selection criteria. The variables used were sex, age, area, department, municipality, incidence rate, case notification, and clinical management. Quantitative variables that had an alphanumeric format were changed to numeric. The variable age was reclassified into the variable age groups. The variable "year" was created from the variable "date of symptom onset." The variable "difference between the date of consultation and date of notification" was created, and the variable "notification greater than, equal to, or less than 24 hours" was created from this new variable.

Microsoft Excel 365 in its 2019 version with the Real Statistics add-in was used for data processing and analysis. Absolute and relative frequencies, ratios and cumulative incidence expressed per 100 thousand inhabitants were calculated; tables and graphs were also made. Descriptive statistics, measures of central tendency, dispersion and the Kolmogorov Smirnov normality test were performed on the continuous quantitative variables in the RStudio program in version 14.1106.[xiii] For the geospatial analysis, the QGIS program version 3.26.0 was used to construct maps of notification of typhoid fever cases according to the date of symptom onset and two color palettes were used to express notification and non-notification in the municipalities; and the nonparametric Mann Whitney U test was used to look for differences in medians between two independent groups such as sex and age.[xvi]

The study was approved by the Ethics Committee of the Instituto National Institute of Health of El Salvador (CEINS/2024/002). The research team adhered to the Declaration of Helsinki as ethical principles for medical research in humans.

Results

In the initial database, 2195 cases were registered, 16 duplicates, two cases with a symptom onset date in 2019, and one case from abroad were eliminated. Of the 2176 cases included in the study, 26 % of the cases were registered in 2020, 38 % in 2021 and 37 % in 2022. The series showed annual cyclicity and slight seasonal variations by epidemiological week (EW), the ascendancy of cases was mainly reflected between EW 10 to 20 (Figure 1).

Fifty-one percent of the cases were male. The median age of the patients was 23 years (interquartile range [IR]: 15-33). The median age in men was 24.90 (IR: 15-31.5), and in women was 26.94 (IR: 16-34). The Mann-Whitney U test comparing age by gender resulted in a p-value of < 0.05, indicating that there was a significant difference between the two medians.

From 2020 to 2022, 89 % of the cases attended a educational center. Seventy-three percent of the cases belonged to the urban area. The urban/rural ratio is 3:1.

A total of 2 % of the cases were referred, 58 % were managed on an outpatient basis, and 40 % were hospitalized. Seventy percent of the cases have a difference between the date of consultation and the date of notification less than or equal to 24 hours. Thirty percent were notified more than 24 hours after providing the consultation.

The age group with the highest rate in 2020 was 20-29 years old (16 cases per 100 000 population), in 2021 the age group with the highest rate was 20-29 years old (25 cases per 100 000 population) and in 2022 the age group with the highest rate was 10-19 years old with 21 cases per 100 000 population (Table 1).

In 2020, the highest rate was recorded in the department of San Salvador with 24 cases per 100 000 inhabitants, followed by La Libertad with seven cases per 100 000 inhabitants. The cities with the highest rates were Santa Tecla (127 cases per 100 000 inhabitants) and Quezaltepeque (55 cases per 100 000 inhabitants) (Figure 2).

In 2021, the highest rate was recorded in the department of San Salvador, with 35 cases per 100 000 inhabitants, and La Libertad, with ten cases per 100 000 inhabitants. The cities with the highest rates were Santa Tecla (department of La Libertad), with 162 cases per 100 000 inhabitants, followed by San Vicente (department of San Vicente) with 87 cases per 100 000 inhabitants (Figure 2).

In 2022, the highest rate was also in San Salvador, with 35 cases per 100 000 inhabitants, followed by La Libertad, with seven cases per 100 000 inhabitants. In the same year, the cities with the highest rates were Ayutuxtepeque (department of San Salvador), with 93 cases per 100 000 inhabitants, followed by Santa Tecla with 90 cases per 100 000 inhabitants (Figure 2).

The incidence rate for 2022 was 11.6 cases per 100 000 inhabitants, which, compared to 2021 with 12.1 cases per 100 000 inhabitants, shows a difference in rates of approximately one case per 100 000 inhabitants. In 2020, the incidence rate was eight cases per 100 000 inhabitants, making a difference between 2020 and 2022 of three cases per 100 000 inhabitants.

Regarding the health institution, during the three years of the analysis, 2170 (99.69 %) of cases consulted a public health institution and six cases (0.28 %) consulted on a private health center.

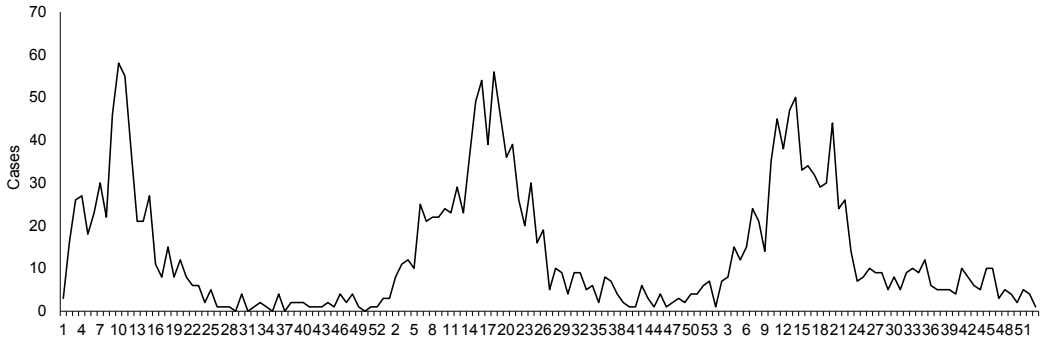

Figure 1. Trend of typhoid fever cases distributed by epidemiological week in the years 2020 to 2022 in El Salvador.

Table 1. Rates by age group of typhoid fever in the years 2020 to 2022 in El Salvador

Age groups	Rate per 100 000 inhabitants		
	2020	2021	2022
Under 1	7	2	5
1 to 4	2	6	7
5 to 9	6	15	13
10 to 19	11	15	21
20 to 29	16	25	18
30 to 39	10	15	13
40 to 49	6	9	8
50 to 59	5	5	5
Over 60	3	4	5
Total	9	13	13

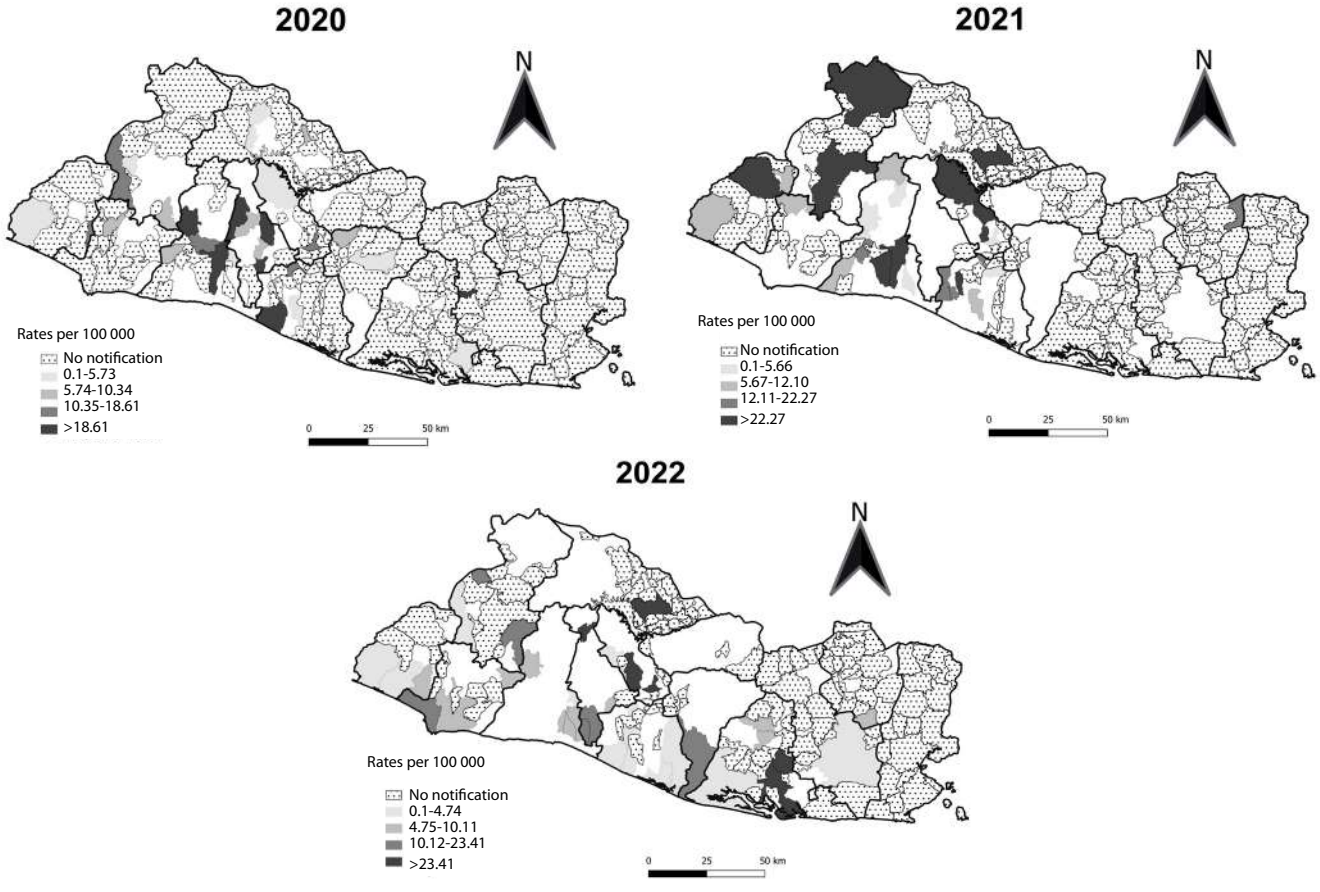

Figure 2. Distribution of typhoid fever rates by city, 2020 to 2022, El Salvador.

Discussion

In this investigation, the highest notification was in San Salvador in the 19 to 29 year-old male age group. This disease is classified based on its incidence per 100 000 inhabitants per year as: low (less than ten cases), moderate (10 to 100 cases), high (more than 100 cases) and very high (more than 500 cases).[xv] The country remained in a low risk category of having the disease during the three years of the study; however, it was above the expected for the Americas region, which is between three to four cases per 100 000 population.[vi]

Worldwide, the highest incidence of the disease is observed in children and adolescents between one and 14 years of age.[vi] The data from El Salvador were concentrated in a wider range and at a higher age than expected, similar to that reported by a study in Colombia, in which the highest percentage of cases was concentrated between ten and 29 years of age[xvi].

Regarding the sex variable, some research has shown that El Salvador has data similar to those reported in Colombia and some European and African countries, where the proportions for each sex are close to 50%.[xvi-xviii.]

Most cases were reported in urban areas, similar to studies in Asia, where typhoid fever was found to be concentrated in impoverished and densely populated urban areas, contrary to those reported from countries in sub-Saharan Africa, where the incidence was found to be higher in rural areas.[xviii] In a study conducted in England, the proportion of cases in urban areas was 96.1 % of the cases of typhoid and paratyphoid fever, a proportion much higher than that reported in this study, although this may be because, in these countries, cases are generally imported and have a history of travel to endemic areas.[xvii]

In El Salvador, the annual variation appears to be small, with the highest incidence occurring at almost the same time each year, between the months of March and May, which correspond to the end of the dry season and the beginning of the rainy season in El Salvador;[xix] this is congruent with other research that reports an association of rainfall and humidity with infectious diseases.[xx]

During the study period, suspected cases of typhoid fever were reported to the surveillance system. In 2024, the surveillance guidelines for El Salvador were updated. Currently, only cases that are confirmed by stool culture, blood culture, or myeloculture are reported. Additionally, the definition of a

suspected case has been modified, and the time for evolution has been extended from seven to ten days.[xxi]

Current epidemiological surveillance in the country is similar to that carried out in Colombia[xvi] and several Asian and African countries,[xxii,xxiii] as it includes passive surveillance focused on health facilities for typhoid fever cases with laboratory confirmation. Other research on the incidence and burden of typhoid fever disease complemented passive surveillance data with serologic surveys and health service utilization surveys.[xxii,xxiii]

Changes in the surveillance system limit the ability to compare case reporting in this research with records outside the study period. In addition, because suspicious cases were recorded in the system during the period analyzed, reporting rates may be overestimated.

Because *Salmonella typhi* is excreted in feces, there is evidence that searching for this agent in sewage or surface water contaminated with sewage in outbreaks or areas of endemic transmission could strengthen surveillance by providing information on the burden of disease in the population and facilitating the identification of TF outbreaks.[xxiv-xxvi] Therefore, its implementation in El Salvador could be a complementary surveillance of the disease, since the patient's environment would be studied more exhaustively for future analyses, especially in San Salvador and La Libertad, which were the most affected departments.

Conclusion

The incidence of TF established by the VIGEPES system data for the years 2020 to 2022 does not vary considerably by year, and its behavior is cyclical at a certain time of the year. The department with the highest notification of the disease is San Salvador, and the age groups with the highest risk, as evidenced by rates, are 19 to 29 years of age, affecting the male gender in greater proportion.

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Original Article

Comparison of effectiveness of two umbilical venous catheter placement methods

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Abstract
Introduction. Umbilical catheterization is the cannulation of the umbilical vessels in critical ill neonates. Methods differ in accuracy and it is not always adequate; the most used are the Shukla and Dunn methods. In the neonatology units of El Salvador, a standard method of placing umbilical venous catheters has not been studied, therefore a randomized trial of two methods was carried out to compare effectiveness. **Objective.** Determine the effectiveness of umbilical venous catheter placement using two methods, Shukla and Dunn, in patients admitted to the neonatal intensive care unit of the National Women's Hospital from october 1st to 31st, 2020. **Methodology.** Randomized clinical trial. The population was all newborns who were admitted to intensive care and had an umbilical venous catheter placed; simple randomization was performed for both catheterization methods. effectiveness is the correct position of the catheter in a single placement attempt. **Results.** There were 60 neonates in the study. The male sex was predominant (53.3 %). 37 neonates were younger than 32 weeks. 58.3 % presented respiratory distress syndrome 30 were catheterized with the Dunn method and 30 with the Shukla method. Better effectiveness is determined with Shukla (86.6 %) vs. Dunn (63.4 %). **Conclusion.** Better effectiveness is determined with the Shukla method and more failures with the Dunn method.

Keywords
Catheters; Umbilical Veins, Infant, Newborn.

Resumen
El cateterismo umbilical es la canalización de los vasos umbilicales en neonatos delicados. Los métodos difieren en cuanto a la exactitud y el método elegido no siempre es el adecuado; los más utilizados son los métodos de Shukla y Dunn. En las unidades de neonatología de El Salvador no se tiene estudiado un método estándar de colocación de catéteres venoso umbilical, por lo cual, se realizó un ensayo aleatorizado de dos métodos para comparar la efectividad. **Objetivo.** Determinar la efectividad de colocación de catéter venoso umbilical por medio de dos métodos, de Shukla y Dunn en los pacientes que ingresaron en la Unidad de Cuidados Intensivos Neonatales del Hospital Nacional de la Mujer del uno al 31 de octubre de 2020. **Metodología.** Ensayo clínico aleatorizado. La población fue todos los recién nacidos que ingresaron a cuidados intensivos y se les colocaba un catéter venoso umbilical; se realizó aleatorización simple para ambos métodos de cateterismo; se consideró como posición efectiva si la punta del catéter radiopaco estaba en la posición de las vértebras T6 y T9. **Resultados.** Fueron 60 neonatos en el estudio. Hubo un predominio del sexo masculino (53,3 %). Treinta y siete neonatos fueron menores de 32 semanas. El 58,3 % presentó síndrome de distress respiratorio. Se cateterizaron 30 con el método Dunn y 30 con el método Shukla. Se determinó mejor efectividad con Shukla (86,6 %) comparado con Dunn (63,4 %). **Conclusión.** Se determinó mejor efectividad con el método Shukla y más fallas con el método Dunn.

Palabras clave
Catéteres, Venas Umbilicales, Recién Nacido.

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Introduction

Umbilical catheterization (UC) is an invasive procedure for cannulation of the umbilical cord vessels as a vascular access route for newborns (NB), for blood sampling, hydration, parenteral nutrition, and administration of medications after delivery.[i,ii] The UC is the route of choice in the critically ill NB, according to international standards and the clinical guidelines of the Ministry of Health of El Salvador.[iii,iv]

There are several techniques for estimating the length of umbilical venous catheter insertion. Dunn's nomogram measures length by drawing a line from the highest part of the shoulders to the umbilical stump (shoulder-oblique distance).[v,vi] This measurement in centimeters is plotted on the graph up to the intersection with the marked line, from which the length of the catheter to be inserted is obtained; subsequently, the centimeters protruding from the umbilical stump are added. The correct catheter tip placement is between the diaphragm and the left atrium.[vi]

In Shukla's method, birth weight is used using the following equations.[vi,vii]

Length of umbilical arterial catheter=

$$3 \times Weight\ in\ Kg + 9$$

Length of umbilical venous catheter=

$$\frac{Lenght\ of\ umbilical\ arterial\ catheter}{2} + 1\ cm$$

Other formulas have been proposed, such as Shukla's version modified by Verheij et al, which proposes the use of the distance from the umbilicus to the middle xiphoid, among others. There is currently no formula that guarantees the effectiveness of adequate catheter placement.[viii]

Another method suggested for the adequate placement of the umbilical catheter is through ultrasonography, which allows guiding the catheter tip[ix]; however, this method is not performed in the institutions of the country, so the formulas exposed are still used, and thoracoabdominal radiography is used to verify the position of the catheter tip.

Incorrect positioning of the catheters makes it necessary to remove the catheter and reposition a new one, which implies a second procedure and leads to a new risk of invasive procedure for the newborn, as well as increased manipulation with risks of infection and embolism.[x]

In the neonatology units of El Salvador, there is no standard method defined for umbilical venous catheter (UVC) placement, which is why the study aimed to determine the effectiveness of UVC placement by comparing the Shukla and Dunn methods in patients admitted to the Neonatal Intensive Care Unit (NICU) of the National Women's Hospital from October 1st to 31st, 2020.

Methodology

A randomized clinical trial was conducted to compare the effectiveness of CVU placement by comparing two methods of neonatal umbilical catheterization: Dunn's method and Shukla's method. The study was conducted from October 1st to 31st, 2020, in the Neonatal Intensive Care Unit (NICU) of "Dra. María Isabel Rodríguez" National Women's Hospital.

The study population corresponds to neonates who required umbilical vein catheter placement according to newborn care protocols. The patient eligibility criteria were all neonates who were admitted to the NICU in the first 24 hours of life and required umbilical catheter placement; neonates with major congenital malformations (those that represented a vital risk, required surgery, involved severe esthetic sequelae or were incompatible with life) and those who, due to anatomical reasons of the umbilical vein lumen, could not have the catheter inserted were excluded.

The simple randomization method with allocation concealment using sealed opaque envelopes was used to compare the effectiveness of both methods. The sample size was based on the average monthly number of neonates admitted and catheterized in the NICU each month (on average 60 admissions per month). Sixty opaque, sealed envelopes were prepared, containing a card indicating the umbilical catheterization method to be applied; 30 envelopes with Dunn's method and 30 envelopes with Shukla's method. The umbilical catheterization was performed by neonatology specialists with experience in the placement of catheters, and the neonatology service personnel were trained in the study methodology, receiving induction and training in both techniques.

When the newborn was admitted to the NICU, the physician proceeded to randomly remove an envelope, opened it and took out the card indicating the umbilical catheterization technique to be used. Afterwards, he/she would write down the patient's file number and name on the back of the card, then place it in another box containing the data; likewise, the record was left in the file of each neonate. The position of the tip of the catheter inserted in the umbilical vein was immediately verified using an X-ray. It was considered as correct or "effective" position if the tip of the radiopaque catheter was located in the position of the thoracic vertebrae T6 and T9.[ii,viii,ix,x]

The variables studied were sex, birth weight (very low birth weight between 1000 g and 1499 g and low birth weight between 1500 g and 2499 g), gestational age at birth (extreme preterm < 28 weeks, very preterm infants between 28 and 32

weeks and late preterm infants between 32 and 37 weeks), the basic cause of admission (diagnosis), the method of UC used (Dunn or Shukla) and complications (intestinal perforation, myocardial perforation, cardiac arrhythmias, bleeding and infection).

The data were entered into an Excel spreadsheet and transferred to the SPSS version 22 statistical program for analysis; in addition, the OpenEpi web calculator was used. For descriptive statistics, frequencies, percentages, and means were used. Tables were divided by sex, weight, and gestational age for each method. The comparison of the methods was performed with the elaboration of 2×2 tables with Fisher's exact test, relative risk values, and risk differences; a p-value < 0.05 was occupied for a statistically significant value.

To safeguard the identity of each patient (as established by the Helsinki norms), a database identified only with the file number was created and handled only by the investigators. Each mother or representative signed the informed consent form and authorized the procedure. This study was reviewed and approved by the local ethics committee of the Hospital Nacional de la Mujer. The clinical records for data collection were used within the hospital facilities.

Results

During the study period, 68 newborns were admitted to the NICU; of these, eight were excluded: four neonates with major congenital malformations and four neonates with umbilical vein lumen abnormalities that prevented umbilical catheter placement (Figure 1). Sixty newborns were studied. Regarding sex, 53 % were male (32) and 47 % female (28).

Regarding birth weight, the largest number of patients was low birth weight newborns, 38.3 % (23); 37 % (22) were very low birth weight, 15 % (9) were extremely low birth weight, and the remaining 10 % (6) were normal birth weight. In the group of neonates in which the Shukla method was used, there were cases of inadequate position in males; 18.2 % (2/11) of the neonates had very low birth weight, while 16.7 % (2/12) had low birth weight. Regarding the group of neonates in whom the Dunn method was used, the catheter was found to be inadequately placed in 45.4 % (5/11) of the low-weight neonates, predominantly male, while in the normal-weight neonates, 75 % (3/4), all female, had an inadequate placement; in contrast, in the very low-weight neonates the percentage was 18.2 % (2/11), all male. Finally, extremely low-weight neonates had an inadequate position in 25 % (1/4), and it was male (Table 1).

Regarding gestational age, 93.3 % were preterm neonates, the predominant gestational age was found in very preterm neonates with 48.3 % of neonates (29/60) followed by late preterm with 31.7 % (19/60), 13.3 % (8/60) were extreme preterm and the remaining 6.7 % (4/60) were term neonates, no postterm neonates were found.

In 13.3 % (4/30) of the neonates who used the Shukla method, the catheter was inadequately placed, all were very premature newborns, which corresponds to 25 % (4/16) of the patients in this gestational age group, with equal percentages in both sexes.

