CS 340 Project Step III Draft for My Kidney Nutrition Tracker Application

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URL: **http://flip1.engr.oregonstate.edu:61257/index.html**

Fixes Based on Feedback from Step 1:

Our feedback from our course grader was that we could potentially add a Doctors entity instead of the Dialysis_Forms entity table. We felt that the form of dialysis was important because of its impact on lab results based on whether the patient is on hemodialysis or peritoneal dialysis as there are different forms of dialysis to consider. The focus in this application is the dialysis patients so we kept the Dialysis_Forms entity but we added kidney_doctor information as an attribute within the entity table as we felt that this comment had value for the patients to help keep track of their kidney doctor. Other recent changes we made can be viewed in the Summary of Changes – Upgrades to the Step I Final Version section. Listed below is the feedback we received from the peer reviewers, and what changes we made from their feedback. We also provided below changes we made as well that we decided upon as a group.

First Peer Reviewer:Cassandra Hedrick:

First I just wanted to say that this is an amazing idea that really seems to not only have a real world application but could really help people.

- Does the overview describe what problem is to be solved by a website with DB back end?
    - Yes this overview laid out exactly what the current problem is and how it is affecting a large group of people. Lack of access to kidney disease nutrition and overabundance of misinformation thus causing life threatening impacts to thousands of people.
- Does the overview list specific facts?
    - Yes the overview specifically talks about the 37 million people that are affected by kidney disease and that there are approximately 165,000 applications that seem to be helpful for the restrictive diet that is necessary with the disease but most if not all are not helpful for patients.
- Are at least four entities described and does each one represent a single idea to be stored as a list?
    - Yes there are Patients, Food, Lab_results, Dialsis_forms and more.
- Does the outline of entity details describe the purpose of each, list attribute data types and constraints and describe relationships between entities? Does the outline clearly indicate which entities (tables) will be implemented and which team member is primarily assigned to the associated page(s)?

    - Yes, such as the Food section has a M:M for as it is explained there will be many foods listed and it will correspond to many patients.
    - I didn't see anything listed on specific tasks for each team member.
- Are 1:M relationships correctly formulated? Is there at least one M:M relationship? Does the ERD present a logical view of the database?
    - Yes the 1:M looks to be properly formulated.
    - The M:M is for Food and Patient relationship
    - The ERD does look like a logical view from my understanding of the project.
- Is there consistency in a) naming between overview and entity/attributes b) entities plural, attributes singular c) use of capitalization for naming?
    - Yes. For example Food is labeled differently than food_id which makes a clear indication with capitalization and the naming between the attributes that they are different. I did not see anything in plural that would give concern on naming.

I think this is a great start to the project. Thank you for sharing it.

Second Peer Reviewer: Clifford Bielinski:

Good job to both of you. Really interesting topic and well thought out project.

- Does the overview describe what problem is to be solved by a website with DB back end?

You do a great job in showing both the scope of the problem at large (kidney disease) and the specific niche that your product is aiming to address among all the health-based apps out there. Perhaps include some metrics on anticipated number of patients that will be using the app when you first roll out.

- Does the overview list specific facts?

Yes - they do a good job describing the purpose of the application and why the entities they're tracking (lab values, dialysis regimen, food content) are important as it relates to kidney disease.

- Are at least four entities described and does each one represent a single idea to be stored as a list?

There are four entities plus an intersection table. Each one clearly represents a unique concept.

- Does the outline of entity details describe the purpose of each, list attribute data types and constraints and describe relationships between entities? Does the

outline clearly indicate which entities (tables) will be implemented and which team member is primarily assigned to the associated page(s)?

I think this is one of the strongest parts in the project outline. The entity descriptions are really great and I have a good sense of what each Entity is about and how it relates to the others. Every attribute has a data type and constraints where appropriate. One thing I question is having separate attributes for values and units of measurement. Perhaps it's stored as a consistent unit of measurement (e.g. Na as mmol/L) and then patients can input it in a variety of predefined units of measurements at the application level and it's just converted and stored at the database level using consistent notation. Probably would make it easier to analyze the data.

- Are 1:M relationships correctly formulated? Is there at least one M:M relationship?

