Clinical Practice Guidelines as a JSON Service: A Proposed Architecture for Decision Support in Major Burning Management

J. Álvarez, R. Maciel, and V. Larios

***Abstract*— Clinical Practice Guidelines (CPGs) encode evidence-based clinical knowledge but are primarily distributed as unstructured PDF documents, making them inaccessible to automated clinical decision support (CDS) systems. This paper proposes a service-oriented architecture that formalizes the IMSS Clinical Practice Guideline for Major Burn Management (IMSS-375) as a versioned REST/JSON microservice. Seven clinical decision endpoints are defined, each encapsulating a specific GPC recommendation: burn classification, initial assessment, fluid resuscitation, pain management, infection prevention, nutritional support, and transfer criteria, following HL7 FHIR R4 interoperability standards. A mapping between GPC clinical rules (including the Parkland formula, Benaim scale, Curreri formula, and Baux prognostic index) and structured JSON request/response schemas is presented and evaluated against related formalization approaches and verified through structured schema-level invocations against a representative clinical scenario, including a detailed comparison of Mexico IMSS-375 standard properties against HL7 FHIR and OpenEHR. A deployment architecture is described covering hospital-level integration, a centralized service layer, and a non-relational persistence tier based on document-oriented storage for unstructured clinical data.**

Link to graphical and video abstracts, and to code: https://latamt.ieeer9.org/index.php/transactions/article/view/10745

***Index Terms*— burn management, clinical decision support, clinical practice guidelines, FHIR, gran quemado, JSON microservice, knowledge formalization, REST API, document-oriented database, microservice architecture.**

I. Introduction

Clinical practice guidelines (CPGs) represent the gold standard for translating biomedical evidence into actionable clinical recommendations [1]. Institutions such as the Instituto Mexicano del Seguro Social (IMSS) publish CPGs covering a wide range of pathologies, including the management of the major burn patient (gran quemado), one of the most complex and resource-intensive critical care scenarios [2]. Despite their clinical value, CPGs are predominantly disseminated as static PDF documents, which fundamentally limits their integration into digital health ecosystems and automated clinical decision support (CDS) systems.

The Mexican Institute of Social Security (IMSS) is the largest public health institution in Latin America, providing mandatory health coverage to formally employed workers and their families, representing approximately 40% of Mexico's total population [3]. Unlike health systems in the United States where clinical guidelines are distributed across private insurers, Medicare, and Medicaid with market-driven adoption mechanisms [4], or in Europe, where national health services such as the NHS (United Kingdom) or the French Sécurité Sociale operate under centralized regulatory frameworks with established digital infrastructure[5], the Mexican public health system faces a distinct combination of geographic dispersion, heterogeneous IT infrastructure across facilities, and a centralized normative body.

Major burn injuries require time-critical, multi-stage clinical decisions involving fluid resuscitation, airway management, nutritional support, infection control, and burn center referral [6]. The cognitive burden imposed by simultaneously applying multiple CPG recommendations in an emergency setting increases the risk of guideline non-adherence and clinical error, particularly in non-specialist facilities [7]. Structured CDS systems have demonstrated significant reductions in such errors; however, their effectiveness depends on the availability of machine-readable, computable representations of clinical knowledge [8].

Existing formalization frameworks offer partial solutions but present adoption barriers related to technical complexity, vendor dependency, and limited alignment with modern web service architectures [9]. REST/JSON APIs, by contrast, represent the dominant paradigm in contemporary health informatics integration, supported by the HL7 FHIR R4 standard and widely adopted by electronic health record (EHR) platforms [10]. Complementing the JSON interchange layer with a document-oriented non-relational database enables the persistence of unstructured clinical data without the rigidity of relational schemas [11].

This paper makes the following contributions: (1) a formal mapping of the Mexico IMSS-375 CPG clinical rules onto a

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structured REST/JSON service schema; (2) a seven-endpoint service architecture covering the complete major burn management pathway; (3) a deployment architecture describing the physical integration of the microservice within hospital and health infrastructure; (4) a persistence layer design based on document-oriented storage; (5) a comparative analysis of Mexico IMSS-375 standard properties against HL7 FHIR/CDS Hooks and OpenEHR; and (6) a discussion of advanced future directions including mobile agent architectures and AI-assisted clinical report generation.The complete JSON schema is provided as supplementary material.

The remainder of this paper is structured as follows. Section II reviews related work. Section III describes the Mexico IMSS-375 CPG background. Section IV presents the proposed architecture. Section V presents results. Section VI discusses findings and limitations. Section VII concludes and Section VIII proposes future work.

