IST 654

ERD Data Modelling

(CLAIM PROCESSING SYSTEM)

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Meeting Venue: Hinds Hall – Room 216

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Context

In today's health care scenario, when a customer is hospitalized or visits a doctor to get treatment, he/she submits a claim with the health provider company. The company then checks if the customer is insured with the company. The company then goes on to check the coverage that the employee is under. Ex: Some treatments like dental treatments are not covered. After checking the coverage, companies check for how the coverage may apply i.e. did you go in network or out network? This is then followed by checking and matching the ICDM-9 () diagnosis code currently ICDM-9 to the CPT (current procedural terminology). Each of these assign numbers to diagnoses and medical procedures.

If the claim has broken toe proximal phalanx great toe code as the diagnosis and the procedure is open reduction internal fixation of the humerus as the procedure the claim will be refused. You simply can't treat a broken toe by operating on the arm. So the diagnosis must match the treatment.

The claim that the patient submitted is verified by the claim processing system and if successful the amount is deducted since the patient's employer had registered the patient while availing the self insured health plan.

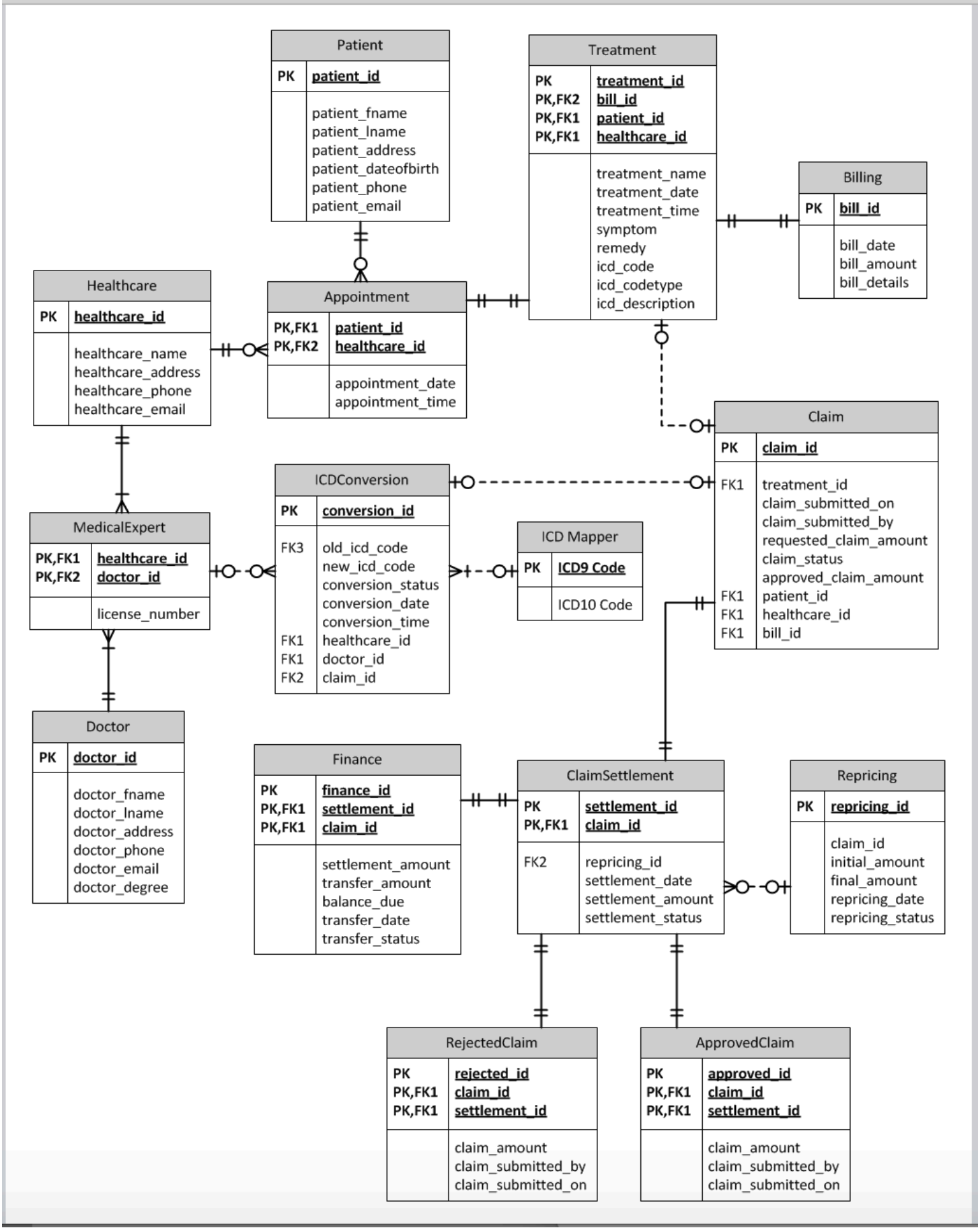
The steps involved in the claim process can be summarized as follows:

