

# DSA 8660 Group Project

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## How does IT transform the healthcare sector?

### Introduction

The 2017 Healthcare Information and Management Systems Society (HIMSS) Conference & Exhibition was one of the world’s largest and most influential healthcare IT events. Held from February 19–23, 2017 at the Orange County Convention Center in Orlando, Florida, the event brought together over 40,000 healthcare and IT professionals, including clinicians, policymakers, researchers, tech executives, industry leaders & more. With more than 1200 exhibits and hundreds of educational sessions, HIMSS 2017 served as a dynamic forum for exploring the constantly growing convergence of healthcare and technology. Key themes included cybersecurity, patient engagement, tele-medicine, and deep/machine learning integration for assistive technology, highlighting the growing need for connected and trained systems that support a rapidly growing healthcare landscape.

Since the 2017 conference, groundbreaking technologies have emerged with the potential to alter how healthcare data is managed, analyzed, and protected. Among these, Deep Learning has shown exceptional promise in areas such as medical imaging, diagnostics, and clinical decision assistance - offering accuracy beyond normal practice. A growth in ethical tech like differential privacy - which enable the sharing and analysis of sensitive health data while preserving individual privacy — shows an increasing concern about earning user trust in the era of big data and personalized medicine. These innovations represent both technical progress and also a shift in how healthcare systems operates at massive scale while maintaining trust, security, and ethical responsibility.

One of the key enablers behind the rise of these advanced data technologies is the significant improvement in computing infrastructure - especially through the widespread adoption of Graphics Processing Units (GPUs). Technology like NVIDIA’s CUDA have transformed GPUs from gaming hardware into essential tools for scientific computing, enabling massive parallel processing that powers modern AI and machine learning applications. As the cost of computing has decreased, high-performance tools—such as dedicated GPUs—have become more accessible and standardized, even in personal and enterprise-level systems. This democratization of computing power has allowed a broader range of researchers, developers, and healthcare organizations to experiment with and deploy data-intensive solutions that were once limited to well-funded labs or tech giants.

The focus areas of HIMSS 2017 and the emergence of next-generation information technologies point toward a radical shift for the healthcare sector. As artificial intelligence, improvements in patient privacy, and scalable data infrastructure get better, they allow the possibility of data-driven personalized care. Our report explores how these technologies are driving change across the healthcare sector - from hospital workflows and patient experience, to large-scale population health management. By analyzing data sets from HIMSS 2017, we will begin to understand how convergence of healthcare and technology is redefining the foundations of patient care.

## Data Preparation

```
# loading datasets
```

```
HAEntity <- read.csv("data/HAEntity.csv")
```

```
head(HAEntity)
```

```
##      HAEntityId SurveyId ParentId UniqueId EntityNo
## 1      856165     56048   856162    44570 100067299
## 2      856166     56048   856162    27264    24193
## 3      856168     56048   856162    27265    24195
## 4      856169     56048   856162    27251 100051340
## 5      856170     56048   856162    27252 100051341
## 6      856171     56048   856162    27260 100059711
##
##                                     Name HAEntityTypeId HAEntityType
## 1 Behavioral Health at Marietta Memorial Hospital           2    Sub-Acute
## 2                                     The Rehabilitation Center           2    Sub-Acute
## 3                                     The Strecker Cancer Center           3    Ambulatory
## 4                               Marietta Health Care Physicians, Inc.           3    Ambulatory
## 5                               Wayne Street Medical Campus - Primary Care           3    Ambulatory
## 6                               Marietta Hospital Belpre Medical Campus           3    Ambulatory
##                                     CBSA MedicareNumber Address1
## 1 Parkersburg-Marietta-Vienna, WV-OH           401 Matthew Street
## 2 Parkersburg-Marietta-Vienna, WV-OH           1106 Colegate Drive
## 3 Parkersburg-Marietta-Vienna, WV-OH           401 Matthew Street
## 4 Parkersburg-Marietta-Vienna, WV-OH           400 Matthew Street
## 5 Parkersburg-Marietta-Vienna, WV-OH           802 Wayne Street
## 6 Parkersburg-Marietta-Vienna, WV-OH           125 Lee Street
##      Address2      City State      Zip      Phone Website Fax EmailConvention
## 1 Division H Marietta      OH 45750 7403741501           NA
## 2 1st Floor Marietta      OH 45750 7403741464           NA
## 3 Level G Marietta      OH 45750 7403765000           NA
## 4 Marietta      OH 45750 7403744500           NA
## 5 Suite 200 Marietta      OH 45750 7405684190           NA
## 6 Belpre      OH 45714 7404239640           NA
##      ProfitStatus ServicePopulation      Type YearOpened
## 1      NA      NA      Behavioral Health      NA
## 2      NA      NA      Rehabilitation      1993
## 3      NA      NA      Oncology      1993
## 4      NA      NA      Family Practice      1995
## 5      NA      NA      Family Practice      1995
## 6      NA      NA      NA Internal Medicine, Pediatric      NA
```

```

## OwnershipStatus NofFTE VendorSelStrategy NofBeds NofStaffedBeds FreeStanding
## 1 Owned NA 13 13 False
## 2 Owned NA 17 17 False
## 3 Owned NA NA NA False
## 4 Owned NA NA NA False
## 5 Owned NA NA NA False
## 6 Owned NA NA NA False
## SameISSystem AcuteId NofPhysicians NofHCareVisits FTETotal DataCenterAcuteId
## 1 True 856163 NA NA NA NA
## 2 True 856164 NA NA NA NA
## 3 False NA 4 NA NA NA
## 4 False NA 1 NA NA NA
## 5 False NA 3 NA NA NA
## 6 False NA 1 NA NA NA
## PhysFT PhysAffiliated PhysTotal IsImaging PhysResidents PhysHospitalists
## 1 NA NA NA False NA NA
## 2 NA NA NA False NA NA
## 3 NA NA NA False NA NA
## 4 NA NA NA False NA NA
## 5 NA NA NA False NA NA
## 6 NA NA NA False NA NA
## PhysOther NofIntensiveCareBeds AverageDailyCensus Latitude Longitude
## 1 NA NA NA 39.43069 -81.46479
## 2 NA NA NA 39.43888 -81.44446
## 3 NA NA NA 39.43132 -81.46489
## 4 NA NA NA 39.43125 -81.46483
## 5 NA NA NA 39.41248 -81.43749
## 6 NA NA NA 39.27217 -81.58209
## IsIDSACOCClassified IsIDSPCMHCertified IsIDSPlanningACO IsIDSPlanningPCMH
## 1 False False False False False
## 2 False False False False False
## 3 False False False False False
## 4 False False False False False
## 5 False False False False False
## 6 False False False False False
## NoOfNeonatalIntensiveCareBeds PhysicianExtenders PercVirtServers
## 1 NA NA NA
## 2 NA NA NA
## 3 NA 0 NA
## 4 NA 0 NA
## 5 NA 0 NA
## 6 NA 1 NA
## PercVirtComputers County DisasterMsgId IsNICUPresent
## 1 NA Washington NA False
## 2 NA Washington NA False
## 3 NA Washington NA False
## 4 NA Washington NA False
## 5 NA Washington NA False
## 6 NA Washington NA False