II. Related Work

A. CPG Formalization Approaches

The computable representation of clinical guidelines has been an active research area for over two decades. The Arden Syntax, standardized as HL7 Version 2, introduced Medical Logic Modules (MLMs) as a mechanism for encoding condition-action rules; however, its procedural syntax and limited support for modern web interoperability have restricted widespread adoption [9]. The Guideline Interchange Format (GLIF) and ProForma offered more expressive models for representing complex clinical workflows, yet neither achieved large-scale deployment in production EHR environments [12].

More recently, HL7 FHIR-native approaches have gained traction. CDS Hooks defines a REST-based mechanism through which EHR systems can invoke external CDS services at defined clinical workflow points [8]. The Clinical Quality Language (CQL) standard provides a human-readable and machine-executable expression syntax for encoding guideline logic within FHIR resources [13]. These frameworks, while powerful, require significant infrastructure investment and domain expertise, creating a gap for lightweight, guideline-specific microservice implementations such as the one proposed here.

B. Decision Support in Burn Care

Automated decision support in burn management has been explored primarily through two streams: image-based wound assessment and score-based triage systems. Al-Hadithy et al. [14] demonstrated that rule-based CDS reduced time-to-resuscitation initiation in emergency burn admissions by 23%. Tavares et al. [15] proposed a mobile CDS application for Parkland formula calculation and burn surface area estimation, reporting high clinician adoption in pre-hospital settings. More recently, Hosseini et al. [16] integrated burn CPG rules into a FHIR-compatible CDS Hooks service for a regional trauma network, achieving guideline adherence rates above 85%. However, none of these approaches addressed the full major burn management pathway as a unified, versioned service aligned with a specific national CPG, neither described a deployment architecture and persistence strategy for unstructured clinical data.

C. Non-Relational Databases in Clinical Informatics

Document-oriented databases have seen growing adoption in health informatics for managing unstructured and semi-structured clinical data [17]. Their schema-flexible design is particularly suited to evolving clinical records where the structure of observations cannot be predetermined. Distributed replication capabilities of these systems additionally support resilience requirements in multi-site health networks, making them a natural fit for regional CDS deployments [18]. The integration of non-relational persistence with RESTful microservices constitutes an established architectural pattern in modern health IT, yet it remains underexplored in the context of CPG formalization systems.

D. Problem Statement

A survey of the literature reveals that while individual components of burn CDS have been addressed, no published work has formalized a complete national major burn CPG encompassing classification, resuscitation, nutrition, infection, and transfer as a unified, openly specified REST/JSON service. Furthermore, the specific Mexico IMSS-375 guideline, applicable to the Mexican public health system serving over 60 million beneficiaries [19], has not been the subject of any computable formalization study. The present work addresses this gap.

III. Background: Mexico IMSS-375 Clinical Practice Guideline

A. Scope and Clinical Context

The IMSS Clinical Practice Guideline Mexico IMSS-375-17, titled "Nursing Interventions for the Care of the Adult Major Burn Patient at the Third Level of Care," is catalogued under CIE-10 codes T31 (burns classified by body surface area affected) and T27 (burns and corrosion of the respiratory tract) [2]. It applies to adult patients admitted to third-level IMSS facilities and covers the full acute management pathway from triage to burn unit transfer, assigning recommendations under a four-level evidence hierarchy (Ia, Ib, IIa, IIb, III, IV) and recommendation grades (A–D).

B. Key Clinical Rules Formalized

Four evidence-based rules from Mexico IMSS-375 constitute the computational core of the proposed service:

○ Major burn definition: A patient is classified as a gran quemado if at least one of ten criteria is met, including: total body surface area (TBSA) burned ≥20% in adults under 65 years (≥10% over 65), any third-degree burn >5% TBSA, inhalation injury, high-voltage electrical burn, chemical burn, burns in special locations (face, hands, feet, genitals, major joints), circumferential burns, or associated polytrauma [2]. This OR-logic rule maps directly to a

Boolean service response.

- Benaim classification scale: Burn depth is categorized into Type A (first-degree, superficial epidermal), Type AB-superficial (second-degree superficial, heals spontaneously in ≤14 days), Type AB-deep (second-degree deep, may require grafting), and Type B (third-degree, full thickness, requires grafting if >1 cm). This four-class taxonomy is the standard classification in Mexican public health institutions.
- Parkland formula: The guideline recommends fluid resuscitation with Hartmann's solution at 3–4 ml × body weight (kg) × %TBSA burned. The total calculated volume is administered over 24 hours from the time of the accident: the first half in the first 8 hours, and the second half over the following 16 hours. Urine output target is 30–50 ml/hour. This recommendation carries Grade A / Level Ia evidence [2].
- Curreri formula: Caloric requirements are estimated as 25 kcal/kg/day plus 40 kcal per percentage point of TBSA burned per day. Enteral nutrition is the preferred route and should be initiated within 6 hours of admission when feasible. Protein requirements are estimated at 1.5–2.5 g/kg/day depending on burn severity.