In the group of neonates in which the Dunn method was used, there were cases

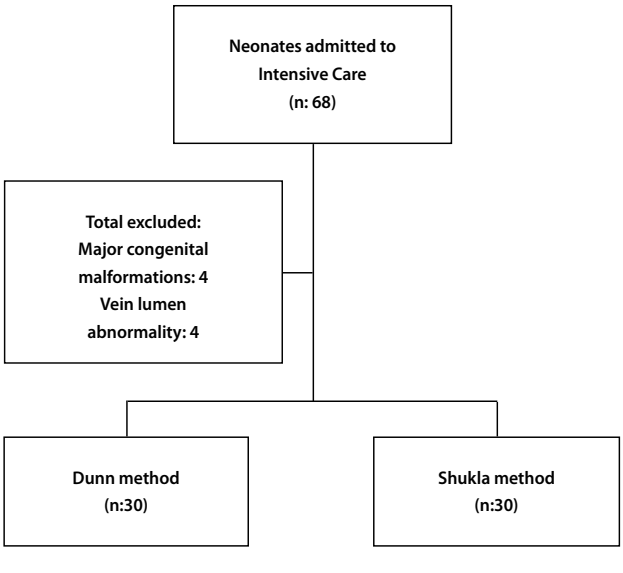

Figure 1. Number of patients admitted to the NICU who met the study inclusion criteria and the reasons for non-inclusion.

of inadequate position in all gestational age categories. In all term neonates, an inadequate position was found, predominantly in the female sex, followed by extreme preterm infants with 33.3 % (1/3), identified in one male neonate while very preterm neonates presented an inadequate position in 30.8 % (4/13) in equal numbers in both sexes. Finally, in late preterm infants, an inadequate position of the catheter tip was identified in 27.3 % (3/11), with a higher value in males (Table 2).

The Shukla method represented 86.6 % (26/30) of catheters in correct or "effective" position, against 63.2 % (19/30) with the Dunn method (Figure 2); it is worth mentioning that all the catheters in inadequate position of the Shukla method corresponded to high positions between T3-T5; while those of the Dunn method 9.1 % (1/11) were in high position and 90.9 % (10/11) in low position (between T10-L5).

Finally, it can be seen that of the 45 neonates who had the catheter properly placed, 58.8 % (26/45) corresponded to UC performed according to the Shukla method. The Shukla method seems to have a higher probability of success in terms of adequate cannulation. The Fisher's exact test obtained a p-value = 0.03, a risk ratio of correct placement of 1.368 (CI: 1.007- 1.859 and with $p < 0.05$) and a proportion of correct placement in a stable population attributable to the umbilical venous catheter placement method of 15.56 %, compared to the Dunn method (Table 3). An incorrect or "ineffective" position represents one more procedure and undergoes an invasive procedure twice.

Discussion

Intravascular catheters are widely used in the NICU. Methods of intravascular access in the newborn include peripheral catheters, arterial or venous umbilical catheters, central venous catheters, and peripherally installed central venous catheters (PICCs).

Umbilical catheterization continues to be the method of choice for administering fluids, medications and nutrition in neonates admitted to an intensive care unit to date, as it is the quickest and safest access route to use.[xi] Newborns who, due to their disease process, require admission to the NICU are immediately placed in an incubator and positioned for the umbilical catheterization procedure upon arrival at the unit. Anomalous catheter positions, especially umbilical catheters, are frequent, since their placement is not guided by images.[xii,xiii,xiv]

Incorrect positioning or malpositioning of the umbilical venous catheters can occur before reaching the desired position and can be found in the umbilical recess, before reaching the left portal vein, and when trying to advance the catheter, it can be pushed back into the umbilical vein. When the catheter reaches the umbilical recess, it should pass through the left portal into the ductus venosus; however, at this point it

Table 1. Distribution of neonates by weight and sex according to the method of umbilical catheterization used. n: 60.

	Method of catheterization / Weight-sex				
	Shukla		Dunn		Total
Birth weight/sex	Correct or "effective" position	Incorrect or "Not effective" position	Correct or "effective" position	Incorrect or "Not effective" position	
Extremely low weight	-	-	-	-	9
Female	2	0	1	0	3
Male	3	0	2	1	6
Very low weight	-	-	-	-	22
Female	4	0	4	0	8
Male	5	2	5	2	14
Low weight	-	-	-	-	23
Female	7	0	3	2	12
Male	3	2	3	3	11
Normal weight	-	-	-	-	6
Female	1	0	1	3	5
Male	1	0	0	0	1
Total	26	4	19	11	60

Table 2. Comparison of umbilical catheterization according to gestational age.

Method of catheterization / Gestational age -Sex					
	Shukla		Dunn		Total
Birth weight/sex	Correct or "effective" position	Incorrect or "Not effective" position»	Correct or "effective" position	Incorrect or "Not effective" position	
Extreme preterm	-	-	-	-	8
Female	2	0	1	0	3
Male	3	0	1	1	5
Very preterm	-	-	-	-	29
Female	5	2	4	2	13
Male	7	2	5	2	16
Late preterm	-	-	-	-	19
Female	5	0	3	1	9
Male	3	0	5	2	10
Term newborn	-	-	-	-	4
Female	1	0	0	2	3
Male	0	0	0	1	1
Total	26	4	19	11	60

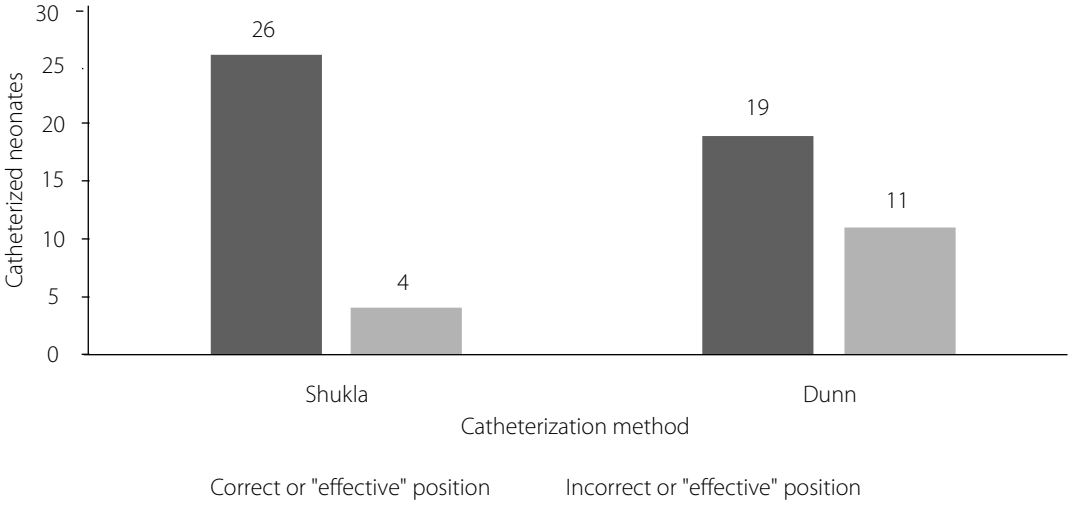

Figure 2. Comparison of two methods of neonatal umbilical venous catheter placement.

Table 3. 2 × 2 comparison table of both methods. N: 60

		Correct position/ Effective	Incorrect position/ Not effective	Total
Method of placement of umbilical venous catheters	Shukla	26	4	30
	Dunn	19	11	30
	Total	45	15	60

Fisher's exact test with p = 0.03
Risk ratio of 1.368 (CI: 1.007- 1.859) p < 0.05
Risk difference of 23.33 %
Attributable risk of 0.23
Population etiologic fraction (PEF) 15.56 %.%

may be deflected into the left portal or right portal or even the main portal, then it may pass into the superior mesenteric and splenic vein. The catheter in the portal portal vein may cause portal thrombosis.[xv,xvi]

Most of the patients under investigation are of low weight and very low weight due to the complexity of the hospital where the study was carried out. Both methods studied are used in the NICU of the hospital where the trial was performed. The catheters that are in the wrong position (liver, right atrium, right ventricle or are left angled) must be changed in order to reduce complications.

Dunn's[v] method registered more inadequate positions, making it necessary to reposition the umbilical venous catheter, which increases material costs and exposure to the risk of the new procedure.

It has been noted in the formulas that have been developed to allow proper positioning of UVC, they are generally based on birth weight. However, no significant difference in terms of demographic characteristics was found in the study conducted, similar to other studies in the literature.[xii-xv]

Umbilical catheterization is associated with multiple complications, including generalized infectionxv,xvi , which is associated with increased mortality, mainly in very premature neonates and in those with very low birth weight; furthermore, complications related to catheter placement, such as migration of the catheter tip into the peritoneal, pleural or pericardial spaces have been described.[xvii-xxii]

UVC placement has been commonly used for vascular access in critically ill neonates of all birth weights at delivery and postpartum. For decades, the standard for accuracy of placement, relied on radiological examinations to know the effective position; in addition, echocardiography method has been used to indicate the position of the catheter tip in the right central atrium (RCA) and/or thoracic atrium inferior vena cava junction-RA (TIVC-RA), two safe locations for the UVC tip; however, there is no international agreement.[xxiii,xxiv]

Currently, in order to verify the accuracy of umbilical catheter placement based on visualization of the catheter tip, it is performed by ultrasound method, even for very low birth weight infants; it is suggested that echocardiography may be useful to verify that misplacement has not occurred or that the catheter has not migrated from the CVU tip into the left atrium.[xxv]

Thus in the 2020 International Clinical Practice Guideline on Bedside Ultrasound and the 2015 Cochrane Review[xxvi,xxvii], internal jugular vein cannulation in children and neonates is recommended to be ultrasound-guided with a quality of evidence grade A. Oulego-Erroz *et al.* recommend ultrasound-guided cannulation of the subclavian vein and brachiocephalic trunk in children and neonates, improving the success rate with fewer needle passes.[xxviii]

The study has limitations, since there was no ultrasound equipment to perform the evaluation of the UVC tip position in real time, only radiographic studies were available (anteroposterior radiography taken in the newborn incubator), which were performed more than 30 minutes from insertion to reading, to obtain the position of the UVC tip. In addition, there are no authoritative guidelines on the procedures to be performed with the position of the UVC tip, and the frequency of tip surveillance is performed in cases of unexpected migration of the UVC.

A study comparing the accuracy of umbilical venous catheter tip position using radiographic and ultrasound studies is recommended to provide guidelines for the placement and measurement of catheter placement in NICUs.

It is necessary to implement the ultrasound study in all NICUs within the guidelines of care to achieve a better placement of umbilical catheters and thus achieve better health safety for our newborns we serve.

Conclusion

When comparing the efficacy of both methods, a higher percentage of inadequate position was found with Dunn's method, which leads these patients to undergo catheterization again, exposing them to more risks and complications for a second procedure. Regarding the usefulness of both methods, it can be said that both have some value in the evaluation of umbilical vein cannulation.

At the local level, radiological examination remains the main tool for monitoring catheter position; early recognition of malpositioning can be useful in preventing possible complications. It is necessary to be familiar with the imaging recommendations for the expected position of the various catheters and also for those that acquire anomalous positions.

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Original Article

Factors associated with disability severity in El Salvador

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Abstract
Introduction. Disability is accompanied by physical, mental, intellectual or sensory difficulties; in the world, it is estimated that 15 % of the population has some type. This condition is a dynamic concept that involves the relationship between the person, physical environment, and social environment. **Objective.** Determine the factors associated with the severity of disability in the National Health Survey, El Salvador. **Methodology.** An analytical cross-sectional study based on the National Health Survey included people registered with disabilities in the axes: vision, hearing, walking, cognition, self-care, and communication, registered through the Washington Group questionnaire. Descriptive statistics, U Mann Whitney, and the association was determined by Odds Ratio with 95 % confidence intervals and p-value. In turn, a logistic regression model was built. **Results.** 17,1 % of the people had disabilities, 58,4 % were female and 62,9 % were from urban areas. The most frequent type of disability by severity indicator was mild with 63,7 %; 37,4 % presented functional difficulty seeing and the total prevalence of the disability condition in the axes evaluated by the National Health Survey was: 17,1 % (IC 95 %: 16,8-17,4). The factor that presented the greatest association was chronic diseases with Odds Ratio 2. 1. (IC 95 %I: 1,15-1,76) $p < 0,05$. **Conclusion.** The factors associated with the severity of disability were age and chronic diseases.

Keywords
Disability Studies, Health Surveys, Surveys and Questionnaires, Secondary Data Analysis, Statistics on Sequelae and Disability.

Resumen
Introducción. La discapacidad se acompaña de dificultades físicas, mentales, intelectuales o sensoriales. En el mundo se calcula que el 15 % de la población tiene algún tipo de discapacidad. Esta condición es un concepto dinámico que involucra la relación entre la persona, entorno físico y ambiente social. **Objetivo.** Determinar los factores asociados a gravedad de discapacidad en la Encuesta Nacional de Salud, El Salvador. **Metodología.** Estudio transversal analítico, a partir de la Encuesta Nacional de Salud 2021, incluyó a personas registradas con discapacidad en los ejes: vista, audición, caminar, cognición, autocuidado y comunicación, registrados mediante el cuestionario del Grupo Washington. Se utilizó estadística descriptiva, pruebas U de Mann Whitney; la asociación se determinó por Odds Ratio, intervalos de confianza al 95 % y valor de $p < 0,05$. Se construyó un modelo de regresión logística. **Resultados.** El 17,1 % de las personas presentaron discapacidad, el 58,4 % pertenece al sexo femenino y el 62,9 % a zona urbana. El tipo de discapacidad por indicador de gravedad con mayor frecuencia fue leve con el 63,7 %, el 37,4 % presentó dificultad funcional para ver y la prevalencia total de la condición de discapacidad en los ejes evaluados por la Encuesta Nacional de Salud fue de: 17,1 % (IC 95 %: 16,8-17,4). El factor que presentó mayor asociación fue la presencia de enfermedades crónicas con Odds Ratio de 2,1 (IC 95 %: 1,15-1,76) $p < 0,05$. **Conclusión.** La edad avanzada y la presencia de enfermedades crónicas fueron los factores asociados a la gravedad de la discapacidad.

Palabras clave
Estudios de la Discapacidad, Encuestas de Salud, Análisis de Datos Secundarios, Estadísticas de Secuelas y Discapacidad.

OPEN ACCESS

Factores asociados a la gravedad de las discapacidades en El Salvador

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Introduction

Disability is a condition accompanied by physical, mental, intellectual, or sensory difficulties that affect the full development of a human being and their performance in daily social activities. It is defined as "a condition in which a person has long-term physical, psychosocial, intellectual, or sensory impairments. When interacting with various barriers, these impairments can impede or reduce their full and effective par-

ticipation in all areas of society on an equal basis with others."[i]

Worldwide, it is estimated that around 15 % of the population has some disability.[ii] Research reports greater severity and risk of death from stroke in populations with multiple disabilities.[iii]

In Latin America, around 12 % of the population has some type of disability, and it is estimated that a person with a disability dies 20 years earlier than someone without a disability.[ii] By 2015, in El Salvador, it was estimated that 222 595 women and 188 203 men had some disability, of which 80 % of the population belonged to the age group of 25 to 64 years.[iv]

Disability, by nature, is a dynamic concept that involves the relationship between the person and their condition, the physical environment, the social environment, economic factors, and religious beliefs. Different scales allow disability to be classified; one is the Washington Group's short questionnaire, founded in 2001 within the framework of the International Seminar on Disability Measurement, which has been applied to measure this condition in various studies.[vi,vii,viii] This questionnaire allows for assessing disability through short, standardized questions, depending on the respondents' responses.[ix]

Disability is complex, and the term encompasses multiple conditions. A 2021 study of factors associated with disability found that the most significant disability was found in women, those with low education, and comorbidities (diabetes *mellitus* and cardiovascular disease).[x] Meanwhile, another study found that people with severe disabilities are 7 .9 times more likely to develop depression compared to those with mild and moderate disabilities.[xii] These findings reinforce the multifactorial nature of disability and the need to understand how various factors, such as age, sociocultural conditions, comorbidities, and others, interact to influence the severity of disability or how a condition can become disabling. This approach is crucial for designing comprehensive prevention and management strategies that reduce the burden of disability and improve the quality of life of people with this condition.

In this context, this study was structured to determine the factors associated with disability severity in Salvadorans who participated in the National Health Survey (ENS, for its acronym in Spanish) during 2021.[xii] Also, the value of this secondary analysis lies in providing scientific evidence on the factors that influence disability severity.

Methodology

It is an analytical cross-sectional study based on data from the National Health Survey of El Salvador, carried out in 2021 by the National Health Institute of El Salvador (INS) [EA1] with the support of the General Directorate of Statistics and Census; this survey collected information from all 14 departments of El Salvador.[xii] The survey included results from 16 500 households nationwide and 62 490 participants. All people registered with any difficulty in the areas assessed by the survey were included in this Research: vision, hearing, gait, cognition, self-care, and communication. People coded as "non-responsive" in the variables of interest were excluded.

This study considered variables such as age, sex, and difficulties with movement, vision, communication, hearing, bathing, understanding, learning, and relating to others, each with four response options: "None," "Yes, little difficulty," "Yes, much difficulty," and "Total." From these variables, the categories "disability" and "severity of disability" were constructed. Other relevant variables were included, such as chronic noncommunicable diseases, department, educational level, area of residence, and health region. All of these data were integrated into a unified database for analysis.

The severity indicators were constructed using the Washington Group's creation tool, using the highest difficulty recorded as the construction method. If a person responded "no difficulty" in any of the assessed areas, they were categorized as having no disability. For the mild disability indicator, participants who did not have any area coded as "total difficulty" or "much difficulty" and who also responded that they had "little difficulty" in at least one area were considered. For moderate disability, participants who did not have any area coded as "total difficulty" and who responded that they have "much difficulty" in at least one area were considered. For the severe disability indicator, those who responded "total difficulty" in some area were considered.

The INS Research Unit provided the database as a linear database with the requested variables of interest. Data quality was verified; the analysis did not include variables with 20 % missing records.

For univariate analysis, frequencies, proportions, and ratios were constructed. Continuous quantitative variables were tested for normality using the Anderson-Darling normality test, with the median as a measure of central tendency and the interquartile range as a measure of disper-

sion. The Mann-Whitney U test was used to determine differences between the median ages by sex. Two-by-two tables were constructed for bivariate analysis, using the prevalence odds ratio (POR) as a measure of association with 95 % confidence intervals and considering p < 0 .05 as significant. A logistic regression model was performed for multivariate analysis with severe disability as the response variable and age, sex, area, education, and chronic noncommunicable diseases as predictor variables. A global test was performed on the model to determine significance. Statistical analysis was performed using RStudio V1 .4 .1106. In addition, a map was created using QGIS v3 .26 to represent the prevalence of disability by department. This Research was approved by the INS Ethics Committee under document number CEINS/2023/011.

Results

The included population consisted of 10 695 people registered with some type of disability. 58 .4 % were female, and 41 .6 % were male. 62 .9 % were from urban areas, and 37 .1% were from rural areas. Table 1shows the sociodemographic characteristics of the population by severity indicator.

Regarding academic level, 40.0 % had a primary education (between first and sixth grade), followed by 12.8 % a secondary education (seventh to ninth). When analyzing by severity indicator, primary education had the highest proportion of mild disability at 50.0 %, moderate disability at 61.0 %, and severe disability at 62.8 %. The Anderson-Darling test for age yielded a result of 0.69 and a p-value < 0.05; the median age was 53 years (interquartile range: 34–68 years). The female ratio was 1:1. The median age for women was 54 (interquartile range: 37–68 years), and for men, 51 (interquartile range: 31–68 years). The Mann–Whitney U test for median age by sex yielded a p-value < 0.05.

Disability is classified according to three severity indicators: mild, moderate, and severe. Mild disability was present in 63.8 % (95 % CI: 62.8–64.7), moderate disability in 32.8 % (95 % CI: 31.9–33.6), and severe disability in 3.4 % (95 % CI: 3.0–3.7). The most common functional difficulty was "seeing," at 37.4 % (95 % CI: 36.5–38.3), followed by "moving" at 18.9 % (95 % CI: 18.1–19.6), and "understanding" or "learning" at 16.3 % (95 % CI: 15.6–17.0). When severity indicators were assessed, it was identified that 27.4 % (95 % CI: 26.5-28.2) had a mild disability in "seeing," 9.7 % moderate (95 % CI: 9.1-10.2), and 0.4 % severe (95 % CI: 0.2-0.4). The severe indicator was identified in functional difficulties in "moving" with 0.9 % (95 % CI: 0.6-1.0) and in "dressing," "bathing," or "eating" with 0.6 % (95 % CI: 0.4-0.7).

The total prevalence of disability across the axes assessed by the 2021 ENS at the national level was 17.1 % (95 % CI: 16.8-17.4). Five departments are above the national prevalence: Chalatenango with a prevalence of 20.4 % (95 % CI: 19.1-21.8), followed by San Vicente with 18.9 % (95% CI: 17.5-20.2), Cabañas with 18.4 % (95 % CI: 17.3-19.5), and La Libertad with 18.4% (95 % CI: 17.2-19.6). Figure 1represents the prevalence of total disability by department among participants in the 2021 ENS.

The department with the highest prevalence of mild disability was Sonsonate, with 66.9 % (95% CI: 63.1-70.5). The department of Morazán had the highest prevalence of moderate disability, 36.1 % (95 % CI: 32.8-39.5). The department that reported the highest prevalence of severe disability was Usulután, with 4.7 % (95 % CI: 3.3-6.5).

Bivariate analysis revealed the following results: male sex had an OR of 1.12 (95 % CI: 0.91-1.38; p = 0.26), indicating a non-significant association. Residents in rural areas had an OR of 0.81 (95 % CI: 0.65-1.01; p = 0.07), which was also without statistical significance. In contrast, those aged over 60 years had an OR of 1.42 (95 % CI: 1.15-1.76; p < 0.05), demonstrating a significant association. For the level of education, the OR was 0.91 (95 % CI: 0.34-3.88; p = 0.88), without statistical significance. Finally, the presence of chronic diseases showed a strong association, with an OR of 2.96 (95 % CI: 2.38-3.69; p < 0.05).

In the multivariate analysis, the results show that the population over 60 years of age had a higher probability of presenting severe disability OR of 1.9 (95 % CI: 1.3-2.6) and a p-value < 0.05. Likewise, the presence of chronic diseases was associated with a higher probability of severe disability with an OR of 2.1 (95 % CI: 1.5-3.0) and a p-value < 0.05. On the other hand, the variables that did not present an association in the model were educational level, area, and sex. Table 2shows the results of the multivariate analysis of the factors associated with severe disability in the Salvadoran population that participated in the ENS.

Discussion

Disability encompasses a wide variety of conditions and is complex to explain in a unidirectional manner. Multiple factors are interrelated with disability, including the physical environment, the atmosphere in society, economic factors, and religious aspects.[xiii,xiv,xv] When determining the age and

Table 1. Sociodemographic characteristics of the population with disabilities from the National Health Survey by severity indicator, 2021.