Yes they have both 1:M and M:M relationships that are properly formulated. They also include an intersection table for the M:M relationship between Foods and Patients. The 1:M seems correct: patients have one form of dialysis at a time and each patient has many lab results.

- Is there consistency in a) naming between overview and entity/attributes b) entities plural, attributes singular c) use of capitalization for naming?

The naming is both consistent and clear. Entities are plural and capitalized. Attributes are lower case and singular with underscores separating words. The attribute names are informative but not overly verbose.

Overall, a really great job!

Third Peer Reviewer: Mark Mendez:

Cool project, guys! I've actually been the person helping a dialysis patient in my family keep track of their diet, so I know the problem this solves. In fact, if you have a feature roadmap that extends beyond this class, I suggest you consider supporting other diet restrictions, such as prohibited foods for transplant patients on immunosuppressants, as a later feature.

- Does the overview describe what problem is to be solved by a website with DB back end?

Yes. The website will help dialysis patients track their diet, which is a difficult task.

- Does the overview list specific facts?

Yes. The overview numbers the potential users as well as some market-related quantities.

- Are at least four entities described and does each one represent a single idea to be stored as a list?

Yes. Patients, Food, Lab_Results, Dialysis_Forms, and Patient_Food each represent a single idea that makes sense as a list.

- Does the outline of entity details describe the purpose of each, list attribute data types and constraints, and describe relationships between entities? Does the outline clearly indicate which entities (tables) will be implemented and which team member is primarily assigned to the associated page(s)?

Yes. The descriptions are especially helpful, because they introduce readers to the concepts used in the table which are not common knowledge. As many have noticed, the assignment page did not prompt to note likelihood of implementation or triage details.

- Are 1:M relationships correctly formulated? Is there at least one M:M relationship?

Yes. 1:M and M:M relationships reflect their intended purpose. I found a minor detail that could be adjusted for consistency between the ERD and word outline. Patients do have a M:M relationship with Food, but this relationship is implemented with food_id and patient_id as foreign keys inside Patients_Food.

- Is there consistency in a) naming between overview and entity/attributes b) entities plural, attributes singular c) use of capitalization for naming?

The Patients_Food table has attributes food_id and patient_id, which I expected to be prefixed as Food_food_id and Patients_patient_id to match the convention used for other attributes. Otherwise, everything is consistent.

Fourth Peer Reviewer: Joshua Nees:
Interesting project, Deanna and Charles! You guys have done a great job showing the need for building the data and how it might be used to improve patient outcomes.

Here are my notes:

Does the overview describe what problem is to be solved by a website with DB back end?

The description gives a great overview of why the database is needed and who it will serve.

Does the overview list specific facts?

Yes, specific facts are listed which give a good indication of the scale of the inputs expected. It may be worth adding additional info about how frequently a patient expects lab results.

Are at least four entities described and does each one represent a single idea to be stored as a list?

Yes.

Does the outline of entity details describe the purpose of each, list attribute data types and constraints, and describe relationships between entities?

Yes.

Does the outline clearly indicate which entities (tables) will be implemented and which team member is primarily assigned to the associated page(s)?

The entities are clearly indicated. No information about team member assignments is given.

Are 1:M relationships correctly formulated? Is there at least one M:M relationship?

Yes, the relationships look correct and there is an M:M relationship between Patients and Food

Is there consistency in a) naming between overview and entity/attributes b) entities plural, attributes singular c) use of capitalization for naming?

Yes, the naming appears consistent.

Feedback Received by Peer Reviewers- Summarized

We had four peer reviewers for our project. The general consensus was that we did a great job showing the scope of the problem at large and the specific area/niche that our application/database would address. We were missing metrics on anticipated number of patients when rolling out the application. The feedback, from our reviewers, also said we did a great job with presenting our entities within the overview. We also did well with conveying the different relationships between the attributes and constraints.

Our strongest part according to our reviewers was our attention to detail within our project outline when it comes to entity/attribute descriptions. We have clear 1:M and M:N relationships that are required for this project. We did not have an area for team assignments within the project. There were some minor details that should be adjusted to help maintain consistency between the entity relationship diagram and the written outline; which is that patients do have a M:N relationship with food but this relationship

is implemented with food_id and patient_id as foreign keys inside Patients_Food. The Patients_Food table has attributes food_id and patient_id which should be prefixed as Foods_food_id and Patients_patient_id to match the convention used for other attributes.