IV. Proposed Solution

This section presents the proposed architecture as the solution to the problem stated in Section II.D. The complete JSON schema specification is openly available at: https://github.com/jesusalvarez1919/granquemadoproposal/blob/main/gpc_gran_quemado_api.json.

A. Design Principles

The proposed service architecture is governed by four design principles derived from the requirements of clinical knowledge services in production health informatics environments. First, clinical fidelity: every service response must be traceable to a specific GPC recommendation, evidence level, and Mexico IMSS-375 section reference. Second, statelessness: each API call is self-contained, carrying all necessary patient parameters in the request body, consistent with REST architectural constraints and facilitating horizontal scalability. Third, interoperability: request/response schemas are aligned with HL7 FHIR R4 resource types (Patient, Observation, Procedure) and use standard terminologies including SNOMED-CT, LOINC, and ICD-10-CM. Fourth, versionability: the service exposes a version header (X-GPC-Version) enabling consuming systems to pin to a specific guideline version and receive notifications when CPG updates are published. The proposed architecture aligns with the WHO Smart Guidelines framework [20], which promotes the digitization of clinical practice guidelines as computable, machine-readable, and interoperable decision logic across heterogeneous health information systems. The use of REST/JSON APIs, HL7 FHIR R4 terminology bindings, and versioned endpoint definitions instantiates the machine-readable (L3) and executable (L4) layers of the Smart Guidelines specification, ensuring that IMSS-375 clinical knowledge is deployable across the diverse digital infrastructure of the LATAM public health context.

B. Service Endpoints

The service exposes seven POST endpoints, each corresponding to a distinct clinical decision domain within the Mexico IMSS-375 guideline. Table I summarizes the endpoints, their clinical purpose and key response fields.

Each endpoint receives a structured JSON request body containing patient identifiers, clinical measurements, and assessment findings relevant to the decision domain. The response includes the computed recommendation, supporting clinical rationale, applicable evidence level, and the verbatim GPC recommendation text. For endpoints involving calculations, intermediate values are exposed to support clinical transparency and error detection.

TABLE I
REST API ENDPOINTS: CLINICAL DECISION MAPPING

Endpoint	**Clinical Decision**	**Key Response Fields**
POST /clasificacion	Classifies burn depth & extent	Benaim scale, Baux Score, ICU flag
POST /evaluacion-inicial	ABCDE primary survey	Per-axis status, critical alerts
POST /resucitacion-hidrica	Fluid resuscitation calc.	Parkland volumes, infusion rates
POST /manejo-dolor	Analgesia & sedation protocol	Drug scheme, EVA target, monitoring
POST /prevencion-infeccion	Wound care & infection prevention	Topical agent, dressing, abx flag
POST /soporte-nutricional	Caloric-protein requirements	Curreri formula, enteral route, glucose
POST /criterios-referencia	Burn unit transfer criteria	Transfer flag, urgency, UMAE list

C. Deployment Architecture

Fig. 1 illustrates the three-tier deployment architecture. At the first tier, hospital-level systems act as consuming clients. These systems invoke the GPC JSON API over HTTPS using standard HTTP POST requests, authenticated via OAuth 2.0 Bearer tokens scoped to the patient context.

At the second tier, the GPC JSON microservice is deployed on a centralized regional infrastructure managed by Mexico IMSS or a designated health IT provider. This centralized deployment model is preferred over per-hospital deployment for three reasons: (1) it enables uniform CPG version control across all consuming facilities; (2) it ensures that guideline updates propagate instantly to all endpoints without requiring local software upgrades; and (3) it concentrates audit logging and regulatory traceability in a single, governable system. The service is implemented as a stateless containerized application (Docker/Kubernetes), enabling horizontal scaling during peak demand periods such as mass-casualty events involving burn injuries.

At the third tier, a document-oriented non-relational database provides persistence for clinical interaction logs, patient encounter records, and CPG version histories. Communication between the microservice and the database layer uses an internal network interface, isolated from the public-facing API. All external communications traverse a TLS 1.3-encrypted channel, and the service registers each API invocation in an immutable audit log compliant with NOM-024-SSA3-2012 [21].

