Patient Portal Model Documentation

\* Group Patient Adoption

L Trial Users = Integral( Adoption Rate-Trial Adopter Abandonment Rate-Conversion to Full Adopters )dt

Init: 0

Unit: (People)

R Adoption Rate = Adoption from Marketing+Adoption from Word of Mouth

Unit: (People/Month)

A Adoption from Marketing = Potential Adopters\*Marketing Contact Rate\*Fraction of Marketing Contacts causing trial

Unit: (People/month)

C Marketing Contact Rate = .2

Unit: (dimensionless/Month)

C Fraction of Marketing Contacts causing trial = .1

Unit: (dimensionless)

L Potential Adopters = Integral( -Adoption Rate+Rate of Inactive Users open to Reconsideration )dt

Init: Initial Patient Population

Unit: (People)

C Initial Patient Population = 250000

Unit: (People)

R Rate of Inactive Users open to Reconsideration = MAX(0,(Inactive Users-Indicated Inactive Users)/Time for Users to become eligible to reconsider)

Unit: (People/month)

C Time for Users to become eligible to reconsider = 6

Unit: (Month)

L Inactive Users = Integral( Trial Adopter Abandonment Rate+Full Adopter Abandonment Rate-Rate of Inactive Users open to Reconsideration )dt

Init: 0

Unit: (People)

R Trial Adopter Abandonment Rate = Trial Users\*(1-Patient Acceptance Fraction)/Trial Time

Unit: (People/month)

C Trial Time = 3

Unit: (Month)

R Full Adopter Abandonment Rate = MAX(0,MIN(Active Users/Full Adopter Time to Abandon,(Indicated Inactive Users-Inactive Users)/Full Adopter Time to Abandon))

Unit: (People/Month)

C Full Adopter Time to Abandon = 4

Unit: (Month)

A Indicated Inactive Users = (1-Patient Acceptance Fraction)\*(Active Users+Inactive Users)

Unit: (People)

L Active Users = Integral( Conversion to Full Adopters-Full Adopter Abandonment Rate )dt

Init: 0

Unit: (People)

R Conversion to Full Adopters = Trial Users\*(Patient Acceptance Fraction)/Trial Time

Unit: (People/Month)

A Adoption from Word of Mouth = (Trial Users+Active Users)\*Patient Adoption Fraction\*Patient Contact Rate\*(Potential Adopters/Total Patient Population)

Unit: (People/month)

C Patient Contact Rate = 1

Unit: (people/people/month)

A Total Patient Population = Potential Adopters+Trial Users+Active Users+Inactive Users

Unit: (People)

C dummy

\* End of group Patient Adoption

\* Group Patient Time on Portal

L Patient Time on Portal = Integral( Increase in Active User Time+Increase in Time from Conversion-Loss in Time from Abandonment )dt

Init: 0

Unit: (Month\*People)

R Increase in Active User Time = Active Users\*Months added per month

Unit: (People)

C Months added per month = 1

Unit: (month/month)

R Increase in Time from Conversion = Conversion to Full Adopters\*Average Experience of Trial users

Unit: (People)

A Average Experience of Trial users = IF trial users=0 then 0 else Trial Users Time on Portal/trial users

Unit: (Month)

L Trial Users Time on Portal = Integral( -Increase in Time from Conversion+Increase in Trial User Time-Loss in Trial Users Time from Abandonment )dt

Init: 0

Unit: (People\*Month)

R Increase in Trial User Time = Trial Users\*Months added per month

Unit: (People)

R Loss in Trial Users Time from Abandonment = Average Experience of Trial users\*Trial Adopter Abandonment Rate

Unit: (People)

R Loss in Time from Abandonment = Full Adopter Abandonment Rate\*Average Experience per Patient

Unit: (People)

A Average Experience per Patient = IF active users=0 then 0 else Patient Time on Portal/Active Users

Unit: (month)

\* End of group Patient Time on Portal

\* Group Provider Adoption

L Doctor Potential Adopters = Integral( -Doctor Adoption Rate+Doctors Open to Reconsideration Rate )dt

Init: Initial Doctor Population

Unit: (People)

C Initial Doctor Population = 500

Unit: (People)

R Doctor Adoption Rate = Doctor Adoption from Management Initiative+Doctor Adoption Rate from WoM

Unit: (People/Month)

A Doctor Adoption from Management Initiative = Effectiveness of Management Initiative\*Doctor Potential Adopters

Unit: (People/Month)

C Effectiveness of Management Initiative = .02

Unit: (dimensionless/month)

A Doctor Adoption Rate from WoM = (Doctor Trial Users+doctor active users)\*Doctor Contact Rate\*Doctor Adoption Fraction\*(Doctor Potential Adopters/Doctor Total Population)

Unit: (People/Month)

C Doctor Contact Rate = 30

Unit: (People/People/Month)

L Doctor Trial Users = Integral( Doctor Adoption Rate-Doctor Trial Adopter Abandonment-Doctor Conversion to Active Users )dt

Init: 0

Unit: (People)

R Doctor Trial Adopter Abandonment = Doctor Trial Users\*(1-Doctor Acceptance Fraction)/Doctor Acceptance Time