1. The insured individual seeks medical attention from a healthcare provider including affiliated hospitals or nursing home etc.
2. The hospital submits charges to the insurer using a health insurance claim form.
3. Claim forms are sent electronically using a series of codes. The charges are received by the insurance company with each claim having a dedicated date and code to ensure timely payment.
4. The health insurance company reviews the charges to make sure they follow their policy guidelines.
5. Once the claim is verified, the selected claims are paid and notified to the customer.

The various services offered by the claim processing system include-

- Verification of claims submitted
- Claim code identification
- Claim code conversion
- Processing of claims
- Sending alerts to individuals about the claim status
- Tracking claim status
- Claim report generation

Entity Relationship Diagram:



ERD Description:

Sr No.	Table	Field	Attribute	Data Dictionary	Keys	Null Type
1	PATIENT			List of Patients who come for treatment		
		patient_id	INT(12)	Patient Identification Number	Primary Key	Not Null
		patient_fname	VARCHAR	Name of the patient		
		patient_lname	VARCHAR	Last name of the patient		
		patient_dateofbirth	INT(5)	Date of birth of the patient		
		patient_address	VARCHAR	Address of the patient		
		patient_phone	VARCHAR	Phone Number of the patient		
		patient_email	VARCHAR	Email address of the patient		
2	HEALTHCARE			List of hospitals, clinics and physicians where patients come for treatment		
		healthcare_id	INT(12)	Healthcare Identification Number	Primary Key	Not Null
		healthcare_name	VARCHAR	Name of the healthcare unit		
		healthcare_address	VARCHAR	Address of the healthcare unit		
		healthcare_email	VARCHAR	Email Address of the healthcare unit		
		healthcare_phone	VARCHAR	Phone Number of the healthcare unit		
3	DOCTOR			Doctor who treats the patient		
		doctor_id	INT(12)	Doctor Identification Number	Primary Key	Not Null
		doctor_fname	VARCHAR	First Name of the Doctor		
		doctor_lname	VARCHAR	Last Name of the Doctor		
		doctor_description	VARCHAR	Description of the Doctor(Degree)		
		doctor_address	VARCHAR	Address of the Doctor		
		doctor_phone	VARCHAR	Phone Number of the Doctor		
		doctor_email	VARCHAR	Email Address of the Doctor		
4	APPOINTMENT			Appointment given to the customer		
		healthcare_id	INT(12)	Healthcare Identification Number	Primary Key, Foreign Key	Not Null
		patient_id	INT(12)	Patient Identification Number	Primary Key, Foreign Key	Not Null
		appointment_date	DATETIME	Date of the Appointment		
		appointment_time	DATETIME	Time of the appointment		