Summary of Changes – Actions Based on Peer Review Feedback

We decided to further expand on metrics for the anticipated number of patients we would target when rolling out the application. This is presented more in depth within our overview portion. We provided more references to support these anticipated numbers. We decided to fix the inconsistencies that were identified above with first fixing that patients do have a M:N relationship with food but this relationship is implemented with food_id and patient_id as foreign keys inside Patients_Food. The Patients_Food table has attributes food_id and patient_id which we decided to prefix as Foods_food_id and Patients_patient_id to match the convention used for other attributes. In our project overview section, we also expanded on our long term goals for the project to capture feedback concerning prohibited foods for transplant patients.

We decided against actioning two pieces of feedback. First, we received feedback from several reviewers noting that we did not assign specific parts of the database implementation to team members. Although the question prompt addressed assigning specific sections to team members, this was not part of the rubric. We decided against adding this in order to encourage collaborative implementation of the entire database. Secondly, one suggestion was to remove the unit attributes from both the Foods and Lab_Results table, and to mandate a standard unit. We acknowledge that standard units will help for data analysis; however, we want to give our database flexibility to work with existing lab architecture, and so for the time being we want to include units as an attribute for phosphorus, potassium, and sodium. Additionally, we have the unit specified for each mineral as “NOT NULL”, which will help mitigate confusion about units used. We added in the table description recommended units.

Summary of Changes – Upgrades to the Draft Version Step I

Our team collaboratively decided to implement some of the feedback provided above to this final step I version from our peer reviewers that were discussed within our Actions Based on Feedback section. Overall, we decided to act on the feedback that we felt was the most conducive/helpful to improve our draft except for the two areas noted in the previous section: team member assignments and the unit review suggestion. The reasons we did not include them can be reviewed within the previous section as well.

Changes we made on our own included we reviewed and fixed more grammatical errors/phrasing of paragraphs/outlines within our draft. We added more

references to support how many potential patients this application/database would target. We reworded the first paragraph in the overview section. We found even more statistics to support our database/application.

Based on instructor feedback during office hours, we also eliminated a 1:M relationship between Dialysis_Forms and Patients, as this relationship was redundant with the 1:M relationship between Patients and Lab_Results,

We reviewed further our entities, attributes and constraints to make sure we were maintaining consistency. We fixed our intersection table based on information that we learned within this week's module. To ensure we maintained naming consistency, we changed the names of all attributes tracking units to their singular form. Also for naming consistency, we renamed our "Food" table to "Foods." We also double checked that all of our changes to the written outline matched the diagram. Additionally, we included each required section for this project and to make sure they were in the correct order. We also worked on normalizing our database to the Third normal form (3NF). We researched normalization and used normalizing principles to reduce the duplication of data, avoid data anomalies, and to ensure referential integrity which is found in a schema that follows the Third normal form such as our database because each of our tables uses a single primary key and each of our attributes uniquely depends on the given row instance, our database meets the requirements for the 3NF. However, we learned we needed to address this further which is listed below.

Summary of Changes – Upgrades to the Step I Final Version

First, we identified that we needed to include both an ER diagram and a schema to convey both detailed and generalized models for our database. We achieved this by re-creating our ER diagram with a simplified model, focusing only on relationships between entities, primary, and foreign keys. We then updated our schema based on normalization principles learned in the "Module 5: Normalization Steps" exploration.

We learned from this module that our database was not normalized as we thought from online research we conducted previously so we eliminated further redundant data such as units for each lab value and food nutrient units. We decided to utilize the Conventional Unit system for laboratory values which is adapting the standardized units used within the United States for these lab values: sodium mEq/L, potassium mEq/L, and phosphorus mg/dL.[1] Since they are based on the Conventional Unit system there is no need to explicitly label each of them in the database on the Lab_Results table. For food measurements we used the Metric system's standardized units, for example, potassium/phosphorus/sodium nutrient content would be in milligrams (mg), and calories would be in kcals within the Foods table. Food

[1] *Conventional units – International Units*. GlobalRPH. (n.d.). Retrieved April 26, 2022, from https://globalrph.com/medical/conventional-units-international-units/

portions/amounts would be reported in grams on the Foods table.[2] We are using Customary units for weight and height in the Patients table which reports weight as pounds and height in inches.[3] We decided since we are using the typical standards that are reported within the dialysis community and in the United States that we decided to leave that information out of the database we designed.