Variable	Mild disability			Moderate disability			Severe disability		
	N 6823	%	IC 95%	N 3507	%	IC 95%	N 365	%	IC 95%
Sex									
Female	4005	58.6	(57.5 - 59.8)	2040	58.2	(56.5 - 59.7)	203	55.6	(50.4 - 60.6)
Male	2818	41.4	(40.1 - 42.4)	1467	41.8	(40.2 - 43.4)	162	44.4	(39.3 - 49.5)
Area									
Urban	4321	63.4	(62.1 - 64.4)	2160	61.6	(59.9 - 63.1)	246	67.4	(62.4 - 70.0)
Rural	2502	36.6	(35.5 - 37.8)	1347	38.4	(36.8 - 40.0)	119	54.5	(49.3 - 59.5)
Age									
0 a 10	432	6.5	(5.7 - 6.9)	178	5.1	(4.3 - 5.8)	30	8.2	(5.8 - 11.4)
11 a 20	543	7.9	(7.3 - 8.6)	209	6.0	(5.2 - 6.7)	32	8.8	(6.2 - 12.1)
21 a 30	645	9.4	(8.7 - 10.1)	215	6.1	(5.3 - 6.9)	43	11.8	(8.8 - 15.4)
31 a 40	689	10.0	(9.4 - 10.8)	229	6.5	(5.7 - 7.3)	34	9.3	(6.7 - 12.7)
41 a 50	1112	16.4	(15.4 - 17.1)	444	12.7	(11.6 - 3.8)	24	6.6	(4.4 - 9.5)
51 a 60	1340	19.6	(18.7 - 20.6)	591	16.9	(15.6 - 18.1)	40	11.0	(8.1 - 14.5)
> 60	2062	30.2	(29.1 - 31.3)	1641	46.7	(45.1 - 48.4)	162	44.3	(39.3 - 49.5)
Level of education*									
Initial	12	0.2	(0.1 - 0.3)	5	0.2	(0.0 - 0.5)	1	0.6	(0.0 - 3.8)
Kindergarten	111	2.1	(1.7 - 2.4)	34	1.4	(0.9 - 1.9)	7	4.3	(1.8 - 8.9)
Elementary	2692	50.0	(48.6 - 51.3)	1479	61.0	(58.9 - 62.9)	103	62.8	(54.8 - 70.1)
Middle school	977	18.0	(17.1 - 19.1)	369	15.2	(13.8 - 16.7)	22	13.4	(8.7 - 19.8)
General High-school	580	10.8	(9.9 - 11.6)	184	7.6	(6.5 - 8.7)	11	6.7	(3.5 - 11.9)
Vocational Highschool	450	8.4	(7.6 - 9.1)	179	7.4	(6.3 - 8.5)	6	3.7	(1.4 - 8.1)
Higher non-university	99	1.8	(1.5 - 2.2)	25	1.0	(0.6 - 1.5)	3	1.8	(0.4 - 5.6)
University	451	8.4	(7.6 - 9.1)	145	6.0	(5.0 - 7.0)	8	4.9	(2,2 - 9,7)
Special	16	0.3	(0.1 - 0.4)	6	0.2	(0.0 - 0.5)	3	1.8	(0.4 - 5.6)
Department									
Ahuachapán	405	5.9	(5.4 - 6.5)	225	6.4	(5.6 - 7.2)	22	6.0	(3.9 - 9.1)
Santa Ana	463	6.8	(6.2 - 7.4)	233	6.6	(5.8 - 7.5)	25	6.8	(4.5 - 10.0)
Sonsonate	419	6.2	(5.5 - 6.7)	187	5.4	(4.6 - 6.1)	20	5.5	(3.4 - 8.4)
Chalatenango	462	6.8	(6.1 - 7.3)	221	6.3	(5.5 - 7.1)	24	6.6	(4.3 - 9.7)
La Libertad	487	7.2	(6.5 - 7.7)	250	7.1	(6.3 - 7.0)	16	4.4	(2.6 - 7.1)
San Salvador	1356	19.9	(18.9 - 20.8)	671	19.1	(17.8 - 20.4)	67	18.4	(14.5 - 22.7)
Cuscatlán	279	4.0	(3.6 - 4.5)	134	3.8	(3.2 - 4.5)	12	3.3	(1.7 - 5.8)
La Paz	410	6.0	(5.4 - 6.5)	203	5.8	(5.0 - 6.6)	18	4.9	(3.0 - 7.8)
Cabañas	562	8.3	(7.6 - 8.9)	294	8.4	(7.5 - 9.3)	35	9.6	(6.8 - 13.1)
San Vicente	368	5.4	(4.8 - 5.9)	198	5.6	(4.9 - 6.4)	22	6.0	(3.9 - 9.1)
Usulután	414	6.0	(5.5 - 6.6)	218	6.2	(5.4 - 7.0)	31	8.5	(5.9 - 11.9)
San Miguel	372	5.4	(4.9 - 6.0)	199	5.7	(4.9 - 6.4)	23	6.3	(4.1 - 9.4)
Morazán	473	6.9	(6.3 - 7.5)	281	8.0	(7.1 - 8.9)	24	6.6	(4.3 - 9.7)
La Unión	353	5.2	(4.6 - 5.7)	193	5.6	(4.7 - 6.3)	26	7.1	(4.7 - 10.3)

*Note. Classified as 98 or NA in education level for mild disability: 1435, moderate 1081 and severe: 201.

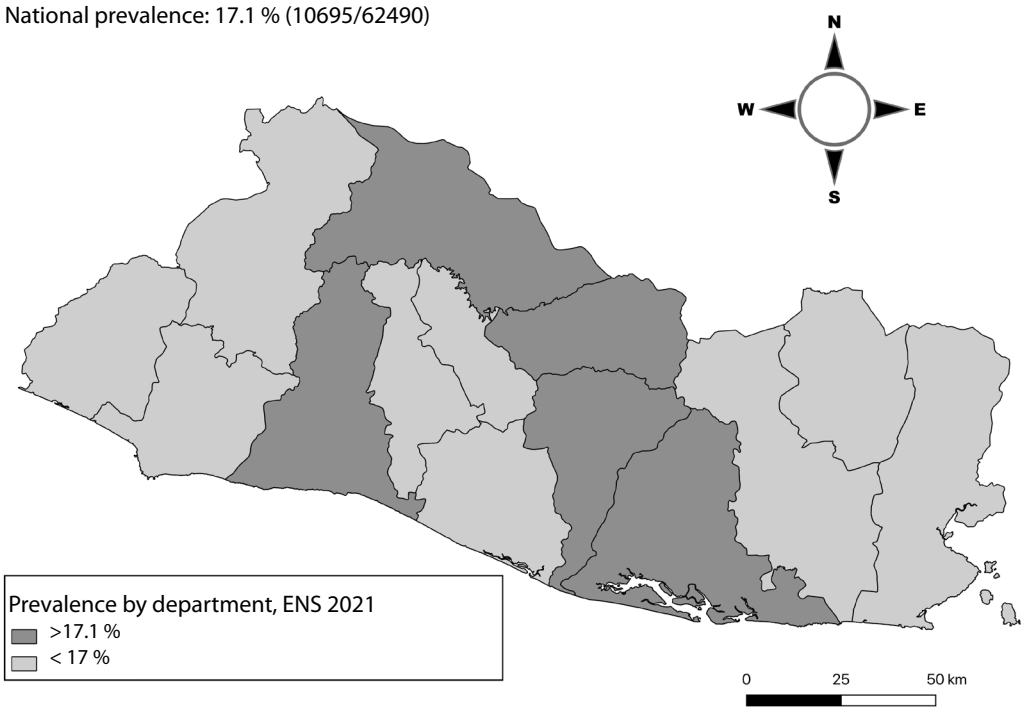

Figure 1. Prevalence of disability in the Salvadoran population participating in the National Health Survey, 2021.

characteristics at which disability occurs, multiple studies report heterogeneity in these data. For example, a study conducted at an adaptive center for people with disabilities determined that the average age of patients who attended was 52 .9 years.[xvi] These data are consistent with those presented in this study, which determined a median age of 53 years and the highest proportion of cases with disabilities occurred in patients over 60 years of age.

Regarding the impact of gender on disability, a 2022 study analyzed and determined that approximately 52 % of women and 47 % of men had some disability. These findings are consistent with this Research's, which observed a higher frequency of cases in women. [xvii] On the other hand, a study conducted in India aimed to estimate the prevalence of disability and analyze its patterns and determinants. They indicated that 75 % of cases were concentrated in rural areas.[xviii] This last figure contrasts with the present Research findings, which show a higher frequency of cases in urban areas.

A secondary analysis of data collected in the Singapore National Survey assessed disability, in which they recorded that the most prevalent type of disability was motor at 1.8 %, followed by visual at 0.8 % and cognitive at 0.5 %. A relevant finding of this study is that most participants had functional vision impairment, and this condition, by severity indicator, was most frequently mild, in contrast to moving or walking, where the indicator with the highest proportion was severe.[xix] Another study conducted in Honduras describes a prevalence in the adult population of 51.2 % and determined that the degree of disability that occurred most frequently was mild.[xx] These data are consistent with those described in this Research, where the prevalence of disability was higher in the mild severity indicator.

A systematic review with meta-analysis of disability studies, published in 2022 in China, revealed a consolidated prevalence of 26.2 %. This figure showed significant variations based on daily activities, gender, and region; prevalence was higher in women and in the central, northeastern, and southwestern regions, demonstrating an influence of the activity scales used in the Research, which were susceptible to prevalence estimates compared to other methodological approaches.[xxi] The review highlights that the scales used to measure prevalence substantially influenced the estimates, highlighting the importance of using standardized and validated instruments such as the one proposed by the Washington group.

Disability has been associated with health conditions such as chronic noncommunicable diseases.[xxii] Research conducted in Cuba describes that diseases such as hypertension, diabetes, arthritis, cataracts, mental illness, and pulmonary embolism were significant in the overall disability score.[xxiii] Meanwhile, in El Salvador, according to data from the

Table 2. Multivariate analysis of factors associated with severity of disability, ENS 2021.

Variable	Estimator	EE	Z	OR	IC95%	P
Intercept	-419.908	0.33933	-12.375	0.01	(0.0 - 0.0)	0.00
Age over 60 years old	0.65087	0.16811	3.872	1.9	(1.3 - 2.6)	0.00
Chronic illness	0.76669	0.17160	4.468	2.1	(1.5 - 3.0)	0.00
Education	0.00335	0.00634	0.529	1.2	(0.9 - 1.4)	0.59
Area	-0.29303	0.18302	-1.601	0.7	(0.5 - 1.0)	0.10
Sex	0.01355	0.05831	0.32	1.1	(0.9 - 1.2)	0.81

Note:

Overall test of the model $p < 0.05$.

Reference category: age > 60 years, chronic disease (yes), education (yes), rural, female.

country profile on the Pan American Health Organization website updated through 2022, chronic noncommunicable diseases such as diabetes reported a prevalence of 12.5 % and high blood pressure 37.0 %.[xxiv]

A study analyzed the contribution of chronic diseases to disability, identifying a high prevalence in older ages. The findings reflect an increase in the incidence of disabling diseases as age increases.[xxv] Another study conducted in 2021 argues that disability is shaped throughout life and that the educational level attained and multimorbidity plays an important role. Advanced age over 70 years was associated with greater disability. The study points to a variation in the reported prevalence ratio; in the United States, the ratio was 1.42, and in countries like Greece, it was 5.04. Furthermore, an education lower than secondary school was associated with disability in all countries reported in that study; for example, in Estonia, a prevalence ratio of 1.49, and in Spain, 2.21. Finally, multimorbidity showed a strong association with disability in all countries, with a prevalence ratio reported in countries like Brazil at 2.07 and the United States at 6.23.[xxvi] These data are consistent with those reported in the present study, as age over 60 years and chronic disease were associated with severe disability. Disability is a condition that can lead to physical inactivity, and physical inactivity is a risk factor for developing chronic noncommunicable diseases.

This research was limited by the fact that it was not possible to measure other aspects that would allow for a comprehensive understanding of the development of disability due to other factors, such as psychosocial, political, or cultural factors. Furthermore, each survey participant self-reported the presence of chronic noncommunicable diseases. It could not be verified through a medical record, which could have led to self-report bias.

Based on the results of this Research, it is recommended to implement specific interventions to improve the quality of life of people with disabilities, especially older adults and those with chronic illnesses, who are more likely to have severe disabilities. It is also important to develop programs that promote social inclusion, access to educational and employment opportunities, and adapt physical infrastructure and environments to the population's specific needs.[xxvii]

The results' external validity could be extended to contexts with similar sociodemographic characteristics. Overall, this study provides useful evidence for designing inclusive public policies and guides future Research that delves deeper into the social determinants, inequalities, and structural factors of disability.

Conclusion

Disability was characterized as more common among women, in urban areas, and in the age group over 60 years. Mild disability predominated when analyzing severity indicators, with visual impairment being the most common type. Factors associated with severe disability were age over 60 years and chronic noncommunicable diseases. These results highlight the importance of targeting specific prevention strategies for these populations with disabilities; furthermo-

re, it is essential to design tailored interventions that consider their characteristics and context. More Research is needed in this field to better understand this population's risk factors and specific needs.

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Original Article

Associated factors with child marriage in Salvadoran woman during 2021

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Abstract
Introduction. Child marriage is a marriage that occurs before the age of 18. In Latin America and the Caribbean, 21. 2 % of women between the ages of 20 and 24 were married before turning 18. **Objective.** To establish the sociodemographic and cultural factors associated with early marriage in women aged 15 to 22, El Salvador, 2021. **Methodology.** This is an analytical cross-sectional study based on the 2021 National Health Survey of El Salvador database. The population was 14 261 women aged 15 to 49, taking as a sample women aged 15 to 22 years who have lived in a union or have been married before the age of 18 years. **Results.** According to the multivariate analysis, factors associated with child marriage include: basic education or no schooling (ORP=6. 46, CI 3. 83-10. 90, p=0. 000), lack of access to a computer or tablet (ORP=1. 38, CI 1. 001. 91, p=0. 04), low asset access index (ORP=1. 73, CI 1. 24-2. 42, p=0. 001), and not making one's own decisions (ORP=5. 52, CI 2. 99-10. 20, p=0. 000). **Conclusion.** Child marriage in El Salvador is related to low educational attainment, lack of autonomy in decision-making, and limited access to information.

Keywords
Marriage, Child, Risk Factors, Marital Status.

Resumen
Introducción. El matrimonio infantil es aquel que se realiza antes de los 18 años. En América Latina y el Caribe, el porcentaje de mujeres entre 20 y 24 años que estaban casadas antes de cumplir los 18 años corresponde al 21,2 %. **Objetivo.** Establecer los factores sociodemográficos y culturales asociados al matrimonio temprano en las mujeres de 15 a 22 años, El Salvador, 2021. **Metodología.** Es un estudio transversal analítico, a partir de la base de datos de la Encuesta Nacional de Salud de El Salvador 2021 siendo la población 14 261 mujeres de 15 a 49 años tomando como muestra a las mujeres de 15 a 22 años que han vivido en unión libre o han estado casadas antes de los 18 años. **Resultados.** Según el análisis multivariado el nivel de escolaridad básica o sin escolarización (ORP=6,46, IC 3,83-10,90, valor de p = 0,000), no tener acceso a computadora o una tableta (ORP=1,38, IC 1,00-1,91, valor de p = 0,04), índice de acceso a bienes bajo (ORP=1,73, IC 1,24-2,42, valor de p = 0,001), no tomar sus propias decisiones (ORP=5,52, IC 2,99-10,20, valor de p = 0,000) son factores de riesgo asociados al matrimonio infantil. **Conclusión.** El matrimonio infantil en El Salvador está relacionado con el bajo nivel educativo, la falta de autonomía en la toma de decisiones y el limitado acceso a información.

Palabras clave
Matrimonio, Niños, Factores de Riesgo, Estado Civil.

OPEN ACCESS

Factores asociados al matrimonio infantil en mujeres salvadoreñas durante el 2021

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Introduction

Child marriage is a union in which at least one person in the couple is under 18 years of age, including marriages with legal ties, as well as common-law unions of a couple, that is, cohabitation without legal recognition and forced marriages. It is considered a violation of human rights, especially the rights of girls and adolescents. This type of marriage or union is more frequent in women than in men, with one in five young women marrying before the age of 18 compared to one in 30 men.[i,ii]

In Latin America and the Caribbean, the percentage of women between the ages of 20 and 24 who were married or in a stable union before the age of 18 is 21.2 %.

The countries reporting data for this indicator to UNICEF have percentages above 30 %: Suriname (36 %), Nicaragua (35 %), Honduras (34 %), Belize (34 %), Dominican Republic (32 %) and Guyana (32 %).[i]

A report in 2019 published that women who were in early unions were influenced by different factors such as poverty, living in rural areas, pregnancy, and, in some cases, domestic violence, since many girls see it as a way out of the situation previously mentioned.[iii] Another important factor is gender inequality in families and society.[iv]

In El Salvador, the final report published in 2015 regarded the matter of marriages reported that 79 % of the girls and adolescents mainly joined for love and wanting to be together. However, when analyzing with other questions, it is estimated that in 50 % of the cases, the girls and adolescents were pressured to join, or in others, it was evidenced that in 25 % of the unions, it was the man who had the final decision on the marriage or union, thus reflecting the low decision-making power of the girls, among other factors.[v,vi] As a result of this problem, in 2017, in El Salvador, a legislative reform of the Family Code was carried out, now stipulates that the minimum age for marriage is 18 years.[vii]

Despite the improvements in the quality of life over the years, there continues to be early unions or teenage mothers. However, unlike in other countries, many thoughts have been changing, such as cultural practices of fathers giving their daughters in marriage in exchange for material goods.[viii]

Therefore, it is necessary to establish the sociodemographic and cultural factors associated with early marriage in women ages 15 to 22 in El Salvador, 2021.

Methodology

This study is based on a secondary analysis of data obtained from the National Health Survey (ENS) conducted in El Salvador in 2021, using a cross-sectional analytical design. The study population included 14 This study is based on a secondary analysis of data obtained from the National Health Survey (ENS, for its acronym in Spanish) conducted in El Salvador in 2021, using a cross-sectional analytical design. The study population included 14 261 women ages 15 to 49 years who participated in the survey.

The sample was selected from women between 15 and 22 years of age at the time of the survey who had been married or in a common law union before the age of 18. Forty-one variables from the main database were requested from the Research Unit of the National Institute of Health corresponding to the household and women section, allowing to obtain variables that responded to the marital status of women, access to goods which was determined from an index constructed with five variables that were found in the survey such as whether they own a television, washing machine, radio, computer and internet, with these variables were cataloged by quintiles, being quintile one and two a low access to goods, quintile three a medium access to goods, finally, quintiles four and five, high access to goods.

A range of additional variables were analysed, including education, categorised as none, elementary, middle, and high school; the presence of discrimination experienced by the woman, categorised as yes or no; the response of the women to one of two forms of discrimination, namely gender discrimination and/or discrimination for other reasons; the occurrence of domestic violence; and the capacity to make independent decisions, categorised as no if the woman indicated that the decision was made by the partner regarding sexual relations or the utilisation of family planning methods, or if she was unable to make her own decisions. A secondary database specifically designed for this analysis was constructed with these variables.

The statistical analysis of the data was descriptive for the sociodemographic variables and an inferential analysis to establish the association of sociodemographic and cultural factors with child marriage, constructed from two variables, married or living in union "if" and if the age at the time they married or began living in union was less than 18 years old. An association between risk factors in women who had united early was established through the Odds Ratio of Prevalence (ORP), and statistical significance was established with the Chi-square test, considering a p-value of< 0.05 as significant. A logistic regression model was also performed for those variables that were statistically significant in the bivariate analysis. The data was procesed using Microsoft Excel 2019 and Epi Info version 7.2.5.0 .

The protocol was approved by the National Institute of Health Ethics Committee, official letter No. CEINS/2023/026. The database provided remains anonymous and is for the exclusive use of the research team.

Results

Of the 3016 women aged 15 to 22, the prevalence of early marriage, i.e., those who were

married or living in union before the age of 18, was 24 %, while 76 % were not married or living in union at the time of the survey.

The sociodemographic characteristics of the women who had married or were living in an early union (Table 1) were as follows: 72.61 % had basic schooling, 57.44 % belonged to the rural area, and 27 % were from the eastern region of the country. Regarding the poverty indicator, 40.17 % were found to have a low index of access to goods. On the other hand, 48 % of these women reported using some means of communication to obtain information.

Of the cultural characteristics (Table 2), 41 % of the women who are in early marriage are of evangelical religion, and only 10.81 % suffer violence. Regarding autonomy, 51.83 % identified that they make their own decisions, but regarding the use of contraceptive methods, only 41.8 % make their own decision, and 7.72 % reported having suffered violence.

Figure 1 shows that women who were in early marriages initiated sexual relations with persons with a median age of 20 years, that is, older than themselves; however, persons up to 57 years of age were recorded.