Sr No.	Table	Field	Attribute	Data Dictionary	Keys	Null Type
5	TREATMENT			Treatment provided to patient		
		treatment_id	INT(12)	Treatment Identification Number	Primary Key	Not Null
		bill_id	INT(12)	Billing Identification Number	Primary Key, Foreign Key	Not Null
		patient_id	INT(12)	Patient Identification Number	Primary Key, Foreign Key	Not Null
		healthcare_id	INT(12)	Healthcare Identification Number	Primary Key, Foreign Key	Not Null
		treatment_name	VARCHAR	Name of the treatment		
		treatment_date	DATETIME	Date of treatment		
		treatment_time	DATETIME	Time of treatment		
		symptom	VARCHAR	Symptoms of patient		
		remedy	VARCHAR	Remedy provided to patient		
		icd_code	VARCHAR	ICD code of treatment		
		icd_codetype	VARCHAR	ICD code type of treatment		
		icd_description	VARCHAR	ICD code description		
6	BILLING			Billing details of treatment		
		bill_id	INT(12)	Billing Identification Number	Primary Key	Not Null
		bill_date	DATETIME	Date of bill		
		bill_amount	VARCHAR	Amount of Bill		
		bill_details	VARCHAR	Details of Bill		
7	ICD CONVERSION			Details of the ICD Code Conversion		
		conversion_id	INT(12)	Conversion Identification Number	Primary Key, Foreign Key	Not Null
		old_icd_code	VARCHAR	Old ICD 9 Code	Foreign Key	Not Null
		new_icd_code	VARCHAR	New ICD 10 Code		
		conversion_status	VARCHAR	Status of conversion		
		conversion_date	DATETIME	Date of conversion		
		conversion_time	DATETIME	Time of conversion		
		healthcare_id	INT(12)	Healthcare Identification Number	Foreign Key	Not Null
		doctor_id	INT(12)	Doctor Identification Number	Foreign Key	Not Null
		claim_id	INT(12)	Claim Identification Number	Foreign Key	Not Null
8	MEDICAL EXPERT			Details of medical expert		
		healthcare_id	INT(12)	Healthcare Identification Number	Primary Key, Foreign Key	Not Null
		doctor_id	INT(12)	Doctor Identification Number	Primary Key, Foreign Key	Not Null
		license_number	VARCHAR	License number of practicioner		