More details can be seen in the ER diagram, schema, and database outline sections.

Project Outline and Database Outline - Updated Version:

Overview

Kidney disease impacts around 37 million people within the United States and is one of the leading causes of death. Health insurances pay an estimated $87.2 billion to treat chronic kidney disease and around $37.3 billion to treat those who have end-stage renal disease.[1] Around 81% of kidney disease patients own a cell phone that has the ability to connect to mobile applications.[2] More generations are tech savvy and becoming more reliant on telehealth/web development technologies. There are 786,000 patients with end-stage renal disease with appropriately 550,000 on dialysis within the United States.[3] We would anticipate that our application would start off with a goal of reaching 100,000 patients but a long-term goal of reaching the 81% of dialysis population with mobile phones that have application access.

The diet for individuals who have kidney disease is one of the most complicated diets to follow which include potentially restricting phosphorus, sodium, and potassium. There are currently more than 165,000 health-related and diet applications where only one-third of these actually focus on chronic diseases. Most of the current kidney-related applications information that is provided are not accurate or evidence-based. Many of them such as Kidney APPetite, Kidney Diet and Pocket Dietitian have been discontinued with newer operating systems.[4]

Our database driven website will provide a niche that is not currently being represented in today's market for dialysis. Especially bringing in renal dietitian skills paired with development; there is currently nothing that exists with this experience mixture but needs to in order to provide accurate and evidence-based information to

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2 *Your guide to the New Food Label*. National Kidney Foundation. (2022, January 13). Retrieved April 26, 2022, from https://www.kidney.org/atoz/content/foodlabel

3 *What are customary units? - definition, facts and examples*. What are Customary Units? - Definition, Facts and Examples. (n.d.). Retrieved April 27, 2022, from https://www.splashlearn.com/math-vocabulary/measurements/customary-units

those that struggle with their diet and require this information to be accessible to them. In this database, we will provide our Patient (on dialysis) with a tracking system for their Foods consumed which will allow the Patient to track specific nutritional content that is renal-focused to help them achieve their health goals/Lab Results that are within metric benchmarks. These Lab Results are influenced by what Foods the Patient decides to consume and impacted by the Dialysis Form they are on as well. This database will provide the Patient with the resources ultimately to achieve better outcomes while tracking certain attributes that influence their abilities to achieve these goals.

Outside the scope of this project, we would look at including additional details, such as prohibited foods for transplant patients, or a limited record of what drugs patients may be taking. We also see this database as forming a structure that could be replicated to address other dietary-related health disorders.

Database Outline

Entities & Attributes:

Patients: Records the details of the patients. Focusing on patients with end-stage renal disease that are on dialysis.

- patient_id: INT (11), auto_increment, unique, not NULL, PK
- last_name: VARCHAR(128), not NULL
- first_name: INT(128), not NULL
- age: INT (11), not NULL
- gender: VARCHAR(20), default NULL
- height: INT(11), not NULL
- weight: INT(11), not NULL
- Using customary units for height and weight assumed to be reported as weight in pounds and height in inches.
- relationship: M:N relationship with Foods implemented with Patients_patient_id and Foods_food_id as a FK inside of Patients_Foods. Along with a timestamp of patient_food_time DATETIME().
- relationship: 1:M relationship with Lab_Results implemented with Patients_patient_id as a FK inside of Lab_Results.

Foods: records the foods the patients consume focusing on minerals/calories that need to be watched in the renal diet. These main minerals include phosphorus, potassium, and sodium. Along with focusing on calories consumed too. Recommended units for potassium, sodium, and phosphorus are mg, and the recommended unit for calories is kcals.