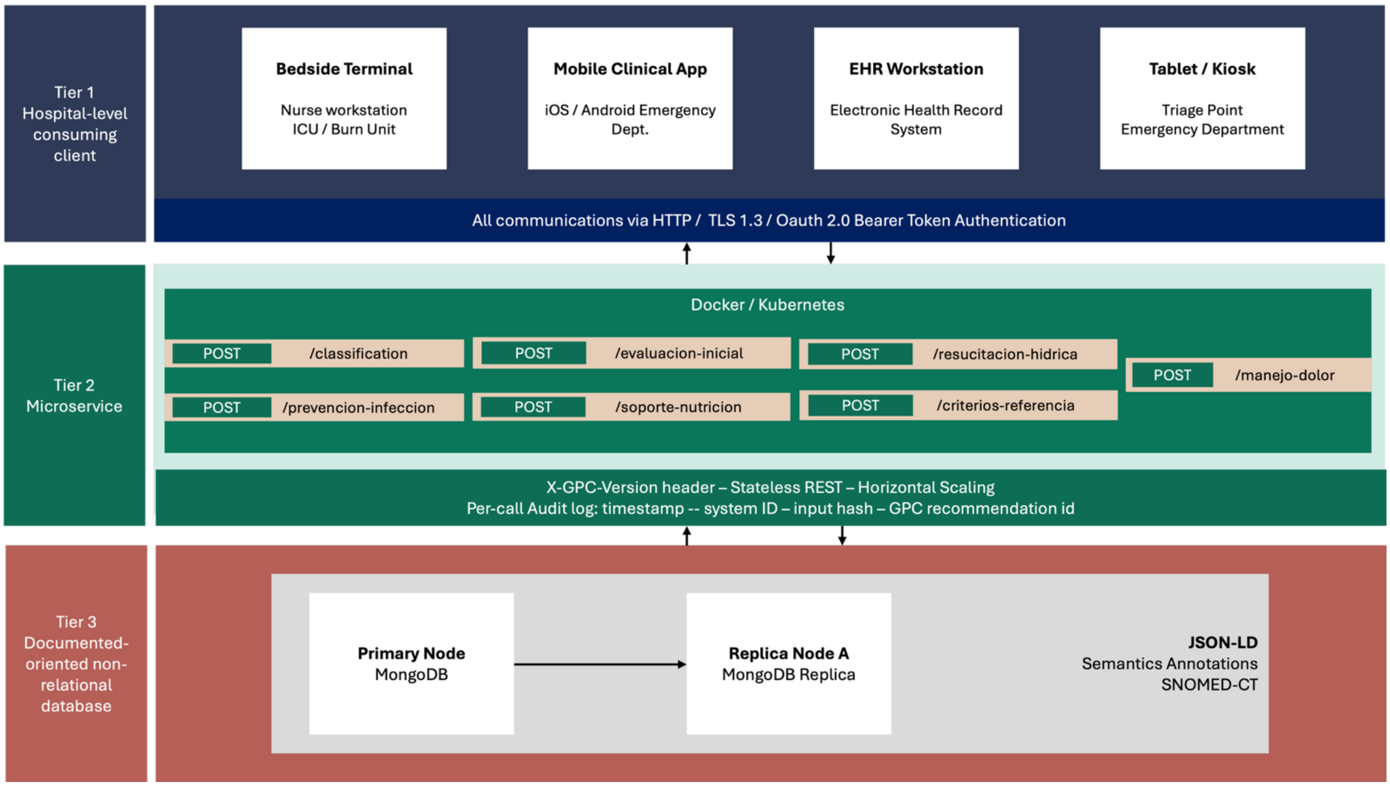

Fig. 1. Three-tier deployment architecture of the GPC JSON microservice.

D. Persistence Layer: Document-Oriented Database

The stateless design of REST microservices implies that no data is retained between calls. While this is architecturally desirable for scalability and simplicity, clinical environments require persistence of encounter records, recommendation histories, and audit trails. To address this, the proposed architecture incorporates a document-oriented non-relational database as the persistence tier.

The choice of a document-oriented model over a relational database is motivated by the nature of major burn clinical data. Wound assessments, photographic records, serial laboratory values, and nursing observations are inherently semi-structured and evolve in schema over a patient's admission. A document store accommodates this variability without requiring schema migrations, enabling the system to ingest data from heterogeneous clinical sources without prior normalization. Each API invocation generates a JSON document persisted to the database, containing the full system identifier, and a hash of the input parameters for integrity verification.

MongoDB's native replication capabilities support a distributed deployment model in which the primary database node resides at the central regional service tier, with secondary replicas synchronized at each participating hospital site. This architecture provides read locality while ensuring write consistency through the primary node. In the event of regional network degradation, local replicas continue to serve read request, maintaining basic CDS functionality even under partial connectivity, a relevant resilience property for geographically dispersed IMSS facilities.

The persistence layer additionally supports integration with JSON-LD representations, enabling semantic annotation of stored documents with SNOMED-CT and LOINC concept identifiers. This makes the accumulated clinical data queryable across standardized vocabularies and interoperable with external health data networks, addressing the long-term data exchange requirements of national health information systems [22].

E. JSON Schema Design and GPC Rule Mapping

The translation of narrative GPC rules into computable JSON schemas required three formalization steps for each rule. First, the natural language rule was decomposed into atomic logical predicates (e.g., "SCQ ≥ 20% AND age < 65"). Second, each predicate was mapped to a typed JSON field with defined constraints (minimum, maximum, enum values). Third, the output recommendation was structured as a combination of computed values (e.g., calculated volumes, Boolean flags) and fixed GPC text fields preserving the original recommendation wording for audit purposes.