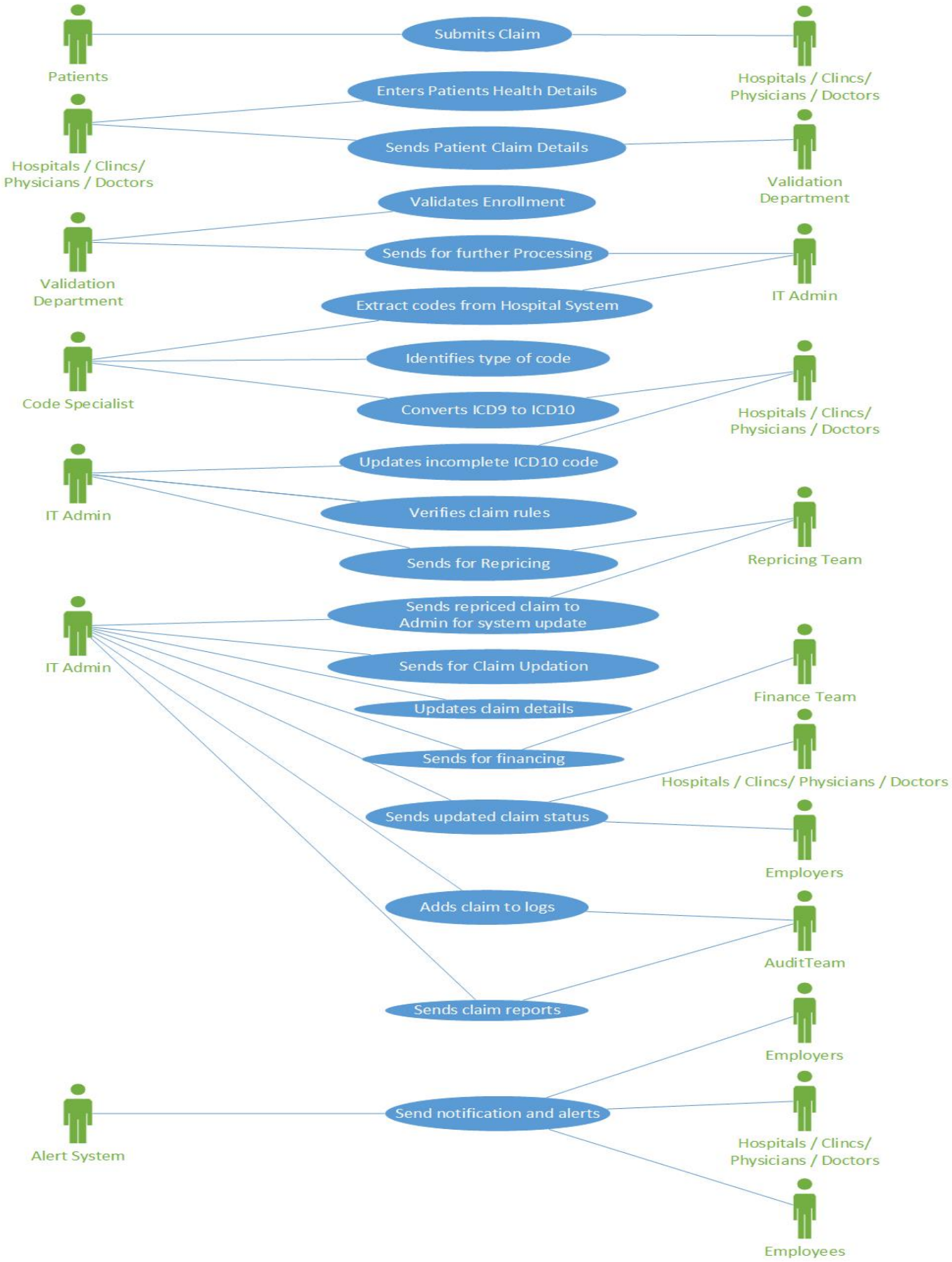
Sr No.	Table	Field	Attribute	Data Dictionary	Keys	Null Type
9	CLAIM			Details of claims submitted		
		claim_id	INT(12)	Claim Identification Number	Primary Key, Foreign Key	Not Null
		treatment_id	INT(12)	Treatment Identification Number	Foreign Key	Not Null
		patient_id	INT(12)	Patient Identification Number	Foreign Key	Not Null
		bill_id	INT(12)	Bill Identification Number	Foreign Key	Not Null
		healthcare_id	INT(12)	Healthcare_Identification_Number	Foreign Key	Not Null
		claim_submitted_on	DATETIME	Claim Submitted on		
		claim_submitted_by	VARCHAR	Claim Submitted by		
		requested_claim_amount	VARCHAR	Requested claim amount		
		claim_status	VARCHAR	Status of claim processing		
		approved_claim_amount	VARCHAR	Approved claim amount		
10	CLAIM SETTLEMENT					
		settlement_id	INT(12)	Settlement Identification Number	Primary Key	Not Null
		claim_id	INT(12)	Claim Identification Number	Primary Key, Foreign Key	Not Null
		repricing_id	INT(12)	Repricing Identification Number	Foreign Key	Not Null
		settlement_date	DATETIME	Date of settlement		
		settlement_amount	VARCHAR	Amount of settlement		
		settlement_status	VARCHAR	Settlement Status		
11	REPRICING					
		repricing_id	INT(12)	Repricing Identification Number	Primary Key	Not Null
		claim_id	INT(12)	Claim Identification Number		
		initial_amount	VARCHAR	Initial Amount beofre repricing		
		final_amount	VARCHAR	Final Amount after repricing		
		repricing_date	DATETIME	Date of repricing		
		repricing_status	VARCHAR	Status of repricing		
12	FINANCE					
		finance_id	INT(12)	Finance dept Identification Number	Primary Key	Not Null
		settlement_id	INT(12)	Settlement Identification Number	Primary Key, Foreign Key	Not Null
		claim_id	INT(12)	Claim Identification Number	Primary Key, Foreign Key	Not Null
		settlement_amount	DATETIME	Amount of settlement		
		transfer_amount	VARCHAR	Amount of moner transferred		
		balance_due	VARCHAR	Balance due after settlement		
		transfer_date	DATETIME	Date of transfer		
		transfer_status	VARCHAR	Status of transfer process		

Sr No.	Table	Field	Attribute	Data Dictionary	Keys	Null Type
13	REJECTED CLAIM					
		rejected_id	INT(12)	Rejected Claims Identification Number	Primary Key	Not Null
		claim_id	INT(12)	Claim Identification Number	Primary Key, Foreign Key	Not Null
		settlement_id	VARCHAR	Settlement Identification Number	Primary Key, Foreign Key	Not Null
		claim_amount	VARCHAR	Final Claim Amount after repricing		
		claim_submitted_by	DATETIME	Claim Submitted by		
		claim_submitted_on	VARCHAR	Claim suubmitted on		
14	APPROVED CLAIM					
		approved_id	INT(12)	Accepted Claims Identification Number	Primary Key	Not Null
		claim_id	INT(12)	Claim Identification Number	Primary Key, Foreign Key	Not Null
		settlement_id	VARCHAR	Settlement Identification Number	Primary Key, Foreign Key	Not Null
		claim_amount	VARCHAR	Final Claim Amount after repricing		
		claim_submitted_by	DATETIME	Claim Submitted by		
		claim_submitted_on	VARCHAR	Claim suubmitted on		
14	ICD Mapper					
		icd9_code	INT(12)	ICD 9 code	Primary Key	Not Null
		Icd10_code	INT(12)	ICD 10 code		