- food_id: INT (10), auto_increment, unique, not NULL, PK

- food_name: VARCHAR(128), not NULL
- phosphorus_content: INT(11), default NULL
- sodium_content: INT(11), default NULL
- calories: INT(11), default NULL
- potassium_content: INT(11), default NULL
- amount: INT(11), default NULL
- Using Metric system's standardized units: potassium/phosphorus/sodium nutrient content would be in mg, and calories would be in kcals. Food portions/amounts would be reported in grams.
- relationship: M:N relationship with Patients implemented with Foods_food_id and Patients_patient_id as a FK inside of Patients_Foods. Along with a timestamp of patient_food_time DATETIME().

Lab_Results: records the lab results of the kidney patients that are nutritionally relevant such as phosphorus, potassium and sodium levels. It is also important to monitor adequacy or also known as Kt/v which is a metric that shows how well the patient is dialyzing which is heavily influenced by the type of dialysis they are on since different forms of dialysis have different adequacy metrics to meet. Recommended units for phosphorus is mg/dL, and for sodium and potassium is mEq/L.

- lab_id: INT(11), auto_increment, unique, not NULL, PK
- phosphorus_lab: FLOAT
- potassium_lab: FLOAT, default NULL
- sodium_lab: INT(11), default NULL
- dialysis_adequacy_lab: FLOAT, default NULL
- lab_results_time: DATETIME(), default NULL
- Utilizes the Conventional Unit system for laboratory values which is adapting the standardized units used within the United States for these lab values: sodium mEq/L, potassium mEq/L, and phosphorus mg/dL.
- relationship: M:1 relationship with Patients implemented with Patients_patient_id as a FK inside of Lab_Results.
- relationship: M:1 relationship with Dialysis_Forms implemented with Dialysis_Forms_dialysis_id as a FK inside of Lab Results.

Dialysis_Forms: records the type of dialysis the kidney patient is on; common types of dialysis include in-center, home-hemo, and peritoneal dialysis. The form of dialysis can affect the desired lab results, and different forms of dialysis have different desired adequacy metrics.

- dialysis_id: INT(10), auto_increment, unique, not NULL, PK
- name: VARCHAR(128), not NULL
- location_type: VARCHAR(128), not NULL

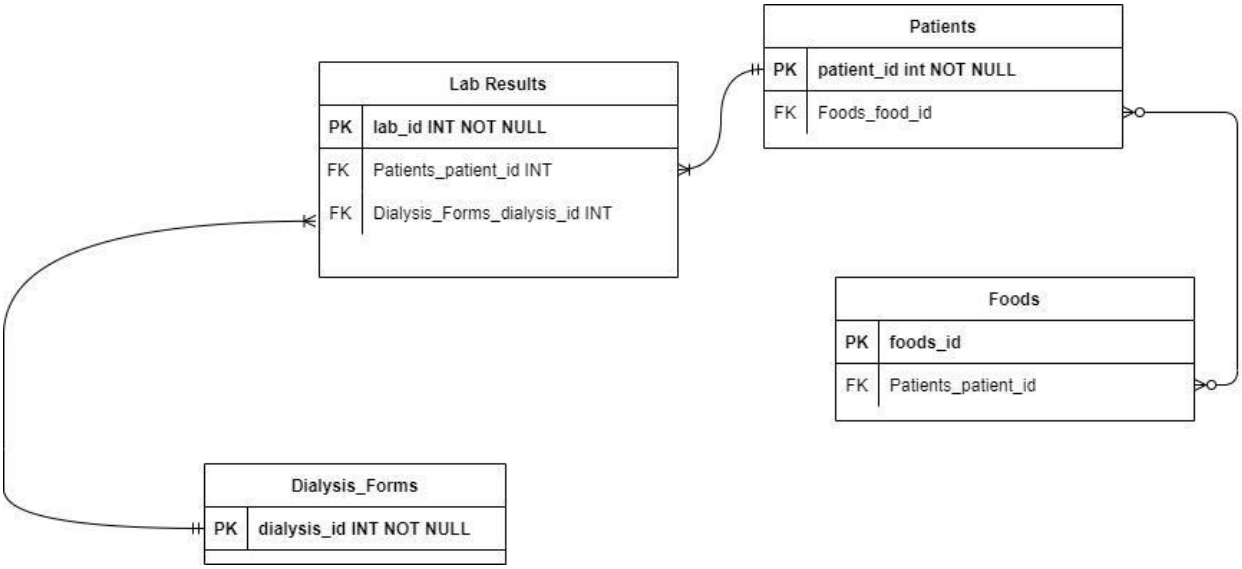
- adequacy_standard: FLOAT, not NULL
- kidney_doctor: VARCHAR(128), not NULL
- relationship: 1:M relationship with Lab_Results implemented with Dialysis_Forms_dialysis_id as a FK inside of Lab_Results.