Of the risk factors according to the bivariate analysis (Table 3), statistical significance was found between child marriage and factors such as: not having schooling (ORP

Table 1. Sociodemographic characteristics of women aged 15 to 22, El Salvador 2021

Variable	Early marriage (n= 712)	%	95 %CI	No early marriage (n=2304)	%	95 % CI
Level of education						
None	15	2.11	1.28-3.45	19	0.82	0.53-1.28
Basic	517	72.61	69.22-75.76	734	31.86	29.99-33.79
Highschool	168	23.6	20.62-26.85	1126	48.87	46.83-50.91
Universitary	12	1.69	0.97-2.92	425	18.45	16.92-20.08
Area						
Urban	303	42.56	38.97-46.22	1277	55.43	53.39-57.44
Rural	409	57.44	53.78-61.03	1027	44.57	42.56-46.61
Region						
Central	88	12.36	10.14-14.98	264	11.46	10.22-12.82
Metropolitan	90	12.64	10.40-15.28	435	18.88	17.33-20.53
Western	144	20,22	17.44-23.33	443	19.23	17.67-20.89
Eastern	199	27.95	24.78-31.36	618	26.82	25.05-28.67
Paracentral	191	26.83	23.70-30.20	544	23.61	21.92-25.39
Access to goods index						
Low	286	40.17	36.63-43.81	465	20.18	18.59-21.87
Average	260	36.51	34.91-38.18	892	38.71	36.34-40.87
High	166	23.31	21.63-25.42	947	41.1	39.65-43.46
Access to information						
Use of newspaper, radio or television	569	79.92	76.82-82.69	1909	82.86	81,26-84,34
Using a computer or tablet	304	42.7	39.11-46.36	1617	70.18	68.28-72.02
Using cell phones to get information	346	48.6	44.94-52.26	1438	62.41	60.42-64.37
Use the media to get information	576	80.9	77.85-83.62	1903	82.6	80.99-84.09

Table 2. Cultural characteristics of women aged 15 to 22, El Salvador 2021

Variable	Early marriage N=712	%	IC95%	No early marriage N=2304	%	IC95%
Religion						
Catholic	255	35,81	32,38-39,40	1068	46,35	44,33-48,39
Protestant	293	41,15	37,59-44,80	938	40,71	38,72-42,73
Other religion	10	1,4	0,76-2,57	48	2,08	1,57-2,75
No religion	154	21,63	18,76-24,80	250	10,85	9,65-12,19
Suffering violence	77	10,81	8,74-13,31	160	6,94	5,98-8,06
Women´s autonomy						
She can say "no" to her partner when she does not want to have sexual intercourse	445	62,5	58,89-65,98	427	81	0
Makes own decisions	369	51,83	48,16-55,48	428	81	0
Currently using contraceptive methods	428	60,11	56,47-63,65	134	5,82	4,93-6,85
Use of contraceptive methods is own decision	179	41,8	38,24-45,45	78	58	0
Discrimination	55	7,72	5,98-9,92	247	10,72	9,52-12,05

2.58 IC95 % 1.30-5.12 p = 0.009) or having only basic education (ORP 5.67 IC95 % 4.70-6.83 p = 0.000) living in rural areas (ORP 1.67 IC95 % 1.41-1.98 p = 0.000), lack of access to information (ORP 3.15 IC95 % 2.65-3.75 p = 0.000), poverty, represented as a low rate of access to assets (ORP 2.65 IC95 % 2.21-3.18 p = 0.000), not belonging to any religion (ORP 2.26 IC95 % 1.81-2.82 p = 0.000), normalizing various violent attitudes (ORP 1.62 IC95 % 1.22-2.16 p = 0.001), and lack of autonomy in decision making (ORP 4.01 IC95 % 3.08-5.22 p = 0.000).

The resulting factors with statistical significance were analyzed by multivariate analysis, resulting in the following: basic schooling level or no schooling (ORP 6.46 IC95 % 3.83-10.90 p = 0.000), not having access to a computer or a tablet (ORP 1.38 IC95 % 1.00-1.91 p = 0.045), Index of access to goods low (ORP 1.73 IC95 % 1.24-2.42 p = 0.001), and not making their own decisions (ORP 5.52 IC95 % 2.99-10.20 p = 0.000) (Table 4).

Discussion

According to what was found in this analysis, in El Salvador, there are risk factors that continue to cause early unions among women; in Colombia and Mexico, they reported similar vulnerability factors such as fleeing from poverty, dominant male norms, lack of education, lack of knowledge of rights, among others.[ix-xii] In Ecuador, the causes of this problem are different from those presented in this study; they are related to adolescent pregnancy and the desire to control sexuality, but similarly, family finances and experiences of violence are also characteristics.[xiii]

Child marriage worldwide has multiple causes that are associated with each other; in each country, they have specific characteristics that create the conditions for the continuity of the problem that limits the potential development of minors and violates their human rights.[ii]

According to this study's findings, basic education or having no schooling at all is a factor that exposes women to deciding to marry early at.[xiv] A study conducted in Mexico reported that girls with primary education were four times more likely to marry early at.[xv] The problem is similar in the region, where low levels of schooling among girls and adolescents are caused by stereotypes and domestic roles or by giving way to early marriage.[ii]

The fact that women suffer violence and do not make their own decisions regarding family planning issues analyzed as a lack of autonomy is a factor that was found to be associated with early marriage; according to UNFPA's regional director for Latin America and the Caribbean at the global level, only half of women can make their own decisions related to medical care, the desire or not to have sexual relations or the use of contraceptive methods.[xvi,xvii] Circles of violence, abuse, and family exploitation make early marriage or union an escape option.[ii]

In a bulletin on inequality and poverty among women, girls, and adolescents in La-

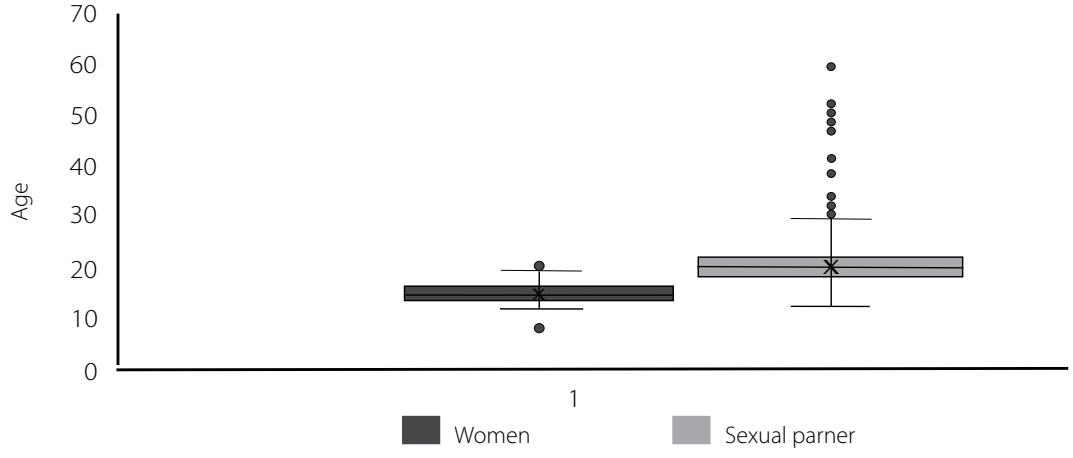

Figure 1. Age of onset of sexual intercourse in early married women compared to age of sexual partner.

Table 3. Factors associated with early marriage, El Salvador 2021

Variable	ORP	IC95%	Valor p
Level of scholling			
None	2,58	1,30-5,12	0,009
Basic	5,67	4,70-6,83	0,000
Area			
Rural	1,67	1,41-1,98	0,000
Access to information			
No access to computer or tablet	3,15	2,65-3,75	0,000
Does not use cell phone for information	1,75	1,48-2,08	0,000
Low rate of access to goods			
Low rate of access to goods	2,65	2,21-3,18	0,000
Variable	ORP	IC95%	Valor p
Religion			
No religión	2,26	1,81-2,82	0,000
Violence			
Attitude towars violence	1,62	1,22-2,16	0,001
Women's autonomy			
Cannot refuse to have sex	2,56	1,96-3,34	0,000
Does not make her own decisions	4,01	3,08-5,22	0,0000
The choice of methods is not her own decision	1,93	1,30-2,87	0,001

tin America and the Caribbean, it was estimated that a higher prevalence is found in households whose income belongs to the lowest quintile; qualitative studies carried out in the region report that it is common for girls and adolescents to marry or enter into a common law union as a strategy to escape poverty in their homes of origin or to seek protection,[xviii,xix] thus perpetuates the cycle of poverty, unlike in other societies, where early marriage may be perceived as a family economic advantage due to the duty system, since a young wife is considered to be of greater value, this is not the case. It is therefore argued that this acquires a transactional character.[xx]

In recent years, there have been improvements in terms of access to information, such as the use of cell phones, computers, or electronic tablets; however, in this analysis, it was found that many women still have limited access to a computer or an electronic tablet, thus being associated as a risk factor for early marriage.[xviii] The media allows access to information that can be used as a tool for empowerment and critical thinking, and technology allows to be aware of their legal rights.[xxi,xxii]

Table 4. Multivariate analysis of sociodemographic and cultural factors associated with early marriage, El Salvador 2021

Variable	ORP	IC95%	Valor p
Level of schooling			
Basic or no schooling	6,46	3,83-10,90	0,000
Area			
Rural	0,93	0,69-1,26	0,000
Access to information			
No access to computer or tablet	1,38	1,00-1,91	0,045
Does not use cell phone for information	0,90	0,67-1,22	0,528
Index of access to goods			
Low	1,73	1,24-2,42	0,001
Religion			
No religion	0,73	0,50-1,26	0,108
Violence			
Normal attitude towars violence	0,81	0,50-1,29	0,001
Women's autonomy			
Cannot refuse to have sex	0,42	0,22-0,96	0,085
Cannot make own decisions	5,52	2,99-10,20	0,000
Decision on methods not own decision	4,79	3,19-7,20	0,000

Conclusion

In El Salvador, early marriage is associated with several risk factors, such as insufficient or no schooling, lack of access to technological devices such as computers or tablets, and unfavorable socioeconomic conditions. The lack of autonomy in decision-making on the part of women regarding sexual health, reproductive health, and maternity is evidence of the persistence of gender norms and stereotypes in which our population is immersed.

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Original Article

Water, sanitation and hygiene (WASH) in Salvadoran households, 2021

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Abstract
Introduction. Access to safe water, sanitation, and hygiene is essential for public health and achieving Sustainable Development Goal 6. The availability of these services is a priority issue , as poor management of these services can increase the incidence of disease. **Objective.** Identify water, sanitation, and hygiene conditions in Salvadoran households in 2021. **Methodology.** A descriptive study was carried out using data from the National Health Survey of El Salvador 2021. A total of 16 585 households were analyzed using 79 variables related to access to water, sanitation, and hygiene. Classification criteria based on the Water, Sanitation, and Hygiene (WASH) methodology were used. **Results.** 67.2 % of the dwellings had a safely managed water service, while 29.1 % had a basic service, 1.5 % had limited or unimproved access, and 0.6 % relied on surface sources. In sanitation, 76.7 % of the dwellings had improved sanitation facilities, while 12.6% had limited sanitation, and 6.7% had unimproved sanitation. Open defecation was still practiced in 1.9 % of the dwellings. Regarding hygiene, 85.5 % of households had hand washing facilities with soap and water, but 3.1 % did not have adequate facilities. **Conclusion.** There has been progress in access to safe water, sanitation, and hygiene, but significant inequalities persist, especially in rural areas.

Keywords
Water, Hand Hygiene, Urban Sanitation.

Resumen
Introducción. El acceso al agua potable, saneamiento e higiene es esencial para la salud pública y el cumplimiento del Objetivo de Desarrollo Sostenible 6. La disponibilidad de estos servicios es un tema prioritario, ya que la mala gestión de ellos puede incrementar la incidencia de enfermedades. **Objetivo.** Identificar las condiciones de agua, saneamiento e higiene en viviendas salvadoreñas durante el año 2021. **Metodología.** Se realizó un estudio descriptivo utilizando datos de la Encuesta Nacional de Salud de El Salvador 2021. Se analizaron 16 585 viviendas mediante 79 variables relacionadas con el acceso al agua, saneamiento e higiene. Se utilizaron criterios de clasificación basados en la metodología «Agua saneamiento e higiene» (WASH). **Resultados.** El 67,2 % de las viviendas contaba con servicio de agua gestionado de forma segura, mientras que un 29,1 % tenía un servicio básico, además el 1,5 % tenía acceso limitado o no mejorado y un 0,6 % dependía de fuentes superficiales. En saneamiento, el 76,7 % de las viviendas poseía instalaciones sanitarias mejoradas, mientras que un 12,6 % presentaba saneamiento limitado y un 6,7 % no mejorado. El 1,9 % de las viviendas aún practicaba la defecación al aire libe. En cuanto a higiene, el 85,5 % de los hogares contaba con instalaciones de lavado de manos con agua y jabón, pero un 3,1 % no disponía de instalaciones adecuadas. **Conclusión.** Existen avances en el acceso a agua potable, saneamiento e higiene, sin embargo, persisten desigualdades significativas, sobre todo en áreas rurales.

Palabras clave
Agua, Higiene de las Manos, Saneamiento.

Introduction

Water, Sanitation, and Hygiene (WASH) is a global strategy driven by the United Nations (UN) and the World Health Organization (WHO). It encompasses vital aspects of public health and contributes to protecting population health. Universal, affordable, and sustainable access to WASH is key to meeting Sustainable Development Goal 6 (SDG 6); water and sanitation should be equitable and accessible to all.[i,ii]

This SDG emerges as a WHO strategy present in resolution WHA64.4 and the 2030 Agenda for the sustainability of the SDGs. It was also adopted by the UN General Assembly in July 2010, with the progressive realization of the human rights to safe drinking water and sanitation by 2025.[iii]

The WASH strategy is divided into households, schools, and health facilities. It provides monitoring of its components (water, sanitation, and hygiene) in all three settings through the Joint Monitoring Program (JMP) in which WHO Member States participate.[i]

WHO has included the components of the WASH strategy since the Organization's inception in 1948. It periodically publishes health guidelines and good practice guidelines on WASH and monitors global access to water and sanitation.

These components form one of the pillars of the 1978 Health for All strategy. Subsequently, the UN has launched a global call for actions for WASH in all health facilities,[iv] with commitments made worldwide under the 2030 Agenda. The target is to ensure the availability of basic water, sanitation, and hygiene services in 60 % of health facilities by the end of 2022. This target rises to 80 % by 2025 and 100 % by 2030.[i]

Over the years, the importance of hand washing and hygiene has been documented and evidenced.[ii] During the COVID-19 pandemic, hand washing was the most promoted habit in the media as part of prevention and self-care in communities;[iii] it is a simple activity that, when performed at the right time and in the right way, can save lives.[ii]

According to WHO, up to US$16.5 in healthcare costs are saved for every dollar (US$) invested in this strategy.[iii,iv] It also states that global progress has been made in meeting SDG 6; however, inequality in global access to handwashing facilities and products persists.[v]

In Latin America, access to drinking water is considered one of the major health problems. SDG 6 on safely managed services has not been achieved, as this requires the availability of water in the home whenever needed, proper management of excreta, avoiding common use between different households[v] and ensuring access to hand washing in the home.

Multiple efforts are focused on improving circularity in water management through the WASH strategy[vi,vii], and these interventions have been successful in reducing the risk of diarrheal diseases in low-and middle-income countries[viii].

In El Salvador, 61.7 % of the population belongs to the urban area, 53.3 % are female, and a high percentage of the young population is more than 25 %. The highest population density is concentrated in the departments of San Salvador, La Libertad, Santa Ana, and Sonsonate. According to the type of housing, most of the population lives in private or independent homes.[ix]

Identifying the water, sanitation, and hygiene conditions in Salvadoran homes during the year 2021 is necessary to obtain representative data on these three components, which will allow visualization of strengths and areas of vulnerability.

Methodology

This descriptive cross-sectional study aimed to identify the water, sanitation, and hygiene conditions of the dwellings included in the National Health Survey of El Salvador conducted in 2021.[x]

A total of 16 585 of the 20 505 households visited were considered since records with a non-response rate greater than or equal to 20 % for the variables of interest and duplicate records were excluded. For the analysis, 79 variables related to demographic, economic, social, water, sanitation, and hygiene information were used. Four indicators were created, three of which belong to the WASH services classification, and the fourth is the overcrowding index, according to the Economic Commission for Latin America and the Caribbean.[xi] Proportions and frequencies were used to describe the data using Microsoft Excel.

Based on the primary variables, the households were classified according to the WASH (water, sanitation, and hygiene) methodology indicators, and to construct each indicator, the categories established by the WASH[i] methodology were used as follows: for the water indicator, each household was categorized according to the water service it had, which could be: safely managed service, basic, limited, unimproved and with access to surface water or without service (Table 1).

For the sanitation indicator, each household was categorized according to the type of sanitation it has, which can be safely managed, including excreta management, basic, limited, unimproved, and open defecation (Table 1).

For the hand hygiene indicator, each household was categorized according to the type of handwashing facility with soap and water, which could be with access to

a basic facility, limited, or no handwashing facility (Table 1).

It was taken into account that soap could be bar, liquid, powdered detergent, and soapy water, and did not include ashes, soil, sand, or other handwashing agents.[i]

Qualitative variables were analyzed using frequencies and percentages.

Results

A total of 16 585 households participating in the National Health Survey 2021 were analyzed. Fifty-three percent of the households were headed by a woman.

Regarding the level of schooling of the heads of household, 32 % have a primary school education, while 7 % have a university education.

Sixty-three percent of the households are located in the urban area. Twenty percent belonged to the department of San Salvador, seven percent to Morazán, seven percent to Santa Ana, and seven percent to Cabañas.

Of the total number of participating households, 24 % were overcrowded, and 43 % had at least one child under five years of age.

Access to water

Of these, 68 % belong to the urban area, and 58 % are not inhabited by children under five years of age (Table 2).

29.1 % of the households have basic water service, 1.5 % have limited service and 1.5 % have unimproved service. Eighty-two percent of the households with unimproved service are in rural areas, 13 % of which belong to the department of Sonsonate, 11 % to La Unión, and 11 % to San Salvador. Seventy-two percent of urban households have safely managed water service, and 98 % have at least basic water service. Fifty percent of households with unimproved water service have children under five years of age (Table 2).

However, 0.6 % of Salvadoran households use surface water (water from rivers, dams, lakes, ponds, streams, or irrigation canals), 82 % of these households belong to rural areas, 22 % are from the Department of Sonsonate, 16 % from Chalatenango and 15 % from Morazán. Children under five years of age live in 43 % of the households where surface water is used (Table 2). Of those surveyed, 0.1 % did not respond the origin of the water they use for consumption.

Table 1. Classification of water, sanitation and hand hygiene services.

Service level	Definition
Water	
Safely managed	Improved source water, on-site, available when needed and free of priority fecal and chemical contamination.
Basic	Improved source water, collection time not to exceed 30 minutes round trip, including queues.
Limited	Water from an improved source, with collection time greater than 30 minutes round trip, including queuing.
Unimproved	Water from an unprotected dug well or unprotected spring.
Surface water	Water from river, dam, lake, pond, stream, canal or irrigation channel.
Sanitation	
Safely managed	Improved sanitation facilities, not shared with other households and excreta are safely disposed of on-site or removed and treated off-site.
Basic	Improved facilities that are not shared with other households.
Limited	Improved facilities shared between two or more households.
Unimproved	Pit latrines without slab or platform, hanging latrines or bucket latrines.
Open defecation	Disposal of human excreta in fields, forests, bushes, open water bodies, beaches and other open spaces or with solid waste.
Hand Hygiene	
Basic	Handwashing facility with soap and water in the home.
Limited	Handwashing facility without soap and/or water at home.
No facility	No handwashing facilities at home.

Source: United Nations Children's Fund and World Health Organization, Integrating Water Quality Testing into Household Surveys: Thematic report on drinking water, UNICEF and WHO, New York, 2020. Available at: https://washdata.org/sites/default/files/2020-10/JMP-2020-water-quality-testing-household-surveys.pdf.

Sanitation

Safe sanitation facilities were found in 76.7 % of the dwellings (Figure 1C), 22 % of which belong to the department of San Salvador and 42 % of which are inhabited by at least one child under five years of age (Table 3). 1.9 % of households have basic sanitation for excreta management, and 12.6 % have limited sanitation (Figure 1C).

Of the 6.7 % of the households with unimproved excreta management, 62 % belong to rural areas. Eleven percent belong to San Salvador, and the same percentage belongs to Sonsonate (Table 3).

Open defecation occurs in 1.9 % of households; of these households, 81 % belong to the rural area (4 % of all households in the rural area and 2 % in the urban area). Fourteen percent belong to the department of La Unión, 14 % to Morazán, 12 % to Cabañas, and 11 % to San Vicente. In 46 % of the households where open defecation takes place, there is at least one child under five years of age (Table 3). Of those surveyed, 0.1 % did not respond or did not know the origin of their drinking water.

Hygiene

As shown in Figure 1D, 85.5 % of households have basic handwashing facilities with soap and water. Of these, 15 % belong to the department of San Salvador, and 45 % of households have at least one child under five years of age.

Of the households surveyed, 3.1 % do not have handwashing facilities, and half are in rural areas. The highest percentage of households without handwashing facilities is in San Salvador (24 %), La Paz (9 %), and Santa Ana (9 %). In addition, of all households without access to hand hygiene facilities, 44 % have at least one child under five years of age (Table 4).