BUSINESS RULES:

1. Every appointment is associated with only one treatment
2. Each appointment is valid for only one patient
3. The repricing team, updates the repricing table and the claim processing system uses only those columns that are specifically required.
4. The medical experts have access to the ICD conversion table and update claims that were not properly converted to ICD10.
5. A patient can submit individual claims for individual treatments, but every treatment can have only one claim id associated with it.
6. The hospitals, pharmacy, clinics have access to the treatment table and can update data during verification of new ICD converted code.

USE CASE DIAGRAM



FUNCTIONALITY AND USAGE OF ERD:

USE CASE	USE CASE DESCRIPTION	ENTITY DESCRIPTION	ENTITIES INVOLVED
1. Submits Claim	The patient (employee) undergoes medical treatment at the hospital/ clinic/ physician/ doctor. He submits his claim at any date after the treatment is complete.	Claims submitted by patients are saved in the Claim table with patient and claim details stamped.	- Claims
2. Enter Patient Health Details	The hospital/ clinic/ physician/ doctor enters the health information of the patient. This includes filing details such as symptoms, location of injury, medication provided, date of treatment and other such details.	The patient details are saved in the patient table and the health details are saved in the treatment table. The hospital/clinic/physician details are saved in the healthcare table	- Patient - Treatment - Doctor - Healthcare
3. Send Patient Claim	The hospital/ clinic/ physician/ doctor send the claim submitted by the patient for further processing of the claim.	The patient treatment and billing details are saved in the treatment and billing tables. These details are linked to the claim table once a claim is submitted by the patient.	- Billing - Treatment - Claim
4. Collect all claims	All the claims that have been submitted on a daily basis are tracked and stored in the claim processing system database for further validation.	All the claims are collected on a daily basis and the claim table is updated with all individual claims.	- Claim
5. Validate Enrollment	The validation department verifies the details of the user that had submitted the claim. It checks if the patient has an active insured plan that has been covered by the employer. It also checks whether all the claim details have been filled correctly and checks for any incorrect fields/ details entered in the claims form.	The validation department uses the patient table and registration table which is their database to verify the patient details. The validation department also checks the claim form and updates the claim table accordingly.	- Claim - Patient
6. Send to Claim Processing	Post verification, the validation department sends the claim for further processing to the IT admin of the Claim Processing department.	Here the data saved in the claims table is queried according to date and processing status and sent for processing.	- Claim
7. Extract codes from Hospital System	The claim processing system has a code specialist that will extract the data from the hospital/ Clinic/ Physician/ Doctor system.	The code specialist extracts data from the healthcare, treatment and claims table to perform this step.	- Healthcare - Treatment - Claim
8. Identify type of code	The code specialist receives the ICD codes sent by the hospital/ Clinic/ Physician/ Doctor and identifies it type.	Here the code specialist uses the icd_codetype present in the treatment table by searching the claim number from claim table.	- Treatment - Claim
9. Convert ICD9 to ICD10	The code specialist, uploads a general equivalence mapping file using which he converts the received ICD9 codes to ICD10 codes.	The code specialist updates the ICD Conversion table after conversion. It contains old and new ICD codes.	- ICD Conversion

FUNCTIONALITY AND USAGE OF ERD (Cont.)

