| **#** | **Time period** | **Task-technology fit** | **Type of performance** | **Magnitude in performance** | **Cause** | **Effect** | **Source** |
| --- | --- | --- | --- | --- | --- | --- | --- |
| 1 | Present |  | Non-functional performance: Claims data (CPT, ICD-9, DRGs i.e., medical treatment data) should be real-time |  |  | Physician do not know that they have approval and cannot perform the treatment timely | PY1\_A3\_DI, Pos. 12  PY1\_A3\_DI, Pos. 16 |
| 2 | Present |  | Non-functional performance: Lack of data timeliness |  |  | [See Ex\_TechPerf#3] | PY1\_A3\_DI, Pos. 45 |
| 3 | Present |  | Constant increase in new data needs, e.g., new treatments coming out, are not accounted for in the system |  |  | Systems break down | PY1\_A3\_DI, Pos. 45 |
| 4 | Present |  | Non-functional performance: Data integrity is compromised, i.e., providers do not have all data about a patient at their disposal which could be useful for their treatment [providers cannot be sure that the health information about a patient is complete] |  | Payers do not share all health information they have about a patient with providers to uphold patient privacy |  | PY1\_A3\_DI, Pos. 55 |
| 5 | Present |  | Functional performance: HIEs and QHINs are not scalable |  | Lack of standardization |  | CS1\_DI, Pos. 10 |
| 6 | Past |  | Functional performance:  There were no systems that could work with the new data standards |  |  | Failure to achieve interoperability | CS1\_DI, Pos. 18/428-537 |
| 7 | Past |  | Functional performance: Until the Cures Act with the introduction of the USCDI [United States Core Data for Interoperability] there was no standardized, ubiquitous format |  | Non-profit organizations were unwilling to create a standard strong enough that it could be practically used for the ubiquitous transfer of data  “Well, Meaningful Use was mandated. And there was actually enforcement. I mean, you wanted part of the Meaningful Use was you got back a bunch of money’s spent as a hospital and buying a new and implementing a new EMR. You don’t do meaningful use, you won’t get that money, a good enforcement, a good incentive. The problem is there was no standard, and there was tremendous incentives on the part of most of the actors. This means the vendors producing the EMRs, Cerner, Epic, Allscripts, and the hospitals involved cannot support interoperability. [quote]” | Failure to achieve interoperability | CS1\_DI, Pos. 18/459-463 |
| 8 | Present |  |  | The fact that an idea is pareto superior is not sufficient for adoption | [See Ex\_Fin#4] |  | CS1\_DI, Pos. 22 |
| 9 | Present |  | Non-functional performance: Lack of truthfulness interoperability, i.e., did the provider up-code? |  |  |  | CS1\_DI, Pos. 28 |
| 10 | Present |  | Functional performance: Lack of semantic interoperability, i.e., can two physicians look at the same piece of data and understand it in the same way, but the Cures Act with TEFCA is expected to get us closer (includes free text form clinical notes) |  | Clinical data requires context |  | CS1\_DI, Pos. 28 |
| 11 | Present |  | Functional performance: Interoperability requires APIs between the two connecting parties |  |  | Parties either have to build the API themselves or partner with an API offering interoperability company | CDE1\_A1\_DI, Pos. 32 |
| 12 | Present |  | Functional performance: Systems do not talk to each other |  | [See Ex\_SystemChar#7] |  | CS1\_DI, Pos. 6 |
| 13 | Present [interviewer talked about it in the context of why people resist using certain technologies] | Technology needs to streamline physician’s job or help them treat patients more effectively |  |  | Physicians are overstretched and stressed | If not, no adoption and use | CDE1\_A1\_DI, Pos. 46 |
| 14 | Present |  | Functional performance: After a node has been spun up synching issues can arise |  |  | Organization needs to figure out what’s wrong and nodes are kind of a black box; need to reach consensus with other nodes, i.e., requires coordination with others | ETC1\_DI, Pos. 24 |
| 15 |  |  |  |  |  |  |  |