Intersection Table:

Patient_Foods: Intersection table between Patients and Foods. This connects the patients to food that they have eaten, and adds a time characteristic for when the patient ate the food.

- Foods_food_id: INT (10), FK ON DELETE CASCADE
- Patients_patient_id: INT (11), FK ON DELETE CASCADE
- patient_food_time: DATETIME(), not NULL

Entity-Relationship Diagram:



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[1] Centers for Disease Control and Prevention. (2022, February 28). *Chronic Kidney Disease Basics*. Centers for Disease Control and Prevention. Retrieved April 3, 2022, from https://www.cdc.gov/kidneydisease/basics.html#:~:text=15%25%20of%20US%20adults%20are,is%20about%2037%20million%20people.

[2] Singh, K. (2021, January 7). *Mobile Health in dialysis: The best engagement medium is the one that's with patients*. American Society of Nephrology. Retrieved April 14, 2022, from https://cjasn.asnjournals.org/content/16/1/12

[3] U.S. Department of Health and Human Services. (n.d.). *Kidney Disease Statistics for the United States*. National Institute of Diabetes and Digestive and Kidney Diseases. Retrieved April 14, 2022, from https://www.niddk.nih.gov/health-information/health-statistics/kidney-disease

[4] *Renal diet apps: Which one should I use?* Kidney Diet Tips. (2018, July 30). Retrieved April 3, 2022, from https://blogs.davita.com/kidney-diet-tips/renal-diet-apps-which-one-should-i-use/

Part II Schema:

To normalize our schema we first created tables that we compiled that would fit our report structure in excel. We eliminated applicable redundant data to make it a first normal form (1NF). We then identified the primary keys within our tables and dependencies. Then we eliminated partial dependencies so that it fits the second normal form (2NF). We reassigned/omitted applicable dependent attributes. We then ensured it was in the third normal form (3NF) by making sure we resolved all transitive dependencies. We followed the normalization steps that were in our module 5 exploration on normalization steps.[4]

Part of these normalization steps, we decided to utilize the Conventional Unit system for laboratory values which is adapting the standardized units used within the United States for these lab values: sodium mEq/L, potassium mEq/L, and phosphorus mg/dL.[5] Since they are based on the Conventional Unit system there is no need to explicitly label each of them in the database on the Lab_Results table. For food measurements we used the Metric system's standardized units: potassium/phosphorus/sodium nutrient content would be in mg, and calories would be in kcals within the Foods table. Food portions/amounts would be reported in grams on the Foods table.[6] We are using Customary units for weight and height in the Patients table which reports weight as pounds and height in inches.[7] We decided since we are using the typical standards that are reported within the dialysis community and in the

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4 https://canvas.oregonstate.edu/courses/1870053/pages/exploration-normalization-steps?module_item_id=22036024

5 *Conventional units – International Units*. GlobalRPH. (n.d.). Retrieved April 26, 2022, from https://globalrph.com/medical/conventional-units-international-units/