USE CASE	USE CASE DESCRIPTION	ENTITY DESCRIPTION	ENTITIES INVOLVED
10. Update incomplete ICD10code	Some iCD9 codes do not have direct mapping to ICD10 codes. In such scenarios the hospital/ Clinic/ Physician/ Doctor need to manually update the ICD9 code to ICD 10.	After conversion to ICD10 code, the ICDConversion table is updated. The data is verified and update by medical experts whose data is stored in medical expert table.	- ICD Conversion - Medical Expert
11. Verify claim rules	The updated ICD10 code is then sent for further processing. Here the claim rules are applied by the IT Admin, to check for other discrepancies like incorrect symptom and treatment mapping, duplicate claim, invalid date and amount etc.	The claim rules are applied to the claim. The data is fetched from the claim, treatment and ICDConversion table here.	- ICD Conversion - Claim - Treatment
12. Send for repricing	Post verification of the accuracy of the claim, the claim is forwarded by the IT Admin to the repricing team for readjusting the prices.	The required data from the claim, billing, ICDConversion and treatment table is sent to the repricing team.	- ICD Conversion - Billing - Claim - Treatment
13. Update claim details	The repricing team adjust the amount and reprices the claim. Post repricing, the claim details are updated by the IT Admin in the database.	The reprising team performs the price adjusting and send the updated data back. The required data from the response is stored in the Repricing table and Claim Settlement table is also updated.	- Repricing - Claim Settlement
14. Send for financing	After approval and updation of the claim amount, the accepted claim is forwarded to the financing team for cheques to be drawn.	The settled claim details are sent to the claim finance system. The cheques are drawn and amounts are transferred using the Finance table.	- Claim Settlement - Finance
15. Send updated claim	The updated claim status 'Approved' or 'Rejected' is then sent to hospital/ Clinic/ Physician/ Doctor, Employers and Employees/ Patient	The claim status is updated post processing and the details are stored and fetched from the Claim Settlement table.	- Claim Settlement
16. Add claim to logs	The IT Admin, sends the claim details and saves it in a database in two separate tables- approved claim and rejected claim.	The processed claims are sorted as Approved or Rejected and the claim details are saved in the ApprovedClaim and RejectedClaim tables respectively.	- Approved Claim - Rejected Claim
17. Send claim report	The IT Admin, generates periodic reports on the claim status and details which help other organization in statistical analysis.	Claim reports are generated using the Claim, Approved/Rejected and ClaimSettlement tables.	- ICD Conversion
18. Send notification and alerts	The claim alert system, generates notification and alerts and sends it to Employers, hospital/ Clinic/ Physician/ Doctor and Employees	Notifications are generated using the Claim, ApprovedClaim / RejectedClaim and ClaimSettlement tables.	- ICD Conversion

Conclusion

The system deals with more precise codes providing potential benefits like fewer rejected claims, improved benchmarking data, improved quality and care management, and improved public health reporting. ICD-10 will advance healthcare in many ways, with benefits accruing across five major categories.

1. **Quality Measurement:** ICD-10-CM and -PCS offer greater detail and increased ability to accommodate new technologies and procedures. The codes have the potential to provide better data for evaluating and improving the quality of patient care. For example, data captured by the code sets could be used in more meaningful ways to better understand complications, design clinically robust algorithms, and track care outcomes.

2. **Public Health:** ICD-10-CM is more effective at capturing public health diseases than ICD-9-CM. It is more specific and fully captures more of the nationally reportable public health diseases, diseases related to the top ten causes of mortality, and diseases related to terrorism

3. **Research:** External cause of injury codes are also much more detailed in ICD-10-CM than in ICD-9-CM. This coding provides a framework for systematically collecting population-based information needed to fully describe and document how and where injuries occur. The codes are important for injury surveillance and for designing, implementing, and monitoring injury prevention and control programs.

4. **Organizational Monitoring and Performance:** ICD-10's increased specificity offers payers and providers the potential for considerable cost savings through more accurate trend and cost analysis. Greater detail can improve payers' abilities to forecast healthcare needs and trend and analyze costs. It will improve payers' and providers' ability to monitor service and resource utilization, analyze healthcare costs, monitor outcomes, and measure performance.

5. **Reimbursement:** The increased specificity of the codes will make it easier to compare reported codes with clinical documentation, check for consistency between diagnosis and procedure codes, and check for illogical combinations of diagnoses. The use of ICD-10-CM and -PCS thus may also help reduce opportunities for fraud and improve fraud detection capabilities. Fewer gray areas in coding will make it more difficult for dishonest providers to hide behind ambiguities in code descriptions or rules.

Thus, the ICD-10 compliant Claim Processing System – Entity Relationship Diagram that is designed is highly beneficial as it helps to understand the data storage, data flow among different entities and helps in covering all aspects of the system design.