Unit: (People/Month)

C Doctor Acceptance Time = 6

Unit: (Month)

R Doctor Conversion to Active Users = Doctor Trial Users\*Doctor Acceptance Fraction/Doctor Acceptance Time

Unit: (People/Month)

L Doctor Active Users = Integral( Doctor Conversion to Active Users-Doctor Active User Abandonment )dt

Init: 0

Unit: (People)

R Doctor Active User Abandonment = MAX(0, MIN(Doctor Active Users/Time for Doctor Active Users to Abandon,(Doctor Indicated Inactive Users-Doctor Inactive Users)/Time for Doctor Active Users to Abandon))

Unit: (People/Month)

C Time for Doctor Active Users to Abandon = 12

Unit: (Month)

A Doctor Indicated Inactive Users = (1-Doctor Acceptance Fraction)\*(Doctor Inactive Users+Doctor Active Users)

Unit: (People)

L Doctor Inactive Users = Integral( Doctor Trial Adopter Abandonment+Doctor Active User Abandonment-Doctors Open to Reconsideration Rate )dt

Init: 0

Unit: (People)

R Doctors Open to Reconsideration Rate = MAX(0,(Doctor Inactive Users-Doctor Indicated Inactive Users)/Time for Inactive Doctors to be open to reconsider)

Unit: (People/Month)

C Time for Inactive Doctors to be open to reconsider = 6

Unit: (Month)

\* End of group Provider Adoption

\* Group Patient Portal Attractiveness

A Patient Acceptance Fraction = MIN(1,Reference Acceptance Fraction\*Patient Satisfaction with Portal)

Unit: (dimensionless)

C Reference Acceptance Fraction = .8

Unit: (dimensionless)

A Patient Satisfaction with Portal = Effect of Functionality on Patient Satisfaction\*Effect of Doctor Use on Satisfaction\*Effect of Health Outcomes on Patient Satisfaction

Unit: (dimensionless)

A Effect of Functionality on Patient Satisfaction = Patient IT Functionality

Unit: (dimensionless)

0 to 1

C Patient IT Functionality = .5

Unit: (dimensionless)

0-1, 1 = state of the art, 0 = nonexistent, .2 = minimal

A Effect of Doctor Use on Satisfaction = Doctor Extent of Use\*Fraction of Doctors Adopting

Unit: (dimensionless)

0 to 1

A Doctor Extent of Use = 1

Unit: (dimensionless)

1= use of full capabilities

0= not using at all

A Fraction of Doctors Adopting = (Doctor Trial Users+Doctor Active Users)/Doctor Total Population

Unit: (dimensionless)

A Doctor Total Population = Doctor Potential Adopters+Doctor Trial Users+Doctor Inactive Users+Doctor Active Users

Unit: (People)

A Effect of Health Outcomes on Patient Satisfaction = Effect of Perceived Quality Gain on Doc Sat

Unit: (dimensionless)

Ranges from 1 (no effect) to a small increase

A Patient Adoption Fraction = Patient Satisfaction with Portal\*Reference Adoption Fraction

Unit: (dimensionless)

C Reference Adoption Fraction = .1

Unit: (dimensionless)

\* End of group Patient Portal Attractiveness

\* Group Provider Portal Attractiveness

A Doctor Acceptance Fraction = MIN(1,Reference Doctor Acceptance\*Doctor Satisfaction)

Unit: (dimensionless)

C Reference Doctor Acceptance = .8

Unit: (dimensionless)

A Doctor Satisfaction = Effect of Doc IT Func on Satisfaction\*Effect of Perceived Financial Gain on Doc Sat\*Effect of Perceived Quality Gain on Doc Sat\*Effect of Patient Satisfaction on Doctor Sat

Unit: (dimensionless)

A Effect of Doc IT Func on Satisfaction = Doctor IT Functionality

Unit: (dimensionless)

C Doctor IT Functionality = .5

Unit: (dimensionless)

A Effect of Perceived Financial Gain on Doc Sat = Table for Effect of Financial Benefits(Financial Benefits Relative to Threshold)

Unit: (dimensionless)

C Table for Effect of Financial Benefits = 1,1, 1.18,1.068, 1.342,1.118, 1.541,1.164, 1.73,1.184, 2,1.2

Unit: (dimensionless)

A Financial Benefits Relative to Threshold = smooth(Total monthly financial benefits/Financial Benefits Threshold,Time to Perceive Financial Benefits)

Unit: (dimensionless)

C Time to Perceive Financial Benefits = 3

Unit: (month)

A Financial Benefits Threshold = 20000

Unit: ($/month)

A Effect of Perceived Quality Gain on Doc Sat = Adherence Relative to Normal

Unit: (dimensionless)

A Adherence Relative to Normal = Perceived Adherence/NonUser Average Adherence

Unit: (dimensionless)

A Effect of Patient Satisfaction on Doctor Sat = Table for effect of patient sat on doctor sat(Perceived Patient Satisfaction)

Unit: (dimensionless)

C Table for effect of patient sat on doctor sat = 3.78e-1,7.82e-1, 6.35e-1,9.92e-1, 7.97e-1,1.083, 1,1.2, 1.264,1.323, 1.486,1.323