| 16 | Present |  | Non-functional performance: It is a challenge to keep the data privacy-preserving on a metadata level |  | The way today’s software systems communicate makes it seem as if there was never the design goal of keeping conversations confidential, i.e., not knowing that they even happened |  | PYV1\_DI, Pos. 6 |
| 17 | Present |  | Functional performance: Technical interoperability, i.e., whether two systems can interact with each other, leaves much to be desired |  |  |  | PYV1\_DI, Pos. 18 |
| 18 | Present |  | Functional performance: The big health IT vendors will merely try to find consensus of the least common denominator |  |  | It is difficult for the customers and users of these service products to govern the technology roadmap, i.e., no user agency | PYV1\_DI, Pos. 22-24 |
| 19 | Present |  | Functional-performance:  Lack of same set of standards for the sharing of clinical data |  | Little incentive for everybody to get on the same set of standards (in contrast to administrative data, i.e., billing and getting paid) |  | CS2\_A2\_DI, Pos. 8 |
| 20 | Present |  | Non-functional performance: Healthcare data breaches have been expanding in the US |  | Lack of privacy and security |  | CS2\_A2\_DI, Pos. 20 |
| 21 |  |  |  |  |  |  |  |
| 22 | Present |  | Functional performance: There is more variability across platforms that store clinical data than necessary, i.e., still has many subjective rather than objective elements to it |  |  |  | CS2\_A2\_DI, Pos. 22 |
| 23 | Present |  | Technical performance: No technical interoperability within systems |  | [See Ex\_TechPerf#24] |  | CS2\_A2\_DI, Pos. 30 |
| 24 | Present |  | System updates cannot be performed |  | Systems are customized for various stakeholders within hospitals and if a hospital has already written its own customized code over it, system updates would delete the code depending on how it was architected |  | CS2\_A2\_DI, Pos. 30 |
| 25 | Present |  | Functional performance: Large range of variability in systems |  | Providers (individual hospitals and physicians) have their own views on how they want to look at data |  | CS2\_A2\_DI, Pos. 32 |
| 26 | Present |  | Functional performance: Health IT systems are purposefully not easy interoperability |  | [See Ex\_RiskTrust#55] |  | PV1\_DI, Pos. 4 |
| 27 | Present | Often the application of the technology requires too many additional clicks by the physician that impedes them from patient care [not in Ex\_ExEff as it is about a misfit of technology design and task] |  |  | Often health IT is not developed by clinicians |  | PV1\_DI, Pos. 30 |
| 28 |  |  |  |  |  |  |  |
| 29 | Present |  | Functional performance: Providers to points of aggregation flows are not scalable |  | Lack of standardization and ubiquity of providers to points of aggregation flows |  | CS1\_DI, Pos. 10 |
| 30 | Present |  | Non-functional performance: Data is not timely, i.e., there’s a lag on claims and permissions |  |  |  | CDE1\_A1\_DI, Pos. 12 |
| 31 | Present |  | Non-functional performance: Data is not accurate, i.e., there are coding issues (under- and over-coding, i.e., the information registered is not truthful e.g., saying that a patient had a different diagnosis than they actually had, which results in a higher DRG [diagnostic-related group] payment from the payer; including risk adjustment, i.e., saying that a patient is sicker than he his) |  | Fraud and abuse | Waste, e.g., by getting more money from the government to treat the patient | CDE1\_A1\_DI, Pos. 12 |
| 32 |  |  | Non-functional performance: Data is not secure, i.e., patient information is not sufficiently protected |  | HIPAA and PCI [payment card industry] are not abided by sufficiently rigorously |  | CDE1\_A1\_DI, Pos. 12 |
| 33 |  |  | Non-functional performance: Data is not actionable, i.e., the information shared is not really used to change physicians’ or other stakeholders’ behavior |  |  |  | CDE1\_A1\_DI, Pos. 12 |
| 34 |  |  | Data integrity issues |  | Garbage in (low quality, not timely inputs) leads to garbage out, in particular as when data gets transmitted there is always lost a little bit | Sharing data is of little utility | CDE1\_A1\_DI, Pos. 18 |