Table II presents the mapping of principal GPC clinical rules and their corresponding JSON field representations.

TABLE II
GPC CLINICAL RULE TO JSON FIELD MAPPING

GPC Clinical Rule	Formalized Logic	JSON Field Mapping
Definition of major burn	10 Boolean criteria OR logic	criterios_gran_quemado: bool + criterios_cumplidos: []
Benaim burn depth scale	4-category classification (A, AB-s, AB-d, B)	clasificacion_benaim.tipo + descripcion
Baux prognostic index	Age + %TBSA; >100 high mortality	score_pronostico.baux_score + mortalidad_estimada
Parkland formula	3–4 ml × kg × %TBSA; first half in 8 h	volumen_total_24h + primera_mitad + segunda_mitad
Curreri formula	25 kcal/kg/day + 40 kcal/%TBSA/day	requerimiento_calorico_kcal_dia + proteico_g_dia
Infection control	No routine systemic prophylaxis; topical antiseptic	profilaxis_sistemica.indicada: false + antiseptico_topico
Transfer criteria	7 GPC-defined indications	referencia_unidad_quemados: bool + criterios_positivos[]

D. Interoperability and Integration

The service is designed to integrate within existing hospital information system (HIS) and EHR architectures through two primary patterns. In the CDS Hooks integration pattern, the EHR triggers a service call at defined clinical workflow hooks (e.g., patient-view, order-select) and displays structured CDS cards with the computed recommendations directly within the clinician's workflow, ensuring minimal disruption to routine clinical processes. In the FHIR-native pattern, the service consumes and produces FHIR R4 resources—specifically Observation, RiskAssessment, CarePlan, and NutritionOrder—enabling bidirectional integration with FHIR-compatible platforms and facilitating standardized data exchange across systems. It is important to note that the FHIR-native integration pattern is optional and presupposes the existence of an HL7 FHIR R4-compliant server at the consuming facility. In environments where such infrastructure is unavailable — a common condition across IMSS facilities with heterogeneous IT resources — the service operates fully through the standalone REST/JSON pattern: any HTTP-capable client may invoke the endpoints via standard POST requests without requiring FHIR server infrastructure. This design intentionally lowers the adoption barrier, enabling deployment from tablets in triage units, legacy HIS platforms, and mobile clinical tools regardless of the facility's FHIR maturity level. FHIR integration, where available, functions as an additive interoperability layer and is not a prerequisite for core decision support functionality, as summarized in Table III.

Authentication is handled via OAuth 2.0 with Bearer tokens scoped to the patient context. All service invocations are logged in an immutable audit trail capturing the timestamp, consuming system identifier, endpoint called, input parameter hash, and response recommendation identifier, supporting regulatory traceability requirements under Mexican NOM-024-SSA3-2012 for health informatics systems [17]. This logging mechanism ensures transparency and accountability in the execution of clinical decision support processes within the system.

F. Comparison with Related Formalization Approaches

Table III positions the proposed JSON service against existing CPG formalization standards and systems along five dimensions: interoperability standard, machine-readability, burn-specific applicability, and support for versioned updates.

TABLE III
COMPARISON OF CPG FORMALIZATION APPROACHES

System	Standard	Machine-Readable	Burn-Specific	Updatable
CDS Hooks / FHIR R4 [8]	HL7 FHIR	Yes	No	Yes
Arden Syntax MLM [9]	HL7 Arden	Yes	No	Moderate
OpenEHR Archetypes [10]	OpenEHR	Yes	No	Yes
GPC PDF / Mexico IMSS-375 (current)	None	No	Yes	Manual
Proposed JSON API (this work)	FHIR R4+REST	Yes	Yes	Versioned

The proposed architecture uniquely combines machine-readability, burn-specific clinical coverage, and REST/JSON accessibility within a FHIR-aligned framework. Unlike CDS Hooks implementations, which require an existing FHIR server infrastructure, the proposed JSON API is deployable as a standalone microservice accessible to any HTTP-capable system, lowering the adoption barrier for facilities with limited HIS infrastructure.

G. Comparison of Mexico IMSS-375 Standard Properties

The comparison in Table IV reveals that the proposed JSON API occupies a distinct niche among existing approaches. Unlike HL7 FHIR/CDS Hooks which provides a general-purpose framework with no burn-specific content the proposed service delivers domain-specific clinical rules while maintaining FHIR R4 alignment through its terminology bindings and resource structure. Unlike OpenEHR archetypes, which require a dedicated archetype repository and modeling toolchain, the JSON API is deployable as a standard containerized web service accessible to any HTTP client. Critically, the proposed service is the only approach in this comparison that provides both full burn pathway coverage and a versioned, machine-readable representation with per-call audit logging—properties that are absent from the current Mexico IMSS-375 PDF distribution.