Discussion

An analysis of water, sanitation, and hygiene conditions in El Salvador, conducted using data from the 2021 National Health Survey, found that less than half of the dwellings in the country have adequate water, sanitation, and hygiene conditions. More than half of the homes have access to a safely

Table 2. Characterization of households by type of sanitation

Variable	Safely managed (n= 11 141))	Basic (n= 4831)	Limited (n= 249)	Unimproved (n= 253)	Surface water (n= 91)	No data (n= 20)
Area						
Rural	3531 (32 %)	2129 (44 %)	163 (65 %)	213 (84 %)	75 (82 %)	13 (65 %)
Urban	7610 (68 %)	2702 (56 %)	86 (35 %)	40 (16 %)	16 (18 %)	7 (35 %)
Department						
Ahuachapán	717 (6 %)	298 (6 %)	6 (2 %)	11 (4 %)	3 (3 %)	1 (5 %)
Cabañas	832 (7 %)	341 (7 %)	16 (6 %)	22 (9 %)	4 (4 %)	2 (10 %)
Chalatenango	640 (6 %)	268 (6 %)	10 (4 %)	24 (9 %)	15 (16 %)	4 (20 %)
Cuscatlán	487 (4 %)	218 (5 %)	6 (2 %)	2 (1 %)	2 (2 %)	-
La Libertad	651 (6 %)	385 (8 %)	18 (7 %)	17 (7 %)	2 (2 %)	-
La Paz	589 (5 %)	349 (7 %)	19 (8 %)	23 (9 %)	10 (11 %)	2 (10 %)
La Unión	629 (6 %)	302 (6 %)	20 (8 %)	29 (11 %)	3 (3 %)	-
Morazán	782 (7 %)	345 (7 %)	29 (12 %)	21 (8 %)	14 (15 %)	2 (10 %)
San Miguel	740 (7 %)	265 (5 %)	28 (11 %)	16 (6 %)	-	-
San Salvador	2295 (21 %)	932 (19 %)	31 (12 %)	29 (11 %)	6 (7 %)	4 (20 %)
San Vicente	537 (5 %)	269 (6 %)	17 (7 %)	8 (3 %)	1 (1 %)	-
Santa Ana	891 (8 %)	275 (6 %)	14 (6 %)	11 (4 %)	5 (5 %)	-
Sonsonate	614 (6 %)	335 (7 %)	15 (6 %)	32 (13 %)	20 (22 %)	2 (10 %)
Usulután	737 (7 %)	249 (5 %)	20 (8 %)	8 (3 %)	6 (7 %)	3 (15 %)
Households with children < 5 years old						
With children	4719 (42 %)	2119 (44 %)	117 (47 %)	126 (50 %)	39 (43 %)	8 (47 %)
Without children	6422 (58 %)	2712 (56 %)	132 (53 %)	127 (50 %)	52 (57 %)	12 (53 %)

Table 3. Characterization of dwellings by type of sanitation

Variable	Safely managed (n= 12 718)	Basic (n= 310)	Limited (n= 2091)	Unimproved (n= 1118)	Open defecation (n= 321)	No data (n= 27)
Area						
Rural	4031 (32 %)	194 (63 %)	928 (44 %)	692 (62 %)	261 (81 %)	18 (67 %)
Urban	8687 (68 %)	116 (37 %)	1163 (56 %)	426 (38 %)	60 (19 %)	9 (33 %)
Department						
Ahuachapán	742 (6 %)	7 (2 %)	184 (9 %)	90 (8 %)	12 (4 %)	1 (4 %)
Cabañas	932 (7 %)	26 (8 %)	142 (7 %)	76 (7 %)	40 (12 %)	1 (4 %)
Chalatenango	745 (6 %)	48 (15 %)	109 (5 %)	36 (3 %)	23 (7 %)	-
Cuscatlán	541 (4 %)	8 (3 %)	108 (5 %)	53 (5 %)	3 (1 %)	2 (7 %)
La Libertad	836 (7 %)	27 (9 %)	138 (7 %)	58 (5 %)	12 (4 %)	2 (7 %)
La Paz	667 (5 %)	34 (11 %)	177 (8 %)	106 (9 %)	4 (1 %)	4 (15 %)
La Unión	726 (6 %)	30 (10 %)	80 (4 %)	101 (9 %)	44 (14 %)	2 (7 %)
Morazán	933 (7 %)	23 (7 %)	139 (7 %)	51 (5 %)	44 (14 %)	3 (11 %)
San Miguel	845 (7 %)	2 (1 %)	101 (5 %)	67 (6 %)	33 (10 %)	1 (4 %)
San Salvador	2815 (22 %)	31 (10 %)	316 (15 %)	118 (11 %)	13 (4 %)	4 (15 %)
San Vicente	565 (4 %)	24 (8 %)	143 (7 %)	63 (6 %)	34 (11 %)	3 (11 %)
Santa Ana	942 (7 %)	12 (4 %)	150 (7 %)	70 (6 %)	20 (6 %)	2 (7 %)
Sonsonate	681 (5 %)	17 (5 %)	170 (8 %)	125 (11 %)	24 (7 %)	1 (4 %)
Usulután	748 (6 %)	21 (7 %)	134 (6 %)	104 (9 %)	15 (5 %)	1 (4 %)
Households with children < 5 years old						
With children	5341 (42 %)	134 (43 %)	996 (48 %)	498 (45 %)	147 (46 %)	12 (44 %)
Without children	7377 (58 %)	176 (57 %)	1095 (52 %)	620 (55 %)	174 (54 %)	15 (56 %)

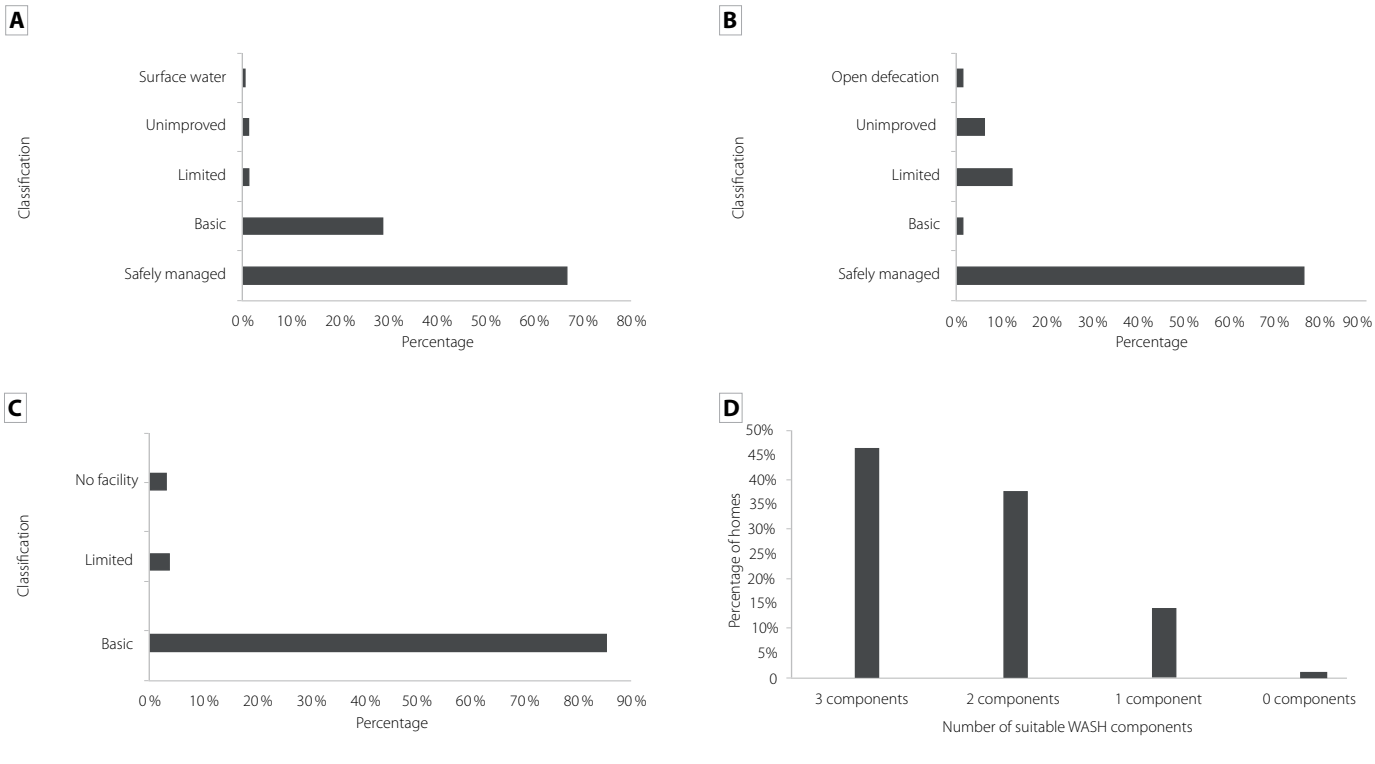

Figure 1. Ranking of Salvadoran dwellings according to WASH methodology in percentages (A) Dwellings classified by type of access to water (B) Dwellings classified by type of access to sanitation facilities (C) Dwellings classified by type of hand hygiene facility (D) Percentage of dwellings by number of WASH service components.

Table 4. Characterization of households according to the type of handwashing facilities available.

Variable	Basic (n=14 184)	Limited (n= 647)	No facility (n= 518)	No data (n= 1236)
Area				
Rural	5428 (38 %)	292 (45 %)	257 (50 %)	147 (12 %)
Urban	8756 (62 %)	355 (55 %)	261 (50 %)	1089 (88 %)
Department				
Ahuachapán	899 (6 %)	42 (6 %)	29 (6 %)	66 (5 %)
Cabañas	1038 (7 %)	51 (8 %)	41 (8 %)	87 (7 %)
Chalatenango	831 (6 %)	32 (5 %)	32 (6 %)	66 (5 %)
Cuscatlán	610 (4 %)	37 (6 %)	13 (3 %)	55 (4 %)
La Libertad	908 (6 %)	55 (9 %)	44 (8 %)	66 (5 %)
La Paz	809 (6 %)	53 (8 %)	48 (9 %)	82 (7 %)
La Unión	856 (6 %)	48 (7 %)	20 (4 %)	59 (5 %)
Morazán	1047 (7 %)	34 (5 %)	25 (5 %)	87 (7 %)
San Miguel	884 (6 %)	39 (6 %)	34 (7 %)	92 (7 %)
San Salvador	2709 (19 %)	96 (15 %)	123 (24 %)	369 (30 %)
San Vicente	761 (5 %)	32 (5 %)	13 (3 %)	26 (2 %)
Santa Ana	999 (7 %)	51 (8 %)	47 (9 %)	99 (8 %)
Sonsonate	891 (6 %)	46 (7 %)	40 (8 %)	41 (3 %)
Usulután	942 (7 %)	31 (5 %)	9 (2 %)	41 (3 %)
Households with children < 5 years old				
With children	6109 (43 %)	292 (45 %)	230 (44 %)	497 (40 %)
Without children	8075 (57 %)	355 (55 %)	288 (56 %)	739 (60 %)

managed drinking water service, and less than a third have access to these services in a basic way. However, it was recorded that there is still an urban and rural population that consumes water from surface sources.

The Multipurpose Household Survey (EHPM, 2022) of El Salvador reported that 74.9 % of households have access to piped water. However, this figure includes households that do not receive water service in sufficient quantities, including those that have not received service for more than one month9. The WHO WASH JMP reports that 79 % of urban households in El Salvador have "safely managed" water service, and 99 % of Salvadoran households have at least "basic" water service.[xii] These data are similar to the findings of the present analysis. However, the differences in these data could be because the JMP uses the EHPM and data from the National Association of Aqueducts and Sewers as the official source for the El Salvador data; however, the latter does not have full nationwide coverage. In addition, the EHPM did not record the service's availability whenever required, so the JMP platform does not have data on the total number of households in the category "safely managed water service."

El Salvador has reached the required percentage of SDG 6 for the year 2022 in terms of infrastructure to provide on-site water service. However, there are difficulties in reaching the required percentage of the water service "safely managed" category due to the lack of supply or intermittency of service, both in rural and urban areas. Currently, the government is making multiple efforts to improve the quality and coverage of the National Water and Sewerage Administration service, investing in water treatment plants and supporting the management of water sources in rural areas. In addition, non-governmental organizations are making efforts to improve coverage in the most vulnerable regions.[xiii-xv]

The "safely managed" water service in El Salvador is higher than that reported by Honduras, which, according to the National Demographic and Health Survey (ENDESA) in 2019, was 49.6 %. Of that percentage, 70.6 % were urban dwellings.[xvi] Meanwhile, in 2017, Costa Rica reported that 93.9 % of the dwellings have drinking water service "safely managed." However, no dwellings were recorded using surface water sources as the main means of supply.[xvii] High-income countries

have greater access to safely managed water services, exceeding 90 % coverage at the national level.[xviii] However, this estimate may be limited, as it does not consider aspects such as geographical coverage, diseases as outcomes, and types of contaminants. In addition, it is necessary to include at-risk populations such as those living in rural areas, low-income communities, Indigenous people, and groups marginalized by discrimination.[xix]

These findings can guide the generation of policies that reorganize the efforts of governments and institutions in the areas of water, sanitation, and hygiene. Such policies can be evaluated in terms of effectiveness, as demonstrated by a meta-analysis showing that WASH interventions reduce the risk of diarrhea incidence in low-and middle-income countries through point-of-use filtered water management and improved drinking fountains in facilities.[viii]

In terms of sanitation, this study shows that more than three-quarters of the dwellings had a safely managed sanitation system. The 2022 EHPM reported that 93.9 % of the dwellings had access to a sanitary service inside or outside the dwelling, higher values than in the present study.[ix]

The JMP did not report national data on sanitation in the "safely managed" category for the year 2022. However, it reported that 17 % of households in urban areas have safely managed sanitation facilities and that 88 % of Salvadoran households had basic managed sanitation services.

This study also found a higher percentage of open defecation than that reported by the JMP for rural and urban areas, which are 2 % and 0 %, respectively.[xii] These differences could be because the EHPM does not consider whether the use of the toilet is exclusive to household members or whether it is managed safely. The JMP for sanitation also has the EHPM as an official source.

Despite the investments made by the government and non-governmental organizations, the growth of sanitation coverage in El Salvador has been minimal, with an increase of only 0.2 %. In 2020, the sewerage coverage was 42.6 %, mainly concentrated in urban areas. In contrast, the remaining population relies on individual sanitation solutions, such as septic tanks, dry toilets, and other alternative systems.[vi]

According to this study's findings, safe sanitation in El Salvador is lower than that reported by Honduras. According to ENDESA, in 2019, 99 % of all households had sanitary facilities for safe excreta management; however, inhabitants who share facilities with other people who do not live in the dwelling have been included.[xvi]

Concerning hygiene, most households in El Salvador have access to basic handwashing facilities, and a minority of households have limited handwashing facilities. These findings are consistent with data reported by the JMP showing that 91 % of households have basic handwashing facilities.

Access to handwashing facilities is similar to that reported by Honduras, where, according to ENDESA, in 2019, 86 % of all households possessed basic handwashing facilities.[xvi] However, having basic handwashing facilities does not guarantee that handwashing is carried out frequently or with proper technique; having fixed or mobile handwashing facilities and implements has been associated with a reduced likelihood of gastrointestinal illnesses such as typhoid fever.[xix] Among the main limitations of this study is the need to adapt the available data to the WASH in households methodology for its categorization, given that this was a secondary analysis. Also, water quality measurement methods were not used because they were not the objective of the National Health Survey, and the menstrual hygiene component recently included in the JMP was not measured. El Salvador also does not report official menstrual hygiene data, [xii] so this is an opportunity for improvement for future national surveys to address WASH fully. The present data are not comparable with most published articles, as these focus on WASH in school components conducted in countries in other regions.[xx-xxiii]

Interventions in these areas can contribute to reducing infectious diseases, especially in countries where climate change negatively influences their appearance and incidence.[xxiv,xxv] In Salvadoran households, it is necessary to emphasize drinking water treatment, create a space dedicated to hand washing, and ensure proper excreta management.

Conclusion

All categories of the Water, Sanitation, and Hand Hygiene components were characterized through the 2021 NSS. More than half of the households have a safely managed water service, although marked inequalities persist between urban and rural areas. In terms of sanitation, most households have improved facilities, while a small proportion still practice open defecation, especially in rural areas. In hygiene, most households have adequate facilities for hand washing with soap and water; however, a minority lack such spaces altogether. The results reflect significant progress but also show persistent gaps, especially in rural areas and among the most vulnerable

populations, which require priority attention in public policies.

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Original Article

Risk factors associated with pneumonia in children under five years of age in El Salvador

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Abstract
Introduction. Pneumonia is known as one of the main causes of morbidity in the world and is the first individual cause of infant mortality worldwide. a". This disease has always been of scientific interest in animal models. **Objective.** identify the risk factors associated with community-acquired pneumonia in children under five years of age admitted to the Hospital Nacional San Rafael in 2022. **Methodology.** A case-control study with a 1:2 ratio. Cases were defined as children under five years of age hospitalized with clinical and radiological criteria of community-acquired pneumonia and controls as children under five years of age hospitalized for causes other than community-acquired pneumonia. Simple random sampling was used. Univariate analysis was performed with frequencies and proportions, and bivariate analysis was performed with the chi-square method. **Results.** The study included 63 cases and 126 controls. The median age was 14 months, and 52 % (33/63) were female. The statistical association was found for history of prematurity (OR 2.62; CI95 % 1.27-5.38; p = 0.01), stunting for age (OR 2.12 CI95 % 1.1-4.40; p = 0.02), overcrowding (OR 1.96; CI95 % 1.06-3.6; p = 0.04), exposure to tobacco smoke (OR 3.20; CI95 % 1.51-6.74; p < 0.01). **Conclusion.** Risk factors associated with community-acquired pneumonia were identified as being premature, stunting, overcrowding, and exposure to tobacco smoke.

Keywords
Pneumonia, Pediatrics, Hospitalization, Risk Factors.

Resumen
Introducción. La neumonía es conocida como una de las principales causas de morbilidad en el mundo y es la primera causa individual de mortalidad infantil a nivel global. **Objetivo.** Identificar los factores de riesgo asociados a neumonía adquirida en la comunidad en menores de cinco años de edad, ingresados en el Hospital Nacional San Rafael durante el 2022. **Metodología.** Estudio de casos y controles con una relación 1:2. Se definió como caso a menores de cinco años hospitalizados con criterios clínicos y radiológicos de neumonía adquirida en la comunidad y como controles a los niños menores de cinco años hospitalizados por causas diferentes a neumonía adquirida en la comunidad. Se usó un muestreo aleatorio simple. Se realizó un análisis univariado con frecuencias y proporciones, y un análisis bivariado con el método chi cuadrado. **Resultados.** El estudio incluyó a 63 casos y 126 controles. La mediana de edad fue de 14 meses, y el 52 % (33/63) fue del sexo femenino. Se encontró asociación estadística en los antecedentes de prematurez (OR 2,62; IC95 % 1,27-5,38; p = 0,01), retraso de crecimiento para edad (OR 2,12 IC95 % 1,1-4,40; p = 0,02), hacinamiento (OR 1,96; IC95 % 1,06-3,61; p = 0,04), exposición al humo de tabaco (OR 3,20; IC95 % 1,51-6,74; p < 0,01). **Conclusión.** Se identificaron como factores de riesgo asociados a neumonía adquirida en la comunidad ser prematuro, retraso de crecimiento para edad, hacinamiento y exposición al humo de tabaco.

Palabras clave
Neumonía, Pediatría, Hospitalización, Factores de riesgo.

OPEN ACCESS

Factores de riesgo asociados a neumonía adquirida en la comunidad en menores de cinco años en El Salvador

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Introduction

Community-acquired pneumonia (CAP) is a common infectious disease that occurs in previously healthy patients in an out-of-hospital setting.[i, ii] It is defined in clinical practice as an acute inflammatory disease affecting the lung parenchyma due to the presence of community pathogens. Viruses are the main cause of CAP in children under five years of age, with respiratory syncytial virus being the most common viral agent, while *Streptococcus pneumoniae* and *Mycoplasma pneumoniae* are the most common bacterial agents in typical and atypical CAP, respectively.[ii,iii]

Characteristic features of this acute illness in children include fever, cough, increased respiratory rate, changes in lung auscultation, and inflammatory infiltrates on chest radiography. CAP can progress to complications involving other organs, and approximately 40 % require hospitalization, and five percent are admitted to the intensive care unit.[i–v] This acute disease often occurs at the extremes of life, and in the pediatric age group, and is influenced by the anatomy of the airways and the response of the still developing immune system;[iii-vi] in addition to other biological conditions, this disease is increasingly associated with environmental and socio-cultural conditions as risk factors.[vii-ix]

CAP is currently the leading preventable cause of under-five deaths worldwide, affecting all regions, with the highest rates of morbidity and mortality in low-income countries.[x] In 2019, CAP caused 14 % of under-five deaths worldwide and 22% of all deaths in children aged one to five years, mainly in regions of South Asia and sub-Saharan Africa.[xi] In the Americas, the incidence of CAP due to *Streptococcus pneumoniae* is more than 350 cases per 100 000 children and accounts for 80 % of pneumococcal deaths in children under five years of age.[xii]

Historically, CAP has been linked to the first reason for consultation in health facilities in El Salvador.[xiii] According to national epidemiological data for the last five years, pneumonia was among the three most frequent reasons for hospitalization in children under five years of age and among the five main reasons for consultation in all age groups who consulted in Ministry of Health facilities.[xiii] In 2022, it was the leading cause of death in patients aged one to four years and the third cause of death in patients under one year of age. [xiv]

Studies from different parts of the world have increasingly linked biological and sociodemographic factors and environmental degradation to increased susceptibility of children to pneumonia. Various risk factors have been studied, such as a history of prematurity or low birth weight, malnutrition, non-exclusive breastfeeding, incomplete immunization, parental education level, poor housing conditions, lack of household hygiene, unhealthy household habits, low household income, air quality, exposure to environmental pollutants, among others, have been associated with the occurrence of CAP in the pediatric age group.[vii-ix,xv-xx] The consequences of CAP risk factors include increased susceptibility to developing recurrent pneumonia, severe and prolonged illness, and increased likelihood of hospitalization and death; the behavior of these outcomes may vary according to individual circumstances and the presence of multiple risk factors.[xxi-xxiii]

The objective of this study was to determine whether there is an association between patient, sociodemographic, and environmental factors in children under five years of age and the occurrence of CAP. Little literature has been published on this topic in El Salvador. Knowing the association of risk factors with CAP allows health authorities to strengthen preventive health strategies, surveillance, and control in a comprehensive manner and work to reduce the current worrying morbidity and mortality rates of the disease.

Methodology

An observational, analytical, case-control study was conducted with a case-control ratio of 1:2. The study was conducted at the San Rafael National Hospital, a second level of care, geographically located in the department of La Libertad, El Salvador. The definition of cases was that all patients under five years of age from the department of La Libertad were hospitalized in the pediatric service between January and December 2022, with a clinical and radiological diagnosis of CAP made by an institutional pediatrician. The definition for the controls was: all patients under five years of age from the department of La Libertad and hospitalized in the Pediatric Service from January to December 2022 with diagnoses other than CAP or any other acute respiratory or pulmonary disease.

Inclusion criteria were patients older than one month and younger than five years of age, previously healthy, admitted to the Pediatric Service, and residing in the department of La Libertad for both cases and controls, from whom the necessary data for the study were collected. Exclusion criteria included patients with evidence of incomplete information in the file or referred from other hospital centers, both for cases and controls. In addition, the study did not include patients with another concomitant disease at the time of admission or hospitalization, patients with known chronic and immunosuppressive diseases, children with congenital malformations with chromosomal alterations, or from institutions that function as children's homes.

The sample size was calculated using the StatCalc calculator of the Epi Info 7.0 program, with the following elements: a confidence level of 95 %, a power of 80 %,

an expected odds ratio (OR) of 2.5 %, a ratio of two controls for each case, and a proportion of controls with an estimated exposure of 50 % and a proportion of cases with an exposure of 71.4 %. A simple randomized sampling was performed using the random number generator module of the OpenEpi software; the source is the list of discharges of the Pediatric Hospital Service during one year, 2022, registered in the Morbidity and Mortality System through the Ministry of Health Web. The data collection technique was the documentation of the information of each patient contained in the clinical files requested from the Department of Statistics and Medical Documents of the hospital. It was performed using a digital instrument elaborated in the program Microsoft Excel 2019. The information collected from the files was saved and stored in a digital database using the same program.

A descriptive analysis of the patient's clinical history was performed. The variables analyzed for their association with CAP were divided into biological, sociodemographic, and socioenvironmental variables. The biological variables were: cesarean delivery, prematurity, low birth weight, nonadherence to exclusive breastfeeding, lack of infant monitoring, growth retardation for age, incomplete immunization, attendance at children's institutions, and malnutrition at admission.

The sociodemographic variables were: male sex, urban origin, adolescent mother, low maternal education, prenatal checkups less than four, no child control, living in children's institutions, mother working outside the home, overcrowding, mud house, tin house, dirt floor, non-drinking water in the home, excreta disposal in a pit, and incomplete basic services. The socio-environmental variables were disposal of buried garbage, disposal of burned garbage, exposure to wood smoke in the home, exposure to tobacco smoke in the home, pet ownership, poultry ownership, and altitude less than 900 meters above sea level.

The Kolmogorov-Smirnov normality test was performed for age, and descriptive presentation was made using frequencies and proportions of variables in tables. The association between the variables studied and the OR calculated by cross-tabulations measured the risk of CAP. The Chi-square method was used to determine the statistical significance of the results, with a decision threshold of p-value less than 0.05 and a 95 % confidence interval. Statistical analysis was performed using SPSS version 26. The information reviewed was treated as strictly confidential, no patient identity data were collected, and the study was approved by the Ethics Committee of the San Rafael National Hospital in Act No. 7-2023 and approved modification in Act No. 13-2023 .