| 35 | Present | The data flow on patient care is through EHR systems and providers have started to work around the billing system rather than develop an electronic health record system that’s best used for patient care |  |  | EHR systems were initially built based for billing only, i.e., making sure that they get reimbursed by the payers who have very stringent criteria | EHR systems are cumbersome | PV1\_DI, Pos. 2-8 |
| 36 | Present | The data is not organized in a user-friendly way so that physicians can do their job |  |  | It is organized in a way to make sure that systems can bill for patient care | It does not lead to better outcomes for patients but to more money being made for large health systems and payers | PV3\_ETC2\_DI, Pos. 10 |
| 37 | Present |  |  | Incentives in terms of efficiency gains and patient outcomes are not big enough | [See Ex\_OrgInnov#8]  “Like when we look around, you know, healthcare system, it’s not uncommon to see a fax machine being heavily used, you know, by organization and that’s not because there’s not better technologies, it’s just because like the incentives really aren’t there to motivate people to embrace some of those changes [quote].” | These innovations lose out in the prioritization process | PY2\_DI, Pos. 26-28 |
| 38 | Present |  |  | The impact of many innovations is hard to quantify |  | [See Ex\_Fin#17] | PY2\_DI, Pos. 26 |
| 39 | Present |  | Functional performance: Deciding on design questions such as whether to use a public or private chain, privacy & security, scalability questions |  |  |  | PY2\_DI, Pos. 30 |
| 40 | Present |  | Functional performance: EMRs have scalability issues i.e., creating a technology that is flexible enough to be applied and used in every place and allows for simple onboarding |  |  | The more complex the system, the more one runs into downstream issues of how to get people on board | HITV1\_DI, Pos. 16-18 |
| 41 | Present |  | Functional performance: onboarding of existing patients into new EMRs is challenging |  |  | If erroneous at the next patient’s visit the data does not flow seamlessly | HITV1\_DI, Pos. 16 |
| 42 | Present |  | Functional performance: the issue of conversion in new EMRs, i.e., uploading any old data into the new format of the new system |  | Physicians need the old data to be usable for future interaction with patients |  | HITV1\_DI, Pos. 16 |
| 43 | Present | Should physicians adopt the EMR? |  |  |  | If it is not a good fit, the system will not be adopted for this department | HITV1\_DI, Pos. 22 |
| 44 | Present |  | Functional performance: Software error |  |  | [See Ex\_RiskTrust#16] | HITV1\_DI, Pos. 22 |
| 45 | Present |  | Functional performance: Scalability issues |  | Lack of data standardization |  | PV2\_CDE3\_DI, Pos. 32 |
| 46 | Present |  | Functional performance: Scalability issues |  | [See\_Ex\_FacilCon#11] |  | PV2\_CDE3\_DI, Pos. 32 |
| 47 | Present |  | Functional performance: Scalability issues |  | [See Ex\_StakeAlign#49-50] |  | PV2\_CDE3\_DI, Pos. 32 |
| 48 | Present |  | Functional performance: Limited functionality that is available to them |  | Stakeholders have the capability to be connected but they are not on the same version / update of the standard | Scalability issues | FA1\_DI, Pos. 44 |
| 49 | Present |  | Functional performance: Clinical data does not flow |  |  | [See Ex\_PriorTech#9] | CS1\_DI, Pos. 45, 1035-1085 |
| 50 | Present |  | Functional performance: Lack of technical interoperability |  |  | [See Ex\_StakeAlign#61] | CS1\_DI, Pos. 61-63 |
| 51 | Present | The technology gets in the way of physicians accomplishing their task |  |  | It is hard to find a balance between treating patients, i.e., doing the core task, and managing the data, alerts, documentation, billing, etc. to support the core work  “I mean, I’ve got 17 people standing in my emergency department waiting room that I need to get through, and there’s all these steps of, you know, arriving them and getting their history and documenting their vital signs and having the nurse see them and it’s like, they’re bleeding for goodness’s sake. So, it’s like just bring them in, and it’s not like that anymore, you know, you can’t just bring them in and start doing things to people [quote].” | There is no time left to take care of the patients | PV2\_CDE3\_DI Pos. 30 |