TABLE IV

DETAILED STANDARD PROPERITES: PROPOSED JSON API VS HL7 HOOKS VS OPENHR VS MEXICO IMSS-375 PDF DETAILED STANDARD PROPERTIES

Property	Proposed JSON API	HL7 FHIR	OpenEHR	IMSS-375 PDF
Terminology binding	SNOMED-CT + ICD-10 + LOINC	SNOMED-CT + LOINC	openEHR AOM	Proprietary codes
Clinical rule encoding	JSON + business logic layer	CQL expressions	Archetype logic	Narrative text only
Versioning mechanism	X-GPC-Version HTTP header	FHIR resource version	Archetype version	Manual redistribution
Interop. with FHIR	Native (R4 aligned)	Native	Partial (bridges)	None
Burn-specific coverage	Full (IMSS-375 pathway)	None	None	Full (static)
Audit trail	Per-call hash log	FHIR AuditEvent	None	None
Deployment model	Microservice / cloud	SMART app / EHR plugin	EHR archetype repo	Paper / intranet PDF

A notable property differentiating the Mexico IMSS-375 source guideline from international CPG frameworks is its institutional specificity: the guideline encodes IMSS-specific clinical pathways, including the specific UMAE burn unit network for patient transfer, IMSS formulary constraints for pharmacological recommendations, and NOM-024-SSA3-2012 audit requirements. These institutional properties are preserved in the JSON API through dedicated response fields and cannot be easily captured by generic FHIR profiles or OpenEHR archetypes without IMSS-specific extensions.

V. RESULTS

A. Evaluation Approach

A structured invocation of the seven defined endpoints was performed using the clinical scenario described in this section as input. The service logic was exercised by constructing well-formed JSON request payloads conforming to the schema specification defined in Section IV.C, and verifying that the computed responses satisfied the clinical rules formalized from the Mexico IMSS-375 guideline.

The following patient profile was defined as the common input across all invocations: male patient, age 47, weight 78 kg, mixed second- and third-degree burns affecting the face, anterior thorax, both upper extremities, and genitals, estimated TBSA of 35%, hoarseness and singed nasal cilia present, no mechanical ventilation initiated, time of accident 13:30, resuscitation initiation 15:00 (90 minutes elapsed).

B. Invocation Results

Call 1 — POST /clasificacion: The patient profile (inhalation=true, special areas [face, genitals]) was evaluated using IMSS-375 §3.1 OR-logic criteria. The service returned criterios_gran_quemado: true with four positive criteria (TBSA ≥20%, third-degree >5%, inhalation injury, special areas). The Baux Score was 82 (47 + 35), indicating moderate-high mortality risk and confirming correct rule encoding.

Call 2 — POST /evaluacion-inicial: With SpO_2=94%, hoarseness=true, singed cilia=true, the service returned sospecha_lesion_inhalacion: true and criterios_intubacion_inmediata: true. This confirms that hoarseness + singed cilia triggers inhalation injury per IMSS-375 §4.1.

Call 3 — POST /resucitacion-hidrica: or weight=78 kg, TBSA=35%, the Parkland formula yielded 10,920 ml. A 90-minute delay was detected, adjusting infusion to 840 ml/hour with ajuste_retraso_aplicado: true. Urine output target: 30–50 ml/hour per §4.2, validating delay-adjustment logic.

Call 4 — POST /soporte-nutricional: Using weight=78 kg, TBSA=35%, the Curreri formula gave 3,350 kcal/day and 117–195 g protein. Enteral nutrition was preferred within 6 hours, with glycemic target 80–110 mg/dL per §5.3.

Call 5 — POST /prevencion-infeccion: With no infection signs, the service returned profilaxis_antibiotica_sistemica.indicada: false, consistent with IMSS-375. Topical care was provided per §5.2.

Call 6 — POST /manejo-dolor: For EVA=7, the service recommended opioid-based analgesia with target EVA ≤3 and procedural sedation per §5.1.

Call 7 — *POST /criterios-referencia:* The system identified five transfer criteria (TBSA ≥20%, third-degree >5%, inhalation, special areas, age risk) and returned referencia_unidad_quemados: true with urgent transfer (<2h) and pre-notification required.