Results

Clinical characterization of patients with CAP

The study included 189 patients, 63 cases, and 126 controls. The proportion of cases was 59 % (37/63) between one and four years, with a median age of 14 months, and 52 % (33/63) in females.

The presence of cough was reported in 81 % (51/63), fever on admission in 83 % (52/63), and tachypnea on admission in 68 % (43/63). Right-sided pulmonary infiltrates were present in 64 % (35/63), leukocytosis in 60 % (38/63) and anemia on admission in 46 % (29/63). CAP was classified as non-specific etiologic origin in 57 % (36/63), bacterial origin in 24 % (15/64) and viral origin in 19 % (12/63).

Cases with any complication due to pneumonia were 17 % (11/63). Ninety-four percent (59/63) were discharged alive and recovered, 6 % (4/63) were transferred to another hospital of higher complexity, and no case died (Table 1).

Bivariate Analysis

Among the biological factors, patients born prematurely (OR 2.62; 95 % CI 1.27-5.38; p = 0.01) had twice the risk of developing CAP. Similarly, patients with growth retardation for age (OR 2.12; 95 % CI 1.1-4.40; p = 0.02) had a twofold increased risk of neumonia compared to those without this condition. No significant associations were found when analyzing cesarean delivery, low birth weight, lack of exclusive breastfeeding, incomplete immunization status, or malnutrition at the time of hospital admission (Table 2).

Regarding sociodemographic factors, patients living in overcrowded households (OR 1.96; 95 % CI 1.06-3.61; p = 0.04) had almost double the risk of developing CAP compared to those not exposed to overcrowded living conditions. No statistically significant associations were observed for age less than one year, male sex, urban residence, adolescent motherhood, low maternal education, lack of routine pediatric check-ups, attendance at childcare facilities, maternal employment outside the home, mud or tin housing, dirt floors, lack of access to potable water, use of pit latrines, or incomplete basic household services (Table 3).

Table 1. Clinical background of the patients included in the study

Variable	CAP n= 63 (%)	No CAP n=126 (%)
Age		
< 1 year	37 (41.3)	57 (42.2)
1 to 4 years	26 (58.7)	69 (54.8)
Gender		
Male	30 (47.6)	66 (52.4)
Female	33 (52.4)	48 (47.6)
Nutritional status		
Malnutrition	18 (28.6)	25(19.8)
Normal	43 (68.3)	96 (76.2)
Overweight	2 (3.1)	5 (4.0)
Complete vaccination for age		
Yes	41 (65)	98 (78)
No	22 (35)	28 (22)
History of repeated respiratory infection		
Yes	8 (12.6)	5 (04.0)
No	55 (87.4)	121(96.0)
Presence of cough		
Yes	51 (80.9)	0 (0.00)
No	12 (19.1)	126 (100)
Presence of fever during hospital admission		
Yes	52 (83.0)	19 (15.0)
No	20 (35.0)	107 (85.0)
Tachypnea		
Yes	43 (68.0)	6 (04.8)
No	24 (38.0)	120 (95.2)
Tachycardia		
Yes	35 (55.6)	18 (14.3)
No	28 (44.4)	108 (85.7)
Anemia		
Yes	29 (46.0)	33 (26.8)
No	34 (54.0)	90 (73.2)
Leukocytosis		
Yes	38 (60.3)	56 (51.9)
No	25 (39.7)	52 (48.1)
Localization of pulmonary infiltrate on chest radiography		
Right	35 (55.6)	-
Left	5 (7.9)	-
Both lobes	21 (33.3)	-
Complicación		
Yes	11 (17.4)	16 (12.6)
No	52 (82.6)	110 (87.4)
Days of hospital stay		
> 5 days	18 (28.6)	57 (45.2)
< 5 days	45 (71.4)	69 (54.8)
Classification of pneumonia		
Bacterial	15 (23.8)	-
Viral	12 (19.0)	-
Unclassified	36 (57.1)	-
Hospital discharge		
Alive and fully recovered	59 (93.7)	119 (94.4)
Alive with after-effects	0 (0.0)	2 (1.6)
Referred to another hospital	4 (06.3)	5 (4.0)
Deceased	0 (0.0)	0 (0.0)

With regard to socioenvironmental variables, a statistically significant association was observed with exposure to household tobacco smoke (OR 3.20; 95 % CI 1.51-6.74; p = 0.00), with exposed patients having a 3-fold higher risk of developing CAP compared to non-exposed patients. No significant associations were found for practices such as burying or burning garbage, exposure to wood smoke, ownership of pets or poultry, or living at an altitude below 900 m above sea level (Table 4).

Discussion

Most children with pneumonia were older than one year, with a slight predominance of females. Vijayan in India and Fonseca in Brazil found a similar distribution, with most cases occurring in children aged one to four years.[vii,xv] In contrast, Ara in Bangladesh reported a predominance of children younger than one year.[xvi] In this study, no association was found between age and CAP. Regarding sex, the present study aimed to associate male sex as a risk factor, but the result was not significant. Other researchers have also shown that sex is not a relevant factor in the occurrence of CAP in children under five, as shown by Cano in Spain, Cuevas in Peru, and Tuğcu in Japan, although female children showed a slightly higher prevalence.[ix,xix] Vijayan in India observed a relatively balanced sex distribution of CAP prevalence.[xv]

Table 2. Biological Factors Associated with CAP

Variable	Cases n = 63 (%)	Controls n = 126 (%)	OR	IC 95%	p value
Cesarean delivery	20 (31.7)	53 (42.7)	1.63	0.86 - 3.09	0.17
Prematurity	20 (31.7)	19 (15.1)	2.62	1.27 - 5.38	0.01
Low birth weight	15 (23.8)	37 (32.7)	0.65	0.32 - 1.30	0.30
Lack of exclusive EBF*	9 (45.0)	13 (35.5)	1.70	0.57 - 5.11	0.51
Growth retardation	18 (28.6)	20 (15.7)	2.12	1.1 - 4.40	0.02
Incomplete vaccination	22 (34.9)	28 (22.6)	1.88	0.96 - 3.65	0.91
Malnutrition at admission	18 (28.6)	25 (19.8)	1.34	0.87 –2.05	0.25

*EBF: Exclusive breastfeeding

Table 3. Sociodemographic Factors Associated with CAP

Variable	Cases n = 63 (%)	Controls n = 126 (%)	OR	IC 95%	p value
Age under 1 year	37 (41.3)	57 (42.2)	1.72	0.90 - 3.16	0.10
Male sex	30 (47.6)	64 (50.8)	0.88	0.48 - 1.61	0.80
Urban origin	40 (63.5)	80 (63.5)	1.00	0.53 - 1.87	1.00
Adolescent mother	15 (23.8)	26 (20.6)	1.20	0.58 - 2.48	0.76
Low maternal education	23 (63.9)	44 (56.4)	1.37	0.61 - 3.08	0.58
Prenatal check-ups < 4	6 (16.7)	12 (15.2)	1.12	0.38 - 3.25	1.00
No pediatric check-ups	8 (12.7)	11 (8.8)	1.50	0.57 -3.96	0.55
Attendance at childcare centers	6 (9.5)	21 (16.8)	0.52	0.20- 1.38	0.27
Mother working outside home	20 (31.7)	30 (24.0)	1.47	0.75 - 2.88	0.34
Overcrowding	36 (57.1)	51 (40.5)	1.96	1.06 - 3.61	0.04
Adobe housing	14 (22.2)	20 (15.9)	1.51	0.71 - 3.25	0.38
Tin housing	6 (9.5)	9 (7.1)	1.37	0.47 - 4.03	0.78
Dirt floor	5 (7.9)	15 (11.9)	0.64	0.22 - 1.84	0.56
Non-potable water at home	13 (20.6)	21 (16.7)	1.30	0.60 - 2.80	0.64
Excreta disposal by pit	23 (36.5)	39 (31.0)	1.28	0.68 - 2.43	0.55
Incomplete basic services	34 (54.0)	53 (42.1)	1.62	0.88 - 297	0.16

Table 4. Socio-environmental Factors Associated with CAP

Variable	Cases n = 63 (%)	Controls n = 126 (%)	OR	IC 95%	p value
Garbage disposal: buried	7 (11.1)	7 (5.6)	2.13	0.71 - 6.35	0.28
Garbage disposal: burned	9 (14.3)	26 (20.6)	0.64	0.28 - 1.47	0.39
Exposure to wood smoke	23 (36.5)	37 (29.4)	1.38	0.73 - 2.62	0.40
Exposure to tobacco smoke	20 (31.7)	16 (13.0)	3.20	1.51 - 6.74	0.00
Ownership of pets	38 (60.3)	64 (50.8)	1.47	0.80 - 2.72	0.28
Ownership of poultry	11 (17.5)	32 (25.4)	0.62	0.29 - 1.33	0.3
Altitude below 900 masl*	42 (66.7)	69 (54.8)	1.65	0.88 - 3.10	0.16

*masl: meters above sea level

At the same time, Girma in Ethiopia reported a 15 % higher proportion in females, and Paredes in a Cuban hospital reported a greater severity of CAP in male children.[vi,xx]

Among biological factors, prematurity has been identified as a risk factor for CAP in children under five years of age. Other investigators have also identified premature birth as an associated risk factor.[vi,xxii-xxv] In Europe, Clark found that prematurity increased the risk of developing CAP fourfold in a prospective study of over 600 children with CAP in 13 hospitals in the United Kingdom.[xxv] Fadl and Baseer in Egypt also found a significant association between prematurity and CAP,[xxvi,xxvii,] and Kasundriya in India found a sevenfold increased risk of severe CAP in premature infants.[xxi] In addition, in a ten-year prospective cohort study in Israel, Feinstein identified prematurity as a factor associated with CAP in children under five years of age requiring admission to the intensive care unit.[xxii] Cheng in China found that both preterm birth and low birth weight were significantly associated with a higher risk of developing severe CAP.[v]

Growth retardation for age was another finding associated with the diagnosis of CAP in this study. Similarly, Vijayan in India found that growth retardation in children under five years of age doubled the risk of CAP compared to those with appropriate height for age.[xv] Goya, also in India, identified low weight-for-height as an independent risk factor for pneumonia.[xxviii] Sheikh in Bangladesh showed that poor nutritional status, reported as stunting and wasting, was predominantly associated with acute respiratory infections in children.[xxiii] Srivastava in India and Fonseca in Brazil found significant independent risk factors for malnutrition leading to growth retardation associated with CAP in children under five years of age.[vii,xxiv] Malnutrition as an isolated condition was not associated with CAP in this study. However, Ngocho in Tanzania included malnutrition as a risk factor for childhood pneumonia, and Dembele found it to be the most common factor associated with pneumonia deaths among children under five in the Philippines.[xvi,xxx]

In terms of sociodemographic conditions, household overcrowding was found to be a predisposing factor for CAP. Fonseca in Brazil, Abebaw in Ethiopia, and Ara in Bangladesh also found an association between living in overcrowded conditions or large families (more than five members) and hospitalization for CAP in children under five years of age.[vii, xvii, xxxi] Srivastava in India reported an even stronger association between overcrowding and CAP than this study.[xxix]

Among the socio-environmental factors, exposure to cigarette smoke at home was identified as a risk factor. It was considered an important finding as it is a modifiable factor. Savitha found that parental smoking habits at home were associated with respiratory infections in rural India.[xxiv] In contrast, Álvarez in Cuba found that passive smoking in children was associated with the acquisition of severe pneumonia.[xxxii] Tazinya in Cameroon found that passive smoking was a significant risk factor for respiratory infections in children under five in a national hospital and also identified wood smoke exposure as a significant risk factor, in contrast to the results of this study, where wood smoke exposure was not statistically significant.[xxxiii] Nirmolia in India, Zhuge in China, Ngocho in Tanzania, and Soelaeman in Asian countries found that indoor air pollution from using solid fuels or natural gas for cooking was associated with childhood pneumonia.[xvi,xxxiv-xxxvi] Other important factors associated with CAP in children under five years of age that have been identified in studies from different countries include incomplete immunization, lack of exclusive breastfeeding, malnutrition, poor adherence to well-child care, low maternal education, and outdoor air pollution.[vii-x, xv-xvii] However, these factors were not found to be conclusively associated with CAP in this study. Limitations of this

study included incomplete or disorganized information in clinical records, mostly in digital format, which prompted the inclusion of physical records.

In some cases, physicians and nurses' poor legibility of handwritten clinical notes presented difficulties. Certain variables evaluated in other studies were not recorded in the medical files, which might have expanded and enriched the context of this study. The validity of the results may have been affected by Berkson's bias due to the selection of hospital-based controls.

It is recommended that the implementation of promotion and education activities at the primary health care level be strengthened to reduce preterm births by addressing preventable risk factors such as maternal age, habits acquired during pregnancy, and adherence to antenatal care.[xxxvi-xxxviii] It is also necessary to implement interventions at all levels of health care, focusing on nutrition, psychosocial care, and well-child care to prevent stunting, particularly in the first two years of life.[vii,xv,xxiii, xxix] In addition, promoting healthy environments free from indoor pollution, ensuring proper ventilation in homes, and promoting safe community environments should be emphasized from primary care onwards. [xxxi,xix]

Conclusion

Prematurity and growth retardation for age were identified as biological risk factors for CAP. Household overcrowding was identified as a sociodemographic risk factor. Exposure to tobacco smoke in the home was identified as a socio-environmental risk factor. These factors are consistent with findings from studies conducted in other regions and continents.

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Narrative review

Management of bilateral paralysis of the vocal cords

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Abstract
Vocal cord paralysis is a pathology within the field of otorhinolaryngology that can progress to the point of causing interference with breathing, compromising the airway, manifesting complications such as dyspnea at rest and laryngeal stridor, especially when there is bilateral paralysis in the paramedian or intermediate position, becoming a medical emergency. The objective of this narrative review is to analyze the different treatments known for the management of bilateral vocal cord paralysis (BVCP). A search was conducted in the PubMed database, including original articles, randomized studies, systematic reviews, and books in Spanish and English. The treatment of vocal cord paralysis is focused on achieving a balance between breathing and phonation, ensuring the patency of the airways and their adequate phonatory functions.

Keywords
Vocal Cord, Vocal Cord Paralysis, Dyspnea.

Resumen
La parálisis de las cuerdas vocales es una enfermedad dentro de la especialidad de otorrinolaringología que puede evolucionar hasta causar interferencia para la respiración, comprometiendo la vía aérea, manifestándose complicaciones tales como disnea en reposo y estridor laríngeo, en especial cuando hay parálisis bilateral en posición paramediana o intermedia, convirtiéndose en una emergencia médica. El objetivo de esta revisión narrativa es analizar los diferentes tratamientos conocidos para el manejo de la parálisis bilateral de las cuerdas vocales. Se realizó una búsqueda en la base de datos PubMed, se incluyeron artículos originales, estudios aleatorizados, revisiones sistemáticas y libros en inglés y español. El tratamiento de la parálisis de las cuerdas vocales se enfoca en lograr un equilibrio entre la respiración y la fonación, garantizando la permeabilidad de las vías respiratorias y sus adecuadas funciones fonatorias.

Palabras clave
Cuerdas vocales, Parálisis de Cuerdas Vocales, Disnea.

Introduction

Bilateral vocal cord paralysis (BVCP) is a disease that involves severe airway compromise and may manifest with symptoms such as dyspnea at rest or during exercise and stridor due to the paramedian position of both vocal cords. In some cases, the intermediate position of the cords may cause aspiration, which may lead to an emergency and ultimately require a tracheostomy.[i]

In BVCP, the medial and paramedial position of the vocal cords may contribute to airway narrowing, a level of the glottis and manifests with inspiratory dyspnea. For years, iatrogenic lesion of recurrent laryngeal nerves during thyroidectomy was considered the most frequent cause of BVCP, occurring in approximately 1 % of this surgical procedure. This complication is more common in surgeries performed for neoplasia, retrosternal goiters, and in patients with a history of multiple thyroid surgeries, with an incidence ranging from 20 % to 30 %.[i,ii] Other causes of BVCP include esophageal surgery, vocal cord trauma during intubation, open neck trauma, tracheal surgery, and viral neuritis.[iii]

This potentially life-threatening disease requires not only the administration of corticosteroids but also intubation as short-term symptomatic therapy, as well as surgical intervention, including tracheostomy. Among the most common surgical methods implemented in BVCP are posterior cordectomy, arytenoidectomy, and, more and more commonly, reinnervation. The main objective of surgical treatment is to ensure airway patency while preserving the phonatory and protective functions of the larynx.[i]

This narrative review study included original articles, randomized studies, systematic reviews, and books in English and Spanish, published between January 1, 2020, and July 1, 2024, in which the different known treatments for managing bilateral vocal cord paralysis were analyzed.

Discussion

Vocal cord paralysis refers to the immobility of vocal cords, while paresis implies an alteration in their mobility. Both conditions can be caused by processes that directly affect the vocal cord (scarring or tumors) due to neuropathies of the nerves that control its motor function, such as the vagus nerve, recurrent laryngeal nerve (RLN), and superior laryngeal nerve (SLN). They can also be associated with central neurological problems, such as ictus tumors or multiple sclerosis, and systemic diseases, such as amyotrophic lateral sclerosis or Guillain-Barré syndrome.[iv]

Symptomatology

The presentation and symptoms of bilateral paralysis will depend on the underlying etiology and the position of the vocal cords. If the vocal folds are paralyzed in a more medial position, stridor and respiratory symptoms may predominate, or the patient may be asymptomatic. At the same time, the voice may remain normal, and episodes of aspiration will not occur. In contrast, the airway will be largely patent if the vocal cords are paralyzed in a more lateral position. However, it may not be able to close adequately, which may manifest with significant vocal complaints, shortness of breath, and risk of aspiration or asphyxia, but with fewer respiratory or stridor-related symptoms.[iv]

BVCP is an uncommon cause of respiratory distress in children; investigating the etiology and clinical features of vocal cord paralysis in this group provides useful information for diagnosis, management, and prognosis.

The natural history of BVCP depends on its etiology, which includes trauma, neurological disorders such as Arnold-Chiari malformation, hydrocephalus, and cerebral palsy, hypoxia, iatrogenic causes (e.g., related to intubation or surgery), idiopathic/unknown, or history of birth trauma. The clinical presentation varies, ranging from mild inspiratory stridor to catastrophic airway compromise.[iii,v,vi]

Preoperative evaluation

A comprehensive evaluation of the functional status of the neuromuscular apparatus of the larynx is necessary for the correct and timely diagnosis of BVCP. To perform surgical intervention successfully, the cause and origin of the lesion must be identified. A nasopharyngolaryngoscopy is also important (Figure 1).

El-Sobki *et al.* mention that voice can be assessed using the vocal disability index, which consists of 30 items equally distributed in three domains related to voice disorders: the functional domain, which describes the impact of the disorder on the patient's daily activities; the organic domain, which assesses the patient's perception of laryngeal discomfort and phonation characteristics; and the emotional domain, which reflects the patient's affective response to the vocal disorder. These describe the impact of voice disorders on daily activities, emotional responses to voice, self-perceived laryngeal discomfort, and characteristics of vocal emission.[iii]

In patients with vocal cord paralysis lasting between four weeks and six months, it will be necessary to perform laryngeal electromyography to obtain prognostic information.[vii,viii] It is important to mention that bilateral alteration of vocal fold movement, with hypomobility or immobility, reduces the glottic opening area, which consequently increases airway resistance, induces persistent stridor and dyspnea that will worsen with inflammatory conditions of the upper airway. An accurate diagnosis and adequate treatment are necessary as this condition may progress to acute respiratory failure.[ix]

Iwai *et al.* describe a case associated with posterior cervical laminoplasty. A possible cause of this disease was an intraoperative hyperflexed neck position, which probably induced a mechanical pinching of the larynx, resulting in swelling and edema of the vocal cords and paresis of the NLR.[x]

Choi *et al.* described a case in which a 36-year-old multiparous woman underwent an emergent cesarean section due to polyhydramnios and active labor at 35 weeks of gestation, delivering a girl, who cried weakly, presented cyanosis, chest retraction, and stridor. Laryngoscopic examination revealed BVCP.

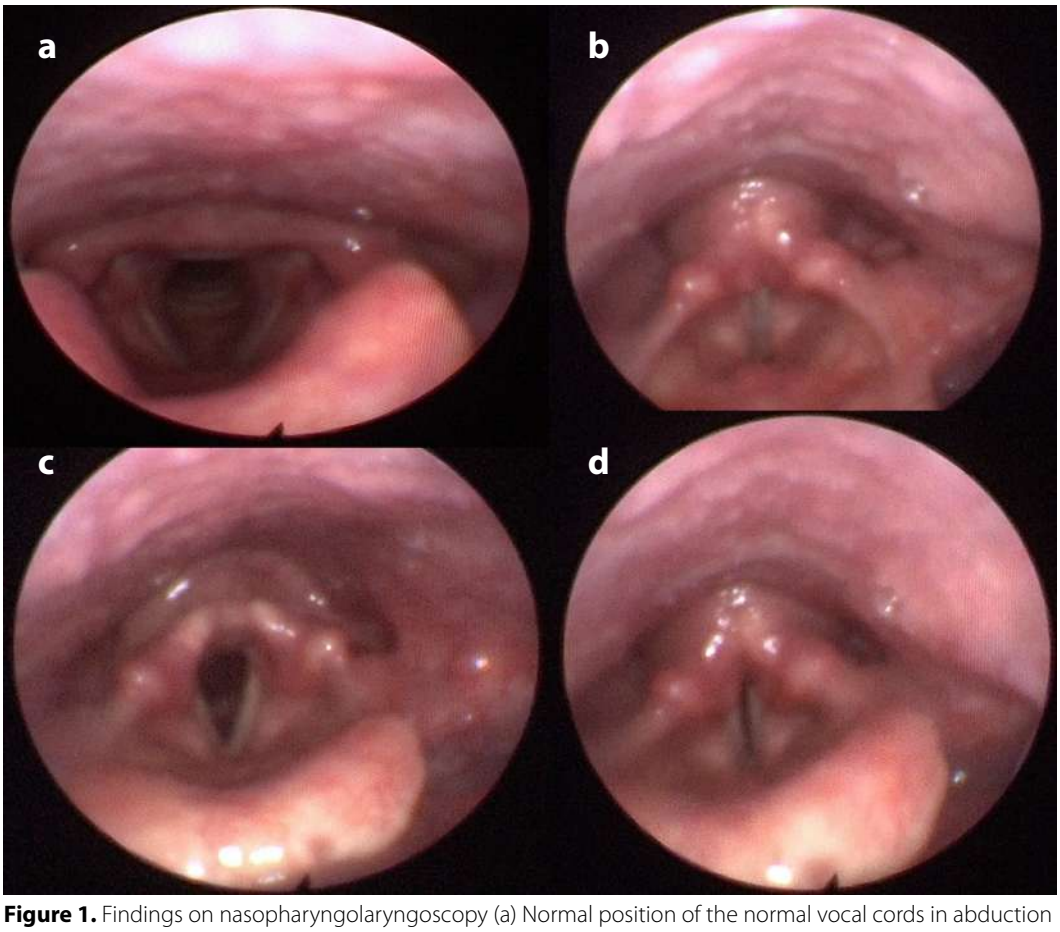

Figure 1. Findings on nasopharyngolaryngoscopy (a) Normal position of the normal vocal cords in abduction during breathing b) Normal position of the normal vocal cords in adduction during phonation, (c) Bilateral vocal cord paralysis in abduction, (d) Bilateral vocal cord paralysis in adduction.
Source: Otorhinolaryngology Service, Specialties Clinic of the Salvadoran Insurance Institute, Social Security (ISSS).