Unit: (dimensionless)

A Perceived Patient Satisfaction = smooth(Patient Satisfaction with Portal, time to perceive patient sat)

Unit: (dimensionless)

C time to perceive patient sat = 6

Unit: (Month)

A Doctor Adoption Fraction = Reference Doctor Adoption Frac\*Doctor Satisfaction

Unit: (dimensionless)

C Reference Doctor Adoption Frac = .01

Unit: (dimensionless)

\* End of group Provider Portal Attractiveness

\* Group Financial Benefits

C Average per patient Cost Savings from Quality = 0

Unit: ($/people/month)

C Fraction of Quality Savings Recouped = 0

Unit: (dimensionless)

For example, in ACO model if reimubursement rate is fixed, any cost savings can be kept

L Cumulative Cash Flow = Integral( Increase in Cumulative Cash Flow )dt

Init: 0

Unit: ($)

R Increase in Cumulative Cash Flow = Net Cash Flow

Unit: ($/month)

A Net Cash Flow = Total monthly financial benefits-Costs

Unit: ($/month)

A Total monthly financial benefits = Benefits from Meaningful Use+Rate of Administrative Benefits+Rate of Doctor Productivity Benefits

Unit: ($/month)

A Benefits from Meaningful Use = IF Fraction of Patients Adopting>Meaningful use Threshold THEN Reimbursement from Meaningful Use ELSE 0

Unit: ($/month)

C Meaningful use Threshold = .1

Unit: (dimensionless)

C Reimbursement from Meaningful Use = 25000

Unit: ($/month)

if you hit patient threshold, each doctor gets this

A Fraction of Patients Adopting = (Active Users + Trial Users)/Total Patient Population

Unit: (dimensionless)

A Rate of Administrative Benefits = Administrative Benefit Per Active User\*(Active Users+Trial Users)

Unit: ($/month)

C Administrative Benefit Per Active User = 1

Unit: ($/people/month)

A Rate of Doctor Productivity Benefits = SMOOTH(Indicated Rate of Doctor Productivity Benefits,Time to Realize Doctor Productivity Benefits)

Unit: ($/month)

C Time to Realize Doctor Productivity Benefits = 6

Unit: (Month)

A Indicated Rate of Doctor Productivity Benefits = (Doctor Trial Users+Doctor Active Users)\*Gains per Doctor from Improved Productivity

Unit: ($/month)

C Gains per Doctor from Improved Productivity = 10

Unit: ($/Month/People)

Doctors can receive higher reimbursement per work day by resolving more minor problems by email and shifting time to work that is more complex.

(could also include effect of fewer missed appts?)

A Costs = Implementation Costs(time) + (IF time >= 12 then Recurring Operating Costs else 0)

Unit: ($/month)

C Implementation Costs = 0,5e+4, 1.2e+1,0, 2.4e+1,0

Unit: ($/month)

C Recurring Operating Costs = 10000

Unit: ($/month)

L Cumulative Discounted Cash Flow = Integral( Change in Cumulative Discounted Cash Flow )dt

Init: 0

Unit: ($)

Note - this excludes gains that will accrue after the final time of the simulation. could add those if necessary to get total NPV for investment

R Change in Cumulative Discounted Cash Flow = Increase in Cumulative Cash Flow\*Discount Factor

A Discount Factor = exp(-Discount Rate\*Time)

C Discount Rate = .05

Unit: (dimensionless)

\* End of group Financial Benefits

\* Group Quality

A Perceived Adherence = SMOOTH(Patient Average Adherence,Time to Perceive Adherence)

Unit: (dimensionless)

C Time to Perceive Adherence = 12

Unit: (month)

A Patient Average Adherence = Patient Trial Rate Frac\*Trial User Average Adherence+Active User Average Adherence\*Patient Active Rate Frac+NonUser Average Adherence\*(1-Patient Trial Rate Frac-Patient Active Rate Frac)

Unit: (dimensionless)

C Trial User Average Adherence = .6

Unit: (dimensionless)

C Active User Average Adherence = .8

Unit: (dimensionless)

C NonUser Average Adherence = .5

Unit: (dimensionless)

A Patient Trial Rate Frac = Patient Fraction of Trial Users\*Effect of Doctor Adoption on Patient Adherence

Unit: (dimensionless)

A Patient Fraction of Trial Users = Trial Users/Total Patient Population

Unit: (dimensionless)

A Effect of Doctor Adoption on Patient Adherence = MIN(1,fifze(0,Fraction of Doctors Adopting/Fraction of Patients Adopting,Fraction of Patients Adopting))

Unit: (dimensionless)

A Patient Active Rate Frac = Patient Fraction Active Users\*Effect of Doctor Adoption on Patient Adherence

Unit: (dimensionless)

A Patient Fraction Active Users = Active Users/Total Patient Population

Unit: (dimensionless)

\* End of group Quality

N TIME=0

SPEC DT=0.03125

SPEC LENGTH=60

SPEC SAVPER=0.03125

SPEC ABS\_ERR=1e-006

SPEC REL\_ERR=0.001