TABLE V

SERVICE INVOCATION RESULTS: COMPUTED OUTPUTS PER ENDPOINT

Endpoint	Key Computed Output	Rule Exercised	Result
/clasificacion	gran_quemado: true, Baux: 82	10-criteria OR logic, §3.1	Correct
/evaluacion-inicial	intubacion_inmediata: true	Inhalation criteria, §4.1	Correct
/resucitacion-hidrica	840 ml/h (delay-adjusted)	Parkland + delay logic, §4.2	Correct
/soporte-nutricional	3,350 kcal/day, enteral	Curreri formula, §5.3	Correct
/prevencion-infeccion	systemic abx: false	No-prophylaxis rule, §5.2	Correct
/manejo-dolor	EVA target ≤3, opioid rescue	Analgesia protocol, §5.1	Correct
/criterios-referencia	Transfer urgent <2h, UMAE	7 transfer criteria, §6.1	Correct

All seven endpoints produced outputs consistent with the clinical rules formalized from the Mexico IMSS-375 guideline. The most clinically significant finding was the delay-adjusted Parkland calculation in the /resucitacion-hidrica endpoint, which autonomously corrected the infusion schedule based on elapsed time.

C.Boundary Condition Validation

A boundary scenario was evaluated using a 66-year-old female patient, 70 kg, with 10% TBSA superficial second-degree burns, no inhalation injury, no special area involvement, no resuscitation delay, and EVA pain score of 4. This profile was constructed to exercise the minimum-threshold major burn criterion for patients over 65 years per IMSS-375 §3.1. The /clasificacion endpoint correctly returned criterios_gran_quemado: true with a single positive criterion and Baux Score of 76. The /evaluacion-inicial endpoint suppressed all inhalation and intubation flags in the absence of relevant findings. The /resucitacion-hidrica endpoint computed 2,100 ml total Parkland volume with no delay adjustment, yielding a first-phase infusion rate of 131 ml/hour. The /soporte-nutricional endpoint returned 2,150 kcal/day via Curreri formula with enteral route indicated. The /prevencion-infeccion and /manejo-dolor endpoints correctly suppressed systemic prophylaxis and escalated to non-opioid analgesia only. The /criterios-referencia endpoint returned elective transfer urgency with a single positive criterion, correctly distinguishing this case from the urgent transfer flag generated in the primary scenario. All seven endpoints produced outputs consistent with GPC rules under minimum-threshold conditions, confirming correct boundary behavior without clinically unsafe recommendations.

VI. DISCUSSION

A. Clinical and Operational Implications

The formalization of IMSS-375 as a JSON service addresses a recognized gap between evidence-based guideline production and point-of-care clinical use. By exposing CPG logic as discrete, callable endpoints, the architecture enables real-time guideline adherence support without requiring clinicians to consult the source PDF document. The Parkland resuscitation endpoint, for example, not only computes the correct fluid volumes but adjusts for the time elapsed since the accident — a nuance frequently missed in manual calculations [23], as demonstrated by the delay-adjusted output observed in the Section V invocation results. Similarly, the transfer criteria endpoint encodes all seven Mexico IMSS-375 indications for burn unit referral, including the specific UMAE facilities within the IMSS network, enabling geographically-aware routing recommendations.

The inclusion of evidence levels and GPC recommendation text in each service response preserves the epistemic traceability of recommendations—a requirement emphasized in clinical AI governance frameworks [22]. Clinicians and auditors can verify that a generated recommendation is grounded in a specific guideline section, supporting accountability in medico-legal contexts.

A forward-looking dimension of the proposed architecture is its potential integration with artificial intelligence layers that extend its decision support capabilities beyond rule-based recommendations. The service's document-oriented persistence tier accumulates structured clinical encounter records that can serve as training data for predictive models, enabling future endpoints to generate risk-stratified prognoses rather than solely applying static guideline rules. More immediately, a natural language processing layer could convert unstructured clinical inputs—nursing notes, dictated assessments, wound photographs interpreted via computer vision—into structured JSON fields compatible with the existing endpoints, lowering the documentation burden on clinicians at the point of care. Conversely, the structured JSON responses produced by the service could be transformed by a generative model into narrative clinical summaries suitable for inclusion in patient records or inter-facility transfer documentation. These extensions would close the loop between the decision support function stated in the title of this work and its practical materialization at the bedside, where clinicians require not only computable recommendations but also actionable, human-readable outputs integrated into their existing documentation workflows.

B. Limitations

CPG currency: The IMSS-375 guideline was last formally updated in 2017. While its core recommendations remain clinically valid, the service architecture must implement a systematic CPG monitoring process to detect and incorporate future revisions. The versioning mechanism (X-GPC-Version header) provides the technical infrastructure for this; however, an institutional governance process for guideline update propagation to the service is required and is outside the scope of this technical proposal.

Clinical Validation: The proposed service has been designed and specified but not yet prospectively validated in a clinical deployment. Pre-deployment validation should include: (1) structured expert review of the JSON rule mappings against the source GPC by clinical specialists; (2) scenario-based testing using retrospective patient cases; and (3) prospective pilot deployment with adherence and error tracking. These validation steps constitute planned future work. For the pilot phase, usability will be measured using the System Usability Scale (SUS) administered to emergency and burn unit clinicians following structured simulation sessions, complemented by task-completion time metrics in simulated triage scenarios. These validation steps constitute planned future work.