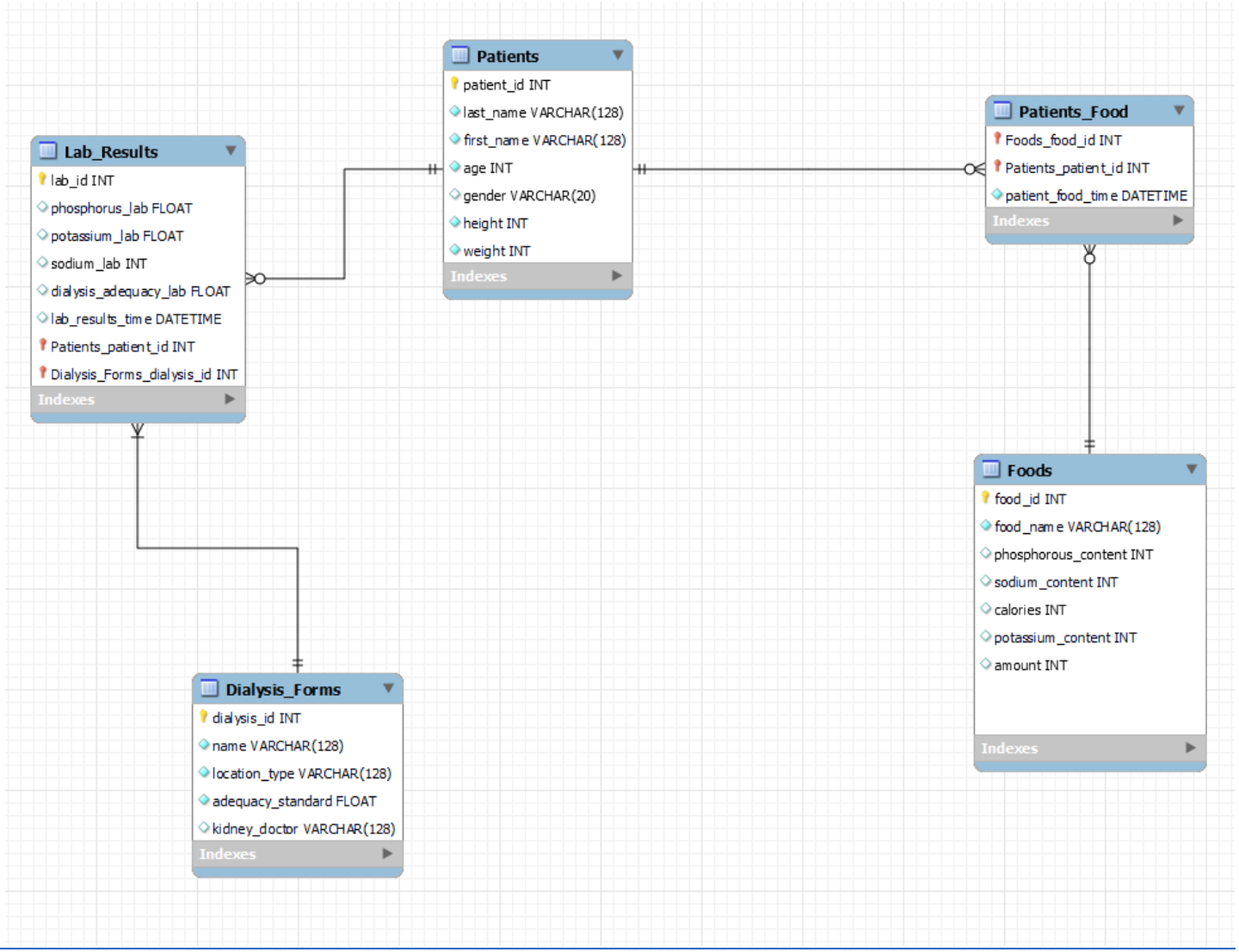
6 *Your guide to the New Food Label*. National Kidney Foundation. (2022, January 13). Retrieved April 26, 2022, from https://www.kidney.org/atoz/content/foodlabel

7 *What are customary units? - definition, facts and examples*. What are Customary Units? - Definition, Facts and Examples. (n.d.). Retrieved April 27, 2022, from https://www.splashlearn.com/math-vocabulary/measurements/customary-units

United States that we decided to leave that information out of the database we designed.

By standardizing units with commonly used unit systems within the United States we were able to successfully decrease the amount of duplication that comes from our previous database and more so fitting the expected guidelines within a 3NF. It also eliminated the partial dependencies as well. See on next page the detailed schema model.

Schema Model:



Example Data:

All sample data is based on fictional patients. Lab standards, dialysis forms, and food data are referenced from sources below. Refer as well to our SQL file containing our Data Definition Queries (DDL) for more information.