```

```
# summary(HAEntity)
```

```
Pharma <- read.csv("data/Pharmacy.csv")
head(Pharma)
```

```
##      Id SurveyId HAEntityId   ADM ADMPlanned ADMTimeFrame ADMPerc Robot
## 1 100262   56424   862656 False      False                NA False
## 2 101535   56797   878405 False      False                NA False
## 3 102373   57094   887601 False      False                NA False
## 4 102376   57094   887604 False      False                NA False
## 5 102382   57094   887610 False      False                NA False
## 6 102365   57094   887593 False      False                NA False
##  RobotPlanned RobotTimeFrame DeptMedical DeptED DeptOR DeptOther DeptOtherName
## 1      False                False      False False      False      False
## 2      False                False      False False      False      False
## 3      False                False      False False      False      False
## 4      False                False      False False      False      False
## 5      False                False      False False      False      False
## 6      False                False      False False      False      False
##  EMAR_CPOE CarouselsTimeFrame CarouselsPlanned Carousels InventoryMgmt
## 1      NA                False      False      False      1378
## 2      NA                False      False      False      1380
## 3      NA                False      False      False      1379
## 4      NA                False      False      False      1379
## 5      NA                False      False      False      1379
## 6      NA                False      False      False      1379
##  PharmaceuticalSupplyVendorID PharmaceuticalSupplyVendorName
## 1                        NA
## 2                        NA
## 3                        NA
## 4                        NA
## 5                        NA
## 6                        NA
```

```
HA_NPI <- read.csv("data/HAEntityNPI.csv")
head(HA_NPI)
```

```
##      id SurveyId HAEntityId NPI_Number ServiceType
## 1 79358   56284   860668 1144221847   Hospital
## 2 80852   56664   871616 1881613909   Hospital
## 3 80853   56664   871616 1699819003   Hospital
## 4 79851   56481   865011 1982047908   Hospital
## 5 79852   56481   865011 1962795120   Hospital
## 6 79614   56424   862656 1255406369   Hospital
```

## Dataframe Information

1. Our first collection of datasets comes directly from the HIMSS 2017 server.

- HAEntity:
  - Description: This table contains the demographic information for all the facilities and systems tracked in the database. (This is a self referencing table).
  - Link: This table links to the other tables by the HAEntityID. This table also links to itself by HAEntityID to ParentID. The table linked by HAEntityID will pull the IDS information and the table linked by ParentID will pull the facility information.
- Pharmacy:

- Description: This table provides an overview of the pharmacy department, including FDA bar code regulations, use and planned ADMS, Robots, and EMARs.
    - Link: This table links to the other tables by the HAEntity\$HAEntityID.
  - HA\_NPI
    - Description: This table provides information regarding medication prescriber's NPI (National Provider Identifier).
    - Link: This table is connected to HAEntity by SurveyId and HAEntityID.
2. The following sets come from ...