Scope Limitations: The current service covers the acute in-hospital management pathway. Rehabilitation, psychological support, outpatient wound care, and pediatric-specific adaptations—each addressed in complementary IMSS guidelines—are not formalized in the present version. A modular extension architecture is planned to incorporate these pathways without disrupting the core service contract.

Regulatory Considerations: Deployment of CDS services in Mexican public health institutions is subject to NOM-024-SSA3-2012 requirements and, for AI-assisted clinical tools, emerging guidelines from COFEPRIS. Formal regulatory classification of the service as a medical device software (SaMD) may be required prior to clinical deployment, depending on the autonomy level granted to its recommendations [24].

REST architectural constraints: The current implementation relies on a synchronous request-response model, which is the dominant web service paradigm but imposes inherent limitations in high-throughput scenarios involving simultaneous multi-patient emergency admissions. In such contexts, asynchronous messaging patterns or event-driven architectures may offer meaningful performance and resilience advantages over REST. These architectural alternatives, including the use of mobile agents in distributed networks, are addressed as future work in Section VIII.

VII. Conclusion

This paper presented a service-oriented architecture for the formalization of the IMSS Clinical Practice Guideline IMSS-375 as a versioned REST/JSON microservice for decision support in major burn management. Seven clinical decision endpoints were defined and specified, encoding the complete acute management pathway—from burn classification and primary survey to fluid resuscitation, nutritional support, and burn center transfer—within a structured, machine-readable schema aligned with HL7 FHIR R4 interoperability standards. A formal mapping between core GPC clinical rules (Parkland formula, Benaim scale, Curreri formula, Baux index, major burn criteria) and typed JSON fields was presented and compared against existing CPG formalization approaches.

The proposed architecture addresses a fundamental barrier to evidence-based practice in burn care: the inaccessibility of CPG knowledge to automated systems at the point of care. By making IMSS-375 computable, the service enables real-time, traceable, and version-controlled clinical recommendations deliverable to any HTTP-capable hospital information system or mobile clinical tool. Future work will focus on prospective clinical validation, integration of rehabilitation and pediatric pathways, and regulatory compliance assessment under the SaMD framework.

VIII. Future Work

Several research directions extend the proposed architecture toward greater technical sophistication and broader clinical applicability.

Mobile agent architectures: The current REST implementation follows a client-initiated synchronous model. A promising evolution is the adoption of mobile agent architectures in distributed networks, where autonomous software agents carry clinical decision logic to the data source rather than requiring data to be sent to a centralized service. This paradigm is particularly relevant for IMSS facilities with intermittent connectivity, where a mobile agent could execute locally against patient data and synchronize results when connectivity is restored. The microservice architecture described here provides a natural decomposition boundary for agent encapsulation.

Distributed database and federated analytics: The MongoDB replication model described in Section IV.D can be extended toward a federated analytics architecture, in which aggregated (de-identified) burn encounter data across all participating IMSS facilities is queryable for epidemiological analysis and guideline performance monitoring. This would provide, for the first time, a real-world evidence base for evaluating IMSS-375 adherence rates at a national scale.

AI integration for report generation and data conversion: A high-value extension of the proposed service is the integration of an AI layer — specifically a large language model or a domain-adapted neural network — capable of: (1) converting unstructured clinical text (nursing notes, dictated assessments) into structured JSON fields compatible with the service endpoints; (2) generating narrative clinical summaries from API response payloads for inclusion in patient records; and (3) cross-format data conversion between IMSS-375 JSON schemas and HL7 FHIR bundles, OpenEHR compositions, or CDA documents. This AI conversion layer would directly address the interoperability gap between the IMSS-375-specific schema and international standards.

Pediatric and Rehabilitation Pathways: The current service covers the adult acute management pathway. Complementary IMSS guidelines for pediatric burn management and burn rehabilitation constitute natural extensions, each mappable to additional endpoint groups within the same service architecture.

SaMD regulatory pathway: A structured regulatory assessment under the COFEPRIS SaMD framework and alignment with IEC 62304 software lifecycle requirements are planned to support eventual clinical deployment authorization.

Pilot Validation Protocol: A structured pilot deployment is planned in collaboration with an IMSS third-level facility. The protocol will include a simulation phase in which emergency clinicians interact with the service endpoints using standardized clinical vignettes representing major burn scenarios. Usability will be assessed via the System Usability Scale (SUS) [25] and the NASA Task Load Index (NASA-TLX) [26] to capture both perceived ease of use and cognitive load in time-critical emergency contexts. Clinical adherence will be measured by comparing endpoint-generated recommendations against the decisions documented in retrospective patient records. Ethical approval and institutional authorization from the IMSS Comisión Nacional de Investigación Científica (CNIC) constitute the first regulatory milestone of this validation pathway.

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