When the baby was 40 days old, a tracheotomy was performed to alleviate persistent stridor and oral feeding difficulties.[xi]

Yamada *et al.* described a case of meningeal carcinomatosis due to adenocarcinoma of the left lung of four years' evolution in an 84-year-old man who developed dysphagia, hoarseness, and BVCP.[xii] In another study, Diaz-Perez *et al.* described the case of a patient with acute BVCP as a manifestation of acute stroke who developed dysphagia and hoarseness.[xii]

Led to acute respiratory failure and urgent tracheotomy.[xiii] This evolution occurred due to a combination of an acute left vocal cord paralysis from a lateral bulbar stroke and a pre-existing chronic bilateral right vocal cord paralysis due to a previous surgical injury to the recurrent laryngeal nerve.[xiii]

Paralysis secondary to viral infections has a good prognosis, and it is important to establish an early pharmacological treatment once the cause is known. In paralysis with high suspicion of viral infection, imaging tests, neurological examination, and lumbar puncture to analyze cerebrospinal fluid and rule out encephalitis will be performed; in addition, an attempt will be made to identify the causal agent by Polymerase Chain Reaction (PCR) tests of the most common viruses in blood and cerebrospinal fluid.[xiv]

Treatment

The treatment of BVCP aims to achieve a balance between improving breathing and preserving the voice. In classical terms, it was described that following a wider glottic area implied incomplete closure and worsened quality, which was the main criterion for developing transoral endolaryngeal techniques.[ii]

Posterior chordectomy consists of resectioning the posterior one-third or two-thirds of the vocal cord, with a consequent increase in the glottic area, leaving the anterior portion for phonation. El-Sobki *et al.*, showed an improvement in maximum phonation time (MPT), mainly when performing laser-assisted posterior cordectomy, and a lack of worsening of voice quality and aspiration scores.[iii]

Qazi *et al.* mention that the main objectives of the CO_2 laser-assisted posterior cordectomy procedure are to avoid tracheostomy while preserving voice and swallowing function. Over the years, they have

shown that the procedure is effective and safe with acceptable results in voice and swallowing, since acceptable voice quality was eventually obtained four to five months after the operation.[xv]

Jackowska *et al.*, found that cordectomy by CO_2 laser microlaryngoscopy is a simple procedure that improves respiratory function and allows decannulation in patients with BVCP. However, factor such as advanced age (> 66 years), comorbidities (diabetes, gastroesophageal reflux disease), multiple thyroid surgeries, and the performance of a tracheotomy below the cricoid cartilage decrease the likelihood of successful decannulation.[xvi]

The vocal fold suturing procedure allows for widening the anterior commissure of the vocal folds while keeping the laryngeal mucosa generally intact. This technique subsequently offers apermanent glottis enlargement or decannulation effect with a single surgical episode. In addition, using arytenoid release for cricoarytenoid articulation fixation has resulted in significant advances in final surgical outcomes, improving both ventilation and phonation and reducing the need for revision surgery.[iii,viii]

Habaza *et al.* described that the suture lateralization technique widened the interglottic distance at the suture site ($p< 0.001$). Decanulation was completed in three out of four tracheostomized patients. The optimal location of the suture insertion points resulted in less in-tracheostomy manipulation of the cords and a shorter operative time.[xvii]

Vocal cord later fixation is a cost-effective alternative procedure to tracheostomy pending recovery, as is unilateral and bilateral posterior transverse cordectomy; both approaches are associated with a 95.1 % decannulation rate and adequate airway volume but with worsening voice quality. Arytenoidectomy involves total or partial removal of the arytenoid cartilages in the larynx. Unilateral/bilateral partial arytenoidectomy data have reported a lower decannulation rate (83%) and better voice quality than cordectomy.[viii]

In the pediatric population, BVCP is one of the main causes of stridor and airway obstruction that can arise idiopathically as a result of birth trauma or in lesions of the central nervous system, such as Arnold-Chiari malformation. Lateralization of the vocal cord suture is reversible and has less morbidity than other surgical interventions for bilateral vocal cord immobility; however, optimal suture placement is vital and challenging.[xix] New techniques in pediatric patients will be described later.

Bilateral selective vocal cord reinnervation aims to restore both vocal cord tone and abductor movements in patients with bilateral vocal cord paralysis. Puxeddu *et al.* state that the posterior cricoarytenoid muscles were reinnervated using the right C3 phrenic nerve root through the greater auricular nerve graft. In contrast, through transverse cervical nerve grafts, adductor muscle tone was restored bilaterally using the thyrohyoid branches of the hypoglossal nerve. After a minimum follow-up of 48 months, all patients were successfully released from tracheotomy and recovered normal swallowing.[xx]

Standardized unilateral non-selective and bilateral selective reinnervation surgeries are viable alternatives to static procedures currently under evaluation in prospective studies. Cervical loop neu- rorrhaphy to the RLN allows long-lasting vocal recovery and satisfactory results, potentially superior to medialization and thyroplasty, by maintaining the viscoelastic properties of the vocal cords and preventing their atrophy. Bilateral selective reinervation shows potential for recovery of inspiratory abduction with improved respiratory function without vocal impairment.[xxi]

In the pediatric population, bilateral selective laryngeal reinnervation holds promise as a treatment option for children with bilateral vocal cord inmobility. It has the potential to restore both abductor and adductor vocal cord motion. This procedure offers an effective strategy for airway management and restoration of dynamic laryngeal function.[xxii]

Although surgical treatment can improve respiratory quality and, consequently, the quality of life of patients with BVCP, completely normal phonation and respiratory parameter values are not achievedwith any of the methods. Dysphagia and aspiration are feared complications after arytenoidectomy surgery.[ii]

Al Omari *et al.* describe the outcome of 18 patients with tracheostomy secondary to BVCP, managed by transoral laser reconstructive microsurgical techniques and followed up for one to five years, all had tracheostomy at presentation due to bilateral true vocal fold immobility and stridor, and were treated by transoral laser reconstructive microsurgery with arytenoidectomy and vocal fold lateralization. All patients were successfully decannulated eight weeks after surgery.[xxiii] The pediatric population with BVCP may present with stridor and respiratory distress requiring tracheotomy. In a study by Windsor *et al.*, endoscopic anteroposterior cricoid division with balloon dilation procedure has been described as an alter-

native to tracheostomy in these patients.[xxiv] This procedure is safe and may effectively eliminate airway symptoms in selected infants with bilateral vocal cord paralysis, avoiding the need for tracheostomy; however, more research is needed in this population.[xxiv]

It should be considered that it is possible to injure the RLN and develop a clinical quagmire during thyroid gland surgery due to the alteration of vocal cord motility in the form of a paradoxical spasm. The treatment of these patients presents particular difficulties.[xxv] Steroids are often used for the treatment of vocal cord paralysis after thyroid surgery. In a study by Donatini *et al.*, the study found that a single intravenous injection of four milligrams of dexamethasone administered within ten minutes following a loss of signal during neuromonitoring in thyroid surgery exerts a therapeutic effect that prevents vocal nerve paralysis and the need for staged thyroidectomy.[xxvi]

Surgery for BVCP is currently not standardized and is highly variable. Postoperative and revision surgery complications are frequent and are related to the patients' drinking habits (alcohol) and the etiology of BVCP.[xxvii]

Laryngeal synkinesia may develop after a unilateral lesion or BVCP. It is a movement disorder due to misdirected reinnervation after an RLN lesion. Syncynetic reinnervation occurs when adductor axons from the RLN reinnervate the abductor muscle (posterior cricoarytenoid) or when abductor axons reinnervate the adductor muscles (thyroarytenoid, lateral cricoarytenoid, and interarytenoid muscles). It has been reported that Botox treatment may delay the need for definitive surgical treatment, and, for those with a tracheotomy, some may achieve decannulation without surgery.[xxviii]

As already mentioned, BVCP is the second most common cause of neonatal stridor. Its management is a controversial issue, and over the years, several surgical procedures have been proposed to improve the glottic breathing space, some previously described. As an innovative management, Zhao *et al.* proposed a new technique of percutaneous endoscopic suture lateralization for BVCP in newborns in China, which was performed under general anesthesia with 3.0 mm endotracheal intubation using the improved technique of needle-directed percutaneous placement of a 4-0 Prolene® suture without the use of specialized equipment.[xxix]

Trozzi *et al.* have proposed another technique, endoscopic lateroabduction of the aritenoids, after complete airway endoscopy, where the endolaryngeal thread guide instrument (ETGI) is guided through the laryngoscope and placed under the vocal process apofisis. Here, a non-absorbable or long-term absorbable suture thread (2.0 or 0 -Prolene®/2.0-PDS II) is passed through the hole in the needle tip and then pulled back into the laryngeal space, the ETGI can be removed; the two corresponding ends are then knotted and fixed under the skin in a small incision.[xxx]

Postoperative evaluation

In their study, El-Sobki *et al.* describe the initiation of feeding six hours postoperatively with semisolids. Clear liquids were started 24 hours postoperatively, and if aspiration occurred, patients were asked to rotate the neck to the nonoperative side while drinking. Patients were usually allowed to start oral fluids 24 hours postoperatively, with the same swallowing precautions for 48 hours, approximately one week postoperatively. In addition, administration of anti-reflux therapy was indicated for three months. Patients continued postoperative follow-up at one week, then at two weeks, one month, three months.[iii,v]

The limitations of this study are the limited bibliography available worldwide on the different treatments known for the management of BVCP in the last five years, which makes it difficult to obtain more detailed information on this disease, and it is therefore suggested that more studies be published in the future.[iii,vi]

The limitations of this study are the limited bibliography available worldwide on the different treatments known for the management of BVCP in the last five years, which makes it difficult to obtain more detailed information on this disease, and it is therefore suggested that more studies be published in the future.

Conclusion

Despite the existing modern high-tech diagnostic technologies and the variety of surgical methods for the treatment of this condition, the problem of diagnosis, treatment, and rehabilitation of patients suffering from BVCP remains a serious challenge for physicians who require further investigation of this pathology.

The evidence in the selected studies shows a consistent effect in favor of surgical treatment, improving respiratory function and decannulation, and with little loss in voice quality or swallowing; however, none of the surgical techniques described showed better respiratory and functional outcomes than the others. The decision as to which surgery to perform should still be made ba-

sed on the otolaryngologist's criteria, considering the patients' needs or preferences and seeking to improve their quality of life.

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Brief communication

Antimicrobial susceptibility profiles of extended-spectrum beta-lactamase-producing bacteria

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Abstract
Introduction. Bacterial resistance is a worldwide problem, with bacteria such as *Escherichia coli* and *Klebsiella pneumoniae* showing increasing resistance rates. **Objective.** Characterize the antimicrobial susceptibility profiles of patients with infection by extended-spectrum beta-lactamase-producing *Escherichia coli* or *Klebsiella pneumoniae* bacteria in two hospitals of the public network of El Salvador, 2022. **Methodology.** Descriptive cross-sectional study of the characteristics and antimicrobial susceptibility profiles of a retrospective cohort of 989 patients with *Escherichia coli* or *Klebsiella pneumoniae* infection. **Results.** 50 .1 % of patients had an infection with extended-spectrum beta-lactamase-producing *Escherichia coli* or *Klebsiella pneumoniae*, and of these, 34 .1 % died at 30-day follow-up. The percentage of resistant susceptibility for these bacteria was 46 .0 % and 13 .0 %, respectively. The percentages of resistance were higher for ampicillin (100 %) and ceftriaxone (43 %-98 %), although carbapenemics also showed resistance (3 %-5 %). **Conclusion.** Severe complications and outcomes were more frequent in patients with infection by extended-spectrum beta-lactamase-producing bacteria with a higher susceptibility to cephalosporins and penicillins.

Keywords
Drug Resistance, Bacterial, beta- Lactamases, *Escherichia coli*, *Klebsiella pneumoniae*.

Resumen
Introducción. La resistencia bacteriana es un problema mundial, ya que las bacterias como *Escherichia coli* y *Klebsiella pneumoniae* presentan tasas de resistencia cada vez más altas. **Objetivo.** Caracterizar los perfiles de susceptibilidad antimicrobiana de los pacientes con infección por bacterias *Escherichia coli o Klebsiella pneumoniae* productoras de betalactamasas de espectro extendido en dos hospitales de la red pública de El Salvador, 2022. **Metodología.** Estudio descriptivo transversal de las características y perfiles de susceptibilidad antimicrobiana de una cohorte retrospectiva con 989 pacientes con infección por *Escherichia coli o Klebsiella pneumoniae*. **Resultados.** El 50,1 % de pacientes cursó con una infección por *Escherichia coli o Klebsiella pneumoniae* productoras de betalactamasas de espectro extendido, y de estos, el 34,1 % falleció en el seguimiento a 30 días. Para estas bacterias el porcentaje de susceptibilidad resistente fue de 46,0 % y 13,0 % respectivamente. Los porcentajes de resistencia fueron mayores para ampicilina (100 %) y ceftriaxona (43 %- 98 %), aunque los carbapenémicos también presentaron resistencia (3 %- 5 %). **Conclusion.** Las complicaciones y desenlaces graves fueron más frecuentes en los pacientes con infección por bacterias productoras de betalactamasas de espectro extendido con una susceptibilidad resistente mayor para cefalosporinas y penicilinas.

Palabras clave
Farmacorresistencia Bacteriana, beta- Lactamasas, *Escherichia coli, Klebsiella pneumoniae*.

Introduction

Antimicrobial resistance (AMR) has increased worldwide in recent decades, causing an increase in medical complications, deaths, and the need for increasingly potent antibiotics, which in turn increases healthcare costs.[i] Therefore, AMR has been cataloged as a serious problem and one of the ten main public health threats.[i,ii]

OPEN ACCESS

Perfiles de susceptibilidad antimicrobiana de bacterias productoras de betalactamasas de espectro extendido

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Thus, the World Health Organization (WHO) has created priority lists of multidrug-resistant pathogens; where in critical priority one are: *Acinetobacter baumanni (A. baumannii)*, *Pseudomona aeruginosa (P. aeruginosa)*, *Klebsiella pneumoniae (K. pneumoniae)* and *Escherichia coli* (*E. coli*). These last two are part of the group of enterobacteria, which may present as one of their resistance mechanisms for the production of extended-spectrum beta-lactamases (ESBL).[iii,iv]

In the last report of the Global Antimicrobial Resistance Surveillance System (GLASS), in which 127 countries participated, levels of resistance were found to be above 50 % of the total number of septicemias reported for *K. pneumoniae or Acinetobacter* spp, of which 8 % had resistance to carbapenemics.[i,v] For urinary tract infections caused by *E. coli*, 20 % had resistance to first and second-line drugs.[i,v]

In El Salvador, 1652 isolates from 26 hospitals were described during 2018. The most frequently isolated agents were *A. baumannii, K. pneumonia, P. aeruginosa, and E. coli*. The percentage of multi-resistance was 87.5 % of all isolates.[vi] Consequently, it is necessary to delimit the information according to the type of bacteria and resistance mechanism present.

This study describes *E. coli* and *K. pneumonia*, which WHO has identified as critical enterobacteria due to their resistance, including ESBL and carbapenemases.[iii,iv]

Both bacteria are responsible for nosocomial and community infections, highlighting the importance of antimicrobial surveillance in hospitals. In 2022, we characterized the antimicrobial susceptibility profiles and characteristics of patients infected with *E. coli or K. pneumoniae* bacteria producing extended-spectrum beta-lactamases in two public hospitals in El Salvador.

Methodology

A cross-sectional study was conducted to describe the clinical characteristics of hospitalized patients with *E. coli and K. pneumoniae* infections, as well as to characterize the susceptibility profiles of ESBL-producing bacteria. The study was carried out in hospitals of the public health system of El Salvador, of the second and third level of care, respectively, with data corresponding to the year 2022. The database of bacterial isolates wa provided by the Directorate of Information and Communication Technologies, whose susceptibility results are by the latest modification of the European Committee for Antimicrobial Susceptibility Testing, "susceptible, intermediate susceptibility and resistant".[vii] This database consisted of 2048 isolates for the second-level hospital and 8259 for the third-level hospital. After the individualization of each patient in the database, the selection of bacteria and samples of interest was carried out, as well as the elimination of repeated records and incomplete data. A total of 989 individuals were identified.

All patients hospitalized during 2022 with positive bacteriologic cultures for *E. coli* or *K. pneumoniae* in blood, urine, and bronchial secretions were included. Those with insufficient information (lack of essential data for analysis) recorded in the physical and digital clinical record were excluded. Data collection was performed using a structured digital form in KoboToolbox version 2.023.21 .

The study variables were defined according to the WHO GLASS guidelines, guaranteeing the data's standardization and com parability. Demographic variables (sex and age), clinical characteristics (hospital admission service, previous hospital admission, prolonged hospital stay, surgical procedure prior to culture collection, type of surgical procedure, use of invasive devices, presence of immunosuppression, clinical complications on admission, need for intensive care unit (ICU), Charlson comorbidity classification, discharge condition, and 30-day follow-up after culture collection) were collected. Thirty-day mortality was defined as death of the patient within 30 calendar days after the date of positive culture; infections were classified according to their probable origin as: community-acquired, present or incubating on admission, with no recent medical history; and healthcare-associated infections (HAIs), acquired during hospitalization or with a history of medical care, invasive devices or recent antibiotic use.

In addition, microbiological variables were used (type of sample, microorganism isolated, origin of the infection, susceptibility of the isolated agent, Betalactamase-producing bacteria positive (ESBL+), and Betalactamase-producing bacteria negative (ESBL-), polymicrobial isolation and infection by other agents), antibiotic therapy received (in previous admissions to in the last 90 days, 48 hours prior to admission where the infection was isolated by *E. coli* and/or *K. pneumoniae*), empirical antibiotic treatment (antibiotic that the patient received to treat the infection before obtaining the microbiological result),[v] adequate empirical antibiotic treatment (empirical treatment whose active ingredient was sensitive to the isolated microorganism, according to the antibiogram) and adequate targeted antibiotic treatment (treatment adjusted after the

antibiogram result, considering sensitivity, route, dose and correct duration).

Frequencies and proportions were calculated for qualitative variables, while the Anderson-Darling normality test was performed for quantitative variables. For the differences in proportions between ESBL+ and ESBL- groups, Chi-square was used (p-value < 0.05 as statistically significant). EpiInfo 7.2.6.0 and Microsoft Excel 365 with its XRealStats.xlam and XLSTAT 2023 add-in were used for data processing and analysis.

The Ethics Committee of each hospital authorized the study. The corresponding registration numbers are File No. 24/2023, Rosales National Hospital, and File No. 8-2023, San Rafael National Hospital.

Results

Characteristics of the population

Of the 989 patients analyzed, 58.4 % were female, and 40 % were aged 60 years or older. The median age was 39 years (RI: 2-67) for the second-level hospital and 57 years (RI: 42-69) for the third-level hospital. The service with the highest number of isolations was Internal Medicine, with 60.0 %. The most frequent type of specimen was urine, with 64.2 %, and the bacterium isolated with the highest proportion was *E. coli*, with 67.7 %. Community infections (52.7 %) were concentrated in urine samples. HAIs (47.3 %) were most frequently present in blood and bronchial secretions. 24.1 % of patients had previous admissions, 29.9 % had undergone a surgical procedure, 84.5 % had exposure to invasive devices, 58.6 % required a prolonged hospital stay (> 7 days), and 52.4 % experienced complications during hospitalization. Of the 50.1 % who had an infection by BLEE+ bacteria, 34.1 % died during the 30-day follow-up after the culture was taken.

Of the 400 patients at the secondary care hospital, 39 % were infected with ESBL+ strains, 72.4 % were *E. coli*, and 27.5 % were *K. pneumoniae*. Regarding age, it was more common in patients over 60 years of age, at 50.6 %. However, this resistance mechanism was also identified in 17.9 % of children under five years of age (Table 1). 59.6 % were of community origin, and 76.2 % had no comorbidities according to the Charlson index, which relates 10-year life expectancy to a patient's comorbidities (Table 2).

Regarding treatment, 96.7 % received empirical antibiotic therapy, 48.7 % received appropriate treatment, and 62.1 % received adequate targeted antibiotic therapy according to the result of the antibiogram (Table 2).

In the 30-day follow-up after culture, mortality in the group with ESBL+ enterobacteria infection was 25.0 %, while in the group with ESBL- enterobacteria infection, it was 11.0 % (Table 2); this difference was statistically significant (p < 0.001).

In the tertiary care hospital, 589 patients were included, of whom 57.5 % presented infections caused by ESBL+ bacteria. Of these infections, *E. coli* was isolated in 54.0 % of the cases and *K. pneumoniae* in 46.0 %. 44.8 % of resistant cases occurred in patients older than 60 years. Furthermore, 66.1 % of infections were of nosocomial origin, and 44.2 % of patients had high comorbidity according to the Charlson index (Table 2).

Regarding treatment, 72 % of the patients received empirical antibiotic therapy at the beginning of the management, which was appropriate in 15.3 % of the cases. A total of 68.1 % received adequate targeted antibiotic therapy based on antibiogram results, and 43.1 % required admission to the ICU (Table 2).

At the 30-day follow-up after culture collection, the mortality rate was 38.3 % in the ESBL+ group and 30 % in the ESBL- group, which represented a significant difference in these proportions (p < 0.04).

Antimicrobial susceptibility profiles

Of the total samples analyzed for ESBL+ *E. coli* and *K. pneumoniae*, the susceptibility percentages were resistant in 46.0 % and 13.0 %; intermediate in 3.4 % and 50.4 %; and susceptible in 50.6 % and 36.9 %, respectively, for each bacterium.

In the secondary care hospital, the most frequently prescribed antibiotics for 48-hour pretreatment and empirical therapy were cephalosporins (37.2 % and 41.9 %, respectively), primarily ceftriaxone (32.4 % and 40.1 %). Penicillins were prescribed for appropriate targeted therapy (38.0 %, mainly ampicillin) (72.0 %).