Patients Table:

		Patients				
patient_id	last_name	first_name	age	gender	height	weight
1	Smith	Arlene	55	F	64	145
2	Rogers	Christopher	63	M	72	180
3	Harrison	Kayla	68	F	65	125
4	Jackson	Henry	74	M	75	200
5	Wonders	Brenda	91	F	60	92

Patient information is fictional
patient_id = auto generating
Height in inches and weight in lbs considered Customary standardized units.

Lab_Results Table:[8]

	Lab_Results						
lab_id	phosphorus_lab	potassium_lab	sodium_lab	dialysis_adequacy_lab	lab_results_time	Patients_patient_id	Dialysis_Forms_dialysis_id
1	3.5	3.4	135	1.2	2022-05-07 23:22:05	3	1
2	5.5	3	142	1.7	2022-05-08 18:36:10	2	2
3	6.5	2.8	146	1.1	2022-05-	4	1

8 *Understanding your lab work*. DaVita. (n.d.). Retrieved April 25, 2022, from https://www.davita.com/education/kidney-disease/symptoms/understanding-your-lab-work

					01 20:20:06		
4	10.5	6.6	144	0.6	2022-05-07 18:01:55	5	1
5	7.2	4.5	134	2.2	2022-05-11 10:19:25	1	2

lab_id, Patients_patient_id, Dialysis_Forms_dialysis_id = auto generating
Using Conventional standardized units for lab values: potassium and sodium measured in mEq/L and phosphorus in mg/dL. Adequacy is measured as a benchmark metric with hemodialysis achieving 1.2 and peritoneal dialysis is achieving 1.7.

Dialysis_Forms Table:[9] [10] [11]

		Dialysis_Forms		
dialysis_id	name	location_type	adequacy_standard	kidney_doctor
1	hemodialysis FMC	incenter	1.2	Dr. House
2	peritoneal Baxter	home	1.7	Dr. Grey

Dialysis_id = auto generating
Doctors are listed as fictional names above.
Adequacy is measured as a benchmark metric with hemodialysis patients achieving 1.2 and peritoneal dialysis 1.7.

[9] *What is dialysis?* National Kidney Foundation. (2022, February 4). Retrieved April 25, 2022, from https://www.kidney.org/atoz/content/dialysisinfo

[10] U.S. Department of Health and Human Services. (n.d.). *Peritoneal dialysis: Dose & Adequacy*. National Institute of Diabetes and Digestive and Kidney Diseases. Retrieved April 25, 2022, from https://www.niddk.nih.gov/health-information/professionals/clinical-tools-patient-management/kidney-disease/identify-manage-patients/manage-ckd/peritoneal-dialysis-dose-adequacy

[11] U.S. Department of Health and Human Services. (n.d.). *Hemodialysis: Dose & adequacy*. National Institute of Diabetes and Digestive and Kidney Diseases. Retrieved April 25, 2022, from https://www.niddk.nih.gov/health-information/professionals/clinical-tools-patient-management/kidney-disease/identify-manage-patients/manage-ckd/hemodialysis-dose-adequacy#:~:text=The%20two%20methods%20generally%20used,blood%20flow%20through%20the%20dialyzer.

Foods_Table:[12]

		Foods				
food_id	name	amount	phosphorus_content	sodium_content	calories	potassium_content
1	Milk, whole	128	251	94.6	152	374
2	Beef, loin, top loin steak	284	585	128	423	801
3	Chicken, breast	174	419	81.8	275	597
4	Yogurt, Greek, nonfat	156	212	56.2	92	220
5	Kale	100	55	53	43	348

Food_id = auto generating
Units of measurement are based on the US metric system: phosphorus/sodium/potassium in milligrams(mg), calories as kcals, and amount/portion in grams.

Patient_Foods Table:

	Patients_Food	
Foods_food_id	Patients_patient_id	patient_food_time
5	1	2022-05-10 15:40:11
4	2	2022-05-20 18:32:04
3	3	2022-05-15 12:08:12
2	4	2022-05-11 15:07:55

[12] *Fooddata Central Search Results*. FoodData Central. (n.d.). Retrieved April 25, 2022, from https://fdc.nal.usda.gov/fdc-app.html#/

1	5	2022-05-16 10:22:28

Foods_food_id and Patients_patient_id = FKs referencing Foods and Patients tables.