In *E. coli* and *K. pneumoniae* ESBL+ isolates, resistance was reported in 31.0 % and 42.8 % of the samples analyzed, respectively. Both bacteria showed 100 % resistance to ampicillin, and ampicillin-sulbactam showed both resistance (54 %, 75 %) and intermediate susceptibility for both bacteria (22 %, 4 %). For *E. coli* ESBL+, other antibiotics with a significant percentage of resistance were tetracycline (67 %), trimethoprim-sulfamethoxazole (64 %), levofloxacin (53 %), ciprofloxacin (52 %) and some cephalosporins such as ceftazidime, ceftriaxone, cefepime, cephalothin, cefazolin (42-50 %). Moreover, carbapenemics such as imipenem (4 %) and

Table 1. Sociodemographic characteristics of patients admitted with Escherichia coli or Klebsiella pneumoniae infection according to BLEE production, 2022.

Características	Second level hospital		Third level hospital	
	ESBL- (n=244)	ESBL+ (n=156)	ESBL- (n=250)	ESBL+ (n=339)
	fr(%)	fr(%)	fr(%)	fr(%)
Sex				
Female	179 (73.4)	98 (62.8)	138 (55.2)	163 (48.1)
Male	65 (26.6)	58 (37.2)	112 (44.8)	176 (51.9)
Age groups (years)				
Under 1	61 (25.0)	24 (15.4)	-	-
1 to 4	20 (8.2)	4 (2.6)	-	-
5 to 9	5 (2.1)	-	-	-
10 to 19	21 (8.6)	3 (1.9)	16 (6.4)	12 (3.5)
20 to 29	33 (13.5)	6 (3.9)	23 (9.2)	27 (8.0)
30 to 39	15 (6.1)	8 (5.1)	20 (8.0)	34 (10.0)
40 to 49	13 (5.3)	8 (5.1)	36 (14.4)	50 (14.8)
50 to 59	18 (7.4)	24 (15.4)	48 (19.2)	64 (18.9)
Over 60	58 (23.8)	79 (50.6)	107 (42.8)	152 (44.8)

ESBL-: beta-lactamase negative bacteria, ESBL+: beta-lactamase positive bacteria.

meropenem (3 %) also reported resistance for *K. pneumoniae* ESBL+, cephalothin (79 %), cefepime, cefazolin, and ceftriaxone (69 %) were reported. Imipenem and meropenem were sensitive (100 %) (Table 1).

In the tertiary care hospital, cephalosporins were most frequently prescribed in pre- and empirical antibiotic therapy (78.1 %, 50.9 %), with ceftriaxone being the most frequently used antibiotic, with 54.0 % and 40.9 %, respectively. Inappropriate targeted therapy, carbapenems were used at 50.6 %, mainly meropenem at 57.9 %.

Of the ESBL+ *E. coli* and *K. pneumoniae* samples tested, 55.7 % and 5.3 %, respectively, were resistant to one or more antibiotics, with 100 % resistant susceptibility to ampicillin and aztreonam. Furthermore, ESBL+ *E. coli* samples had percentages 98 % of resistance to cephalothin, cefazolin, cefepime, cefoxitin, and ceftriaxone, and 3 % resistance to imipenem and meropenem. ESBL+ *K. pneumoniae* samples were 98 % resistant to cephalothin, cefazolin, cefepime, cefoxitin, and ceftriaxone, 4 % resistent to imipenem and 5 % resistent to meropenem (Table 3).

Discussion

In this study, the ESBL+ resistance mechanism was found to be present in half of all infections. In this group, more than one-third of the population died within 30 days of culture collection, a proportion that represents almost twice the mortality observed in the group with infections caused by non-ESBL-producing bacteria, suggesting that the presence of this resistance mechanism could influence the unfavorable prognosis of patients.[viii, ix]

In other studies, during the same 30-day follow-up period in patients with *E. coli* and *K. pneumoniae* bacteremia, mortality is generallly higher when the ESBL resistance mechanism is present than when it is absent, and patients may even die before starting adequate antibiotic treatment.[v,x,xi]

The presence of this resistance mechanism has varied from 18.1 % in an analysis of pediatric patients in Mexico to 46 % in patients with urinary tract infections reported in Jordan and 96 % in the case of Iran.[xii] The percentage and outcome vary according to the complexity of the hospital evaluated, the isolation samples, and the characteristics of the population analyzed, such as age, sex, comorbidities, and previous antibiotic therapy, among others.[v,xii,xiii] Thus, as in this study, the percentage of infections by ESBL+ bacteria was higher in the third-level hospital.

The most frequent characteristics present in the group with infection by ESBL+ bacteria in this research were similar to those identified in other studies, such as the older age of the patient, between the fifth and sixth decade of life, the presence of complications such as sepsis or septic shock, exposure to invasive devices, previous admissions, prolonged hospital stay, immunosuppression, history of previous and empirical antibiotic therapy.[v,xii] One of the

Table 2. Clinical characteristics of patients admitted with *Escherichia coli* or *Klebsiella pneumoniae* infection according to ESBL production, 2022.

Features	Second level hospital		Third level hospital	
	ESBL- (n=244)	ESBL+ (n=156)	ESBL- (n=250)	ESBL+ (n=339)
	fr(%)	fr(%)	fr(%)	fr(%)
Clinics				
Hospital service				
Internal Medicine	91 (37.3)	100 (64.1)	179 (71.6)	216 (63.7)
Surgery	14 (5.7)	20 (12.8)	71 (28.4)	123 (36.3)
Pediatrics	67 (27.5)	13 (8.3)	-	-
Obstetrics and Gynecology	52 (21.3)	8 (5.1)	-	-
Neonatology	20 (8.2)	15 (9.6)	-	-
Previous income	33 (13.5)	41 (26.3)	69 (27.6)	96 (28.3)
Extended stay	61 (25.0)	92 (59.0)	171 (68.4)	256 (75.5)
Surgical procedure	15 (6.1)	27 (17.3)	95 (38.0)	159 (46.9)
Minimally invasive	2 (0.8)	6 (3.8)	17 (6.8)	22 (6.5)
Invasive	13 (5.3)	22 (14.1)	78 (31.2)	137 (40.4)
Invasive device	216 (88.5)	147 (94.2)	185 (74.0)	288 (85.0)
Immunosuppression	6 (2.5)	11 (7.1)	129 (51.6)	179 (52.8)
Presence of complications	43 (17.6)	67 (42.9)	157 (62.8)	252 (74.3)
Admission to ICU	-	-	82 (32.8)	146 (43.1)
Charlson comorbidity				
Absent	216 (88.5)	119 (76.3)	64 (25.6)	72 (21.2)
Download	14 (5.7)	15 (9.6)	74 (29.6)	117 (34.5)
High	14 (5.7)	22 (14.1)	112 (44.8)	150 (44.2
Exit condition				
Alive	219 (89.8)	119 (76.3)	170 (68.0)	204 (60.5)
Deceased	25 (10.2)	37 (23.7)	80 (32.0)	135 (39.8)
30-day follow-up				
Alive	208 (85.2)	114 (73.1)	169 (67.6)	205 (60.2)
Deceased	27 (11.1)	39 (25.0)	75 (30.0)	130 (38.3)
Unknown	9 (3.7)	3 (1.9)	6 (2.4)	4 (1.2)
Microbiological				
Type of sample				
Urine	212 (86.9)	114 (73.1)	139 (55.6)	170 (50.1)
Blood	24 (9.8)	32 (20.5)	60 (24.0)	91 (26.8)
Bronchial secretion	8 (3.3)	10 (6.4)	51 (20.4)	78 (23.0)
Isolated microorganism				
Escherichia coli	214 (87.7)	113 (72.4)	160 (64.0)	183 (54.0)
Klebsiella pneumoniae	30 (12.3)	43 (27.6)	90 (36.0)	156 (46.0)
Origin of infection				
Community	208 (85.2)	93 (59.6)	105 (42.0)	115 (33.9)
HAI	36 (14.8)	63 (40.4)	145 (58.0)	224 (66.1)
Polymicrobial isolation	1 (0.4)	1 (0.6)	8 (3.2)	19 (5.6)
Infection by other agents	4 (1.6)	7 (4.5)	48 (19.2)	75 (22.1)
Antibiotic treatment				
Previous entry (90 days)	23 (9.4)	27 (17.3)	69 (27.6)	94 (27.7)
Prior to admission (48 hours)	21 (8.6)	22 (14.1)	190 (76.0)	94 (27.7)
Empirical	238 (97.5)	151 (96.8)	184 (73.6)	244 (72.0)
Appropriate empirical	190 (77.9)	76 (48.7)	87 (34.8)	52 (15.3)
Adequately addressed	203 (83.2)	97 (62.2)	201 (80.4)	231 (68.1)

ESBL-: beta-lactamase negative bacteria, ESBL+: beta-lactamase positive bacteria, ICU: Intensive Care Unit. HAI: Healthcare-associated infections.

Table 3. Antimicrobial susceptibility profiles of-producing bacteria in the second and third level of care hospital, 2022.

Antibiotic	*E. coli* ESBL+ (%)						*K. pneumoniae* ESBL+ (%)					
	2nd level (n=113)			3rd level (n=183)			2nd level (n=43)			3rd level (n=156)		
	R	I	S	R	I	S	R	I	S	R	I	S
Amikacin	2	0	98	1	0	99	0	4	96	1	3	96
Amoxicillin/Clavulanic Acid	27	60	13	21	63	16	9	-	55	29	64	7
Ampicillin	100	0	0	-	0	0	-	0	0	-	0	0
Ampicillin-sulbactam	54	22	25	84	6	10	75	4	21	87	7	6
Aztreonam	56	0	44	-	0	0	55	0	45	-	0	0
Cephalothin	46	20	34	99	1	0	79	7	14	-	0	0
Cefazolin	50	0	50	89	0	11	69	0	31	99	0	1
Cefepime	43	0	57	99	0	1	69	0	31	99	0	1
Ceftazidime	42	0	58	99	0	1	54	0	46	99	0	1
Ceftriaxone	43	0	57	99	0	1	69	0	31	99	0	1
Ciprofloxacin	52	20	28	91	5	4	66	3	31	89	7	4
Ertapenem	6	0	94	2	1	96	3	0	97	6	0	94
Fosfomycin	3	1	96	4	0	96	-	-	-	0	0	-
Gentamicin	28	0	72	43	0	57	49	0	51	69	4	27
Imipenem	4	0	96	3	0	97	0	0	100	4	1	94
Levofloxacin	53	27	20	95	5	0	18	-	55	57	43	0
Meropenem	3	0	97	3	0	97	0	0	100	4	0	96
Nitrofurantoin	1	5	94	9	12	78	24	-	32	45	40	15
Piperacillin-Tazobactam	20	10	71	17	11	72	14	0	86	16	10	74
Tetracycline	67	0	33	89	0	11	55	0	45	93	0	7
Tigecycline	0	0	-	2	0	98	0	0	100	4	0	94
Trimethoprim-sulfamethoxazole	64	0	36	73	0	27	68	0	32	90	0	10

R: Resistant, I: Intermediate, S: Susceptible, S: Sensitive.

differences identified in the second-level hospital was that the absence of comorbidities and the community origin of the infection was the most frequent within the ESBL+ group, unlike the third-level hospital and other studies where a high Charlson index and the origin of nosocomial infection predominate.[v,x,xv] This is possibly explained by the complexity of the hospital, such as the tertiary level hospital in this study, which attends to patients with comorbidities and more serious complications, as well as long-standing diseases and a predominantly adult population.

The profiles for both bacteria reported a higher percentage of resistance for penicillins and cephalosporins. In contrast, for some drugs, all the samples analyzed were resistant, such as ampicillin in both hospitals. This is consistent with previous studies that point to the widespread use of these antibiotics as a key factor in the proliferation of ESBL+ strains.[xvi,xvii]

In addition, a percentage of resistance between 3 % and 4 % was presented for potent drugs such as imipenem and meropenem. This is in agreement with WHO reports and other studies where antibiotics used as first-line are ineffective due to the high resistance reported, and those considered as last choice antibiotics such as carbapenemics already have reports of resistance to them by some bacteria.[v,xii,xviii,xx] In the case of *K. pneumoniae*, it presented higher percentages of resistance for most drugs, compared to *E. coli*, which is different from that reported in other countries where it is *E. coli* that presents higher percentages of resistance.[xii] Due to the increasing prevalence of antibiotic resistance, the development of new antibiotics and alternative therapies, improvements in infection control, and antibiotic optimization programs should be considered.[xxi] In addition, evidence-based guidelines for empirical treatment and restricting the use of third-generation cephalosporins are the

most successful measures to control the severity of ESBL+ microbial pathogens.[xvii]

As this is a retrospective study, data collection depends on the quality and availability of previous medical records, which limits the researchers' ability to control this information. Furthermore, the impossibility of controlling the quality of the collection, handling, transport, and processing of biological samples must be considered. Therefore, the GLASS protocol was chosen, as it standardizes variable definitions and reduces the risk of data bias.

Conclusion

Infections caused by ESBL-producing bacteria continue to represent a significant clinical challenge in second-third-level care hospitals in El Salvador. *Klebsiella pneumoniae* ESBL+ showed resistance to cephalosporins, quinolones and carbapenemics, especially in HAIs, underscoring the need to review and optimize treatment guidelines. *Escherichia coli* ESBL+ showed resistance in urinary tract infections of community origin, suggesting spread of resistance beyond the hospital setting.

Patients with ESBL+ infections presented higher mortality. These findings emphasize the importance of implementing more effective control and prevention measures adapted to the local context of resistance. Furthermore, it is necessary to develop and integrate therapeutic strategies that consider the growing resistance to carbapenems, prioritizing early identification and continuous monitoring of these pathogens.

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Letter to the editor

A big step in defending global health security

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Madam Editor:

After three years of intense negotiations, the member countries of the World Health Organization (WHO) reached a consensus on a draft Global Pandemic Treaty, which will be approved in May at the next World Health Assembly.

During the negotiation process, a disinformation campaign incorrectly claimed that the Treaty would mean a WHO "power grab" to impose various demands on countries and a loss of their sovereignty.[i]

Except for Argentina and the United States, which explicitly withdrew from the WHO and the negotiation process, all Member States will push for its ratification to enter into force at the global level and have an instrument of international law binding in the event of future pandemics.

The Treaty represents an important milestone for global health and multilateralism. It arises from the experience of COVID-19, where many countries experienced major difficulties in accessing strategic health products, such as vaccines, diagnostics, and personal protection equipment, seeking greater solidarity and ensuring equity of access.

Among the pillars of the new Treaty are: a) strengthening health systems; b) sustainable financing; c) capacity building and the transfer of technology; d) surveillance based on the "One Health" approach; and e) sharing of pathogens and benefits.

"Technology transfer" for pandemic-related products was one of the critical points in the discussion. The Treaty moves forward on intellectual property issues, proposing the possibility of compulsory licensing to allow countries to produce their own drugs and vaccines.[ii] Countries with pharmaceutical industries holding patents strongly opposed this compulsory licensing, arguing that these clauses do not incentivize scientific innovation. In this sense, technology transfer should be carried out on "mutually agreed terms" with the owners of the technology. However, if necessary, the countries' sovereignty should be safeguarded for compulsory licensing.

According to the Treaty, the WHO will receive 20 % of the production of vaccines, therapies, and diagnostics for the pathogens causing future pandemics and distribute them in solidarity to low-and middle-income countries according to their needs.

According to Reges *et al.*,[iii] the Global Pandemic Treaty has two main points: Equity as a structuring principle (Art. 3). Equity is established as a transversal and essential principle committed to reducing avoidable inequalities between countries and populations. Solidarity is another key aspect.

Strengthening the health workforce (Art. 7) calls for developing, protec-

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Un gran paso en la defensa de la seguridad sanitaria global

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ting, and investing in a skilled and secure health workforce. It includes combating discrimination, promoting decent working conditions, and creating a global health emergency force that can be deployed in pandemic situations.

Sustainable and supportive financing (Art. 20). Mechanisms to mobilize additional resources, including subsidies and innovative approaches, are promoted to strengthen financing.

International Cooperation and Capacity Transfer (Art. 19). Cooperation is promoted to strengthen the capacities of developing countries through the transfer of technology, technical assistance, and financial support, expanding their knowledge base and scientific sovereignty.

"One Health and environmental integration" (Art. 5). The "One Health" approach recognizes the interdependence between human, animal, and environmental health. It aims to integrate policies to prevent zoonoses and reduce the environmental factors that drive pandemics through coordinated and multisectoral plans.

Integrated prevention and surveillance (Art. 4) promotes the formulation of comprehensive national disease prevention and surveillance plans that incorporate environmental, climatic, social, and economic factors and coordinate responses between sectors.

Access and benefit-sharing system (Art. 12). A multilateral system is proposed for the rapid exchange of pathogens and their genetic information, with mechanisms to ensure the equitable distribution of the benefits derived from their use by the Nagoya Protocol, promoting transparency and fair access.

Supply chains and logistics (Art. 13). A global network is proposed to ensure equitable and timely access to essential commodities during pandemics. It provides for stockpiling, rapid release, and distribution based on risk and public health needs.

Strengthening regulatory authorities (Art. 14) aims to improve national and regional regulatory capacity to ensure the quality, safety, and efficacy of pandemic-related products.

Communication, literacy, and public trust (Art. 18). The agreement promotes access to science-based information and combats misinformation. It encourages research on public health evidence and trust in institutions, with special attention to coordinated risk communication campaigns.

Governance, monitoring, and updating. It promotes the creation of the Conference of the Parties to oversee the agreement's implementation, with the possibility of establishing subsidiary bodies. It encourages the peaceful resolution of disputes and establishes mechanisms for proposing amendments and protocols, ensuring adaptive flexibility based on new evidence.

Among the main gaps and challenges is that, despite the progress made, the agreement has significant limitations. There are no robust monitoring and sanction mechanisms or clear guarantees on sustainable financing or equitable distribution of resources during emergencies. The operationalization of technology transfer still lacks concrete instruments. In addition, there is a lack of clear proposals for ensuring the resilience of health systems, accelerating research and development during crises, and coordinating efforts among multiple global institutions. Environmental gaps, although recognized, lack binding targets or mechanisms.

Cooperation to strengthen capacities for future pandemics in developing countries through technology transfer, technical assistance, and financial support, expanding their knowledge base and scientific sovereignty, is a missed opportunity for countries with both scientific-technological capacities for the production of drugs and vaccines.[iv]

The new Treaty constitutes an important collective commitment to global health security, preparing and strengthening capacities for future pandemic episodes, particularly about overcoming the problems of access to strategic health products, such as vaccines, personal protective equipment, and diagnostics experienced during the COVID-19 pandemic. Undoubtedly, in the face of new pandemic events, it can only be overcome through multilateralism and cooperation based on principles of solidarity and equity.

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Systematic review and meta-analysis

Systematic reviews representing a synthesis of evidence, original, quantitative or qualitative studies, that use a rigorous process to minimize biases and that identify, evaluate and synthesize studies to answer a specific clinical question are accepted. The search process for the original studies, the criteria used for the selection of those that were included in the review and the procedures used in the synthesis of the results obtained by the reviewed studies must be described in detail.

The article must have the following sections: abstract, keywords, introduction, methodology, results, discussion, conclusion and references. The text must have a maximum of 4000 words and a minimum of 3000, not including references, abstract and text of figures and tables. The abstract must have a maximum of 250 words and must be structured in introduction, objective, methodology, results and conclusion. Use of acronyms, abbreviations and references in the abstract is not allowed. There is no limit to the number of references. 75 % of them must not be older than five years since their publication date. The use of grey literature as part of references is not permitted. Tables and figures cannot be more than five in total.

Recommended format: PRISMA guide.

Narrative or critical review

Narrative or critical review must have descriptive writing and make a comprehensive presentation and discussion of topics of scientific interest in the field of public health. A clear formulation of a scientific object of interest with logical argumentation must be presented.

The article must have the following sections: abstract, keywords, introduction, discussion, conclusion and references. The text must have a maximum of 3500 words and a minimum of 2500, not including references, abstract and text of figures and tables. The abstract must have a maximum of 200 words. Use of acronyms, abbreviations and references in the abstract is not allowed. A maximum of 50 references and a minimum of 30 are allowed. 70 % of them must not be older than five years since their publication date. Only 15 % of grey literature is allowed as part of references. Tables and figures cannot be more than three in total.

Brief communication

This type of scientific paper is shorter than an original article. They are works that aim to publish data of interest in the health situation on a report of a research in development and innovative techniques or methodologies, among others.

The article must have the following sections: abstract, keywords, introduction, methodology, results, discussion, conclusion and references. The text must have a maximum of 2000 words and a minimum of 1500, not including references, abstract and text of figures and tables. The abstract must have a maximum of 200 words and must be structured in introduction, objective, methodology, results and conclusion. Use of acronyms, abbreviations and bibliographic citations in the abstract is not allowed. A maximum of 20 references and a minimum of 15 are allowed. 65 % of them must not be older than five years since their publication date. Only 5 % of grey literature is allowed as part of references. Tables and figures cannot be more than three in total.

Case report

This type of text refers to the presentation of clinical cases that meet established criteria and whose diagnostic and treatment aspects make a considerable contribution to scientific knowledge on the subject. It must respect the provisions of the Declaration of Helsinki and international ethics guidelines ffor health-related research involving human beings.

The text must have the following sections: abstract, keywords, introduction, case presentation, treatment, outcome, clinical diagnosis, discussion, ethical aspects and references. The text must have a maximum of 2000 words and a minimum of 1500, not including references, abstract and text of figures and tables. The abstract must have a maximum of 200 words and must be structured in case presentation, treatment and outcome. Use of acronyms, abbreviations and bibliographic citations in the abstract is not allowed. A maximum of 20 references and a minimum of 15 is allowed. 70 % of them must not be older than five years since their publication date. Only 5 % of grey literature is allowed as part of references. Tables and figures cannot be more than five in total.

Recommended format: CARE guide.

Letter to the editor

Letter to the editor or the editorial committee clarifying, discussing or commenting on the content presented in previous issues of this journal. Comment letters on specific public health issues may also be accepted. Letters must have the following sections: title and object of correspondence. It can have a maximum of 1000 words and a minimum of 700. Tables and figures are not accepted. A maximum of five references and a minimum of three are accepted.

Summary of the characteristics of the different articles

General format for the presentation of articles					
Type of manuscript		Word count	References	Abstract	Tables or figures
Original articles		3000 – 4000	25 – 35	250 words (structured)	Up to 5
Review articles	Systematic	3000 – 4000	As appropiate	250 words (structured)	Up to 5
	Narrative	2500 – 3500	30 – 50	200 words	Up to 3
Brief communications		1500 – 2000	15 – 20	200 words (structured)	Up to 3
Case report		1500 – 2000	15 – 20	200 words (structured)	Up to 5
Letter to editor		700 – 1000	3 – 5	No	No

For further information, please refer to the instructions to authors on our website at: www.alerta.salud.gob.sv

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