2014 EAAC TAIPEI TAIWAN

18TH EAST ASIAN ACTUARIAL CONFERENCE

12-15 October 2014

Taipei International Convention Center in Taipei Taiwan

Customer Lifetime Value: Bridging the Gap between Business Analytics and Actuarial Science

David J. Fogarty, PhD

Benny T. Wong, CFA

Jing Lin, PhD

Xiaoyu Wu, PhD

Motong Qiao, PhD

Cigna Global Customer Value Management

Common Actuarial Measures of a Portfolio Profitability

Profitability (Fogarty, 2014)

ANP
(Annualized New Premium)

sum of 100% annualized first year premiums before reinsurance ceded

GWP
(Gross Written Premium)

total premium written and assumed before deductions for reinsurance and ceding commissions

VNB
(Value of New Business)

new business PV after-tax statutory profits less the cost of required capital

VIF
(Value of In-Force)

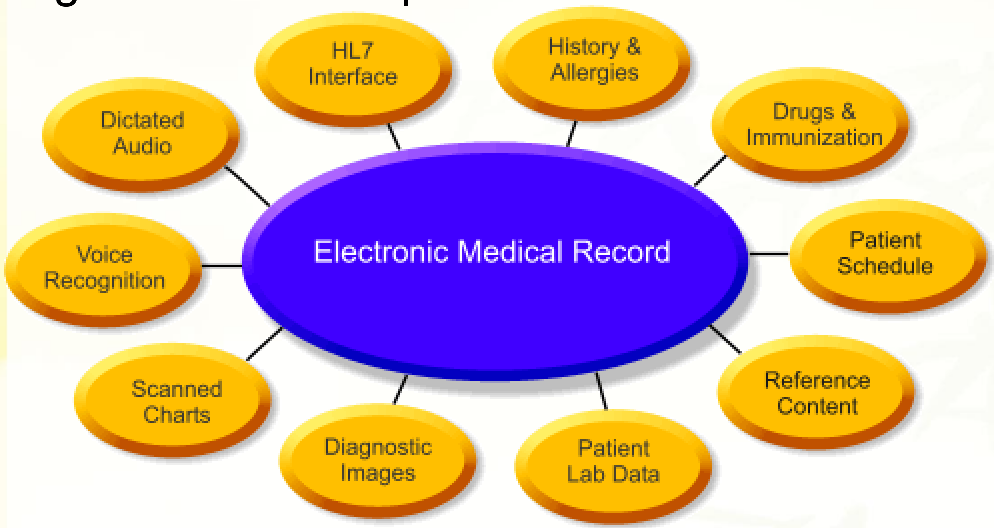
current in-force business PV after-tax statutory profits less the cost of required capital

EV
(Embedded Value)

economic value of a life insurance business based on assumptions as to future experience excluding economic value attributable to future new business

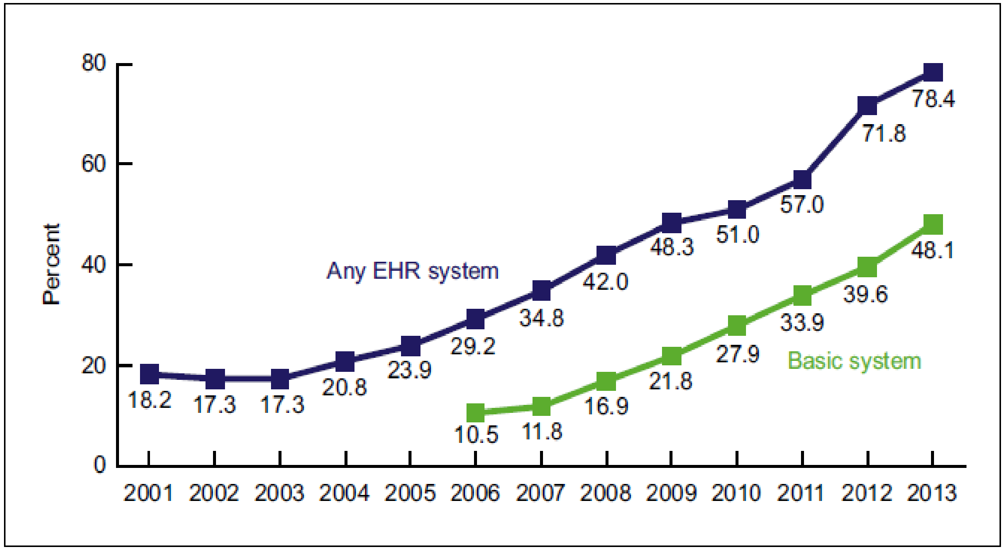
Electronic Medical Record (EMR)

EMR or EHR (Electronic Health Record) contains the standard medical and clinical data gathered in one provider's office.



- More medical data were captured electronically since early 1970 (Hannan,1996).
- Medical and claim records are electronically stored in database format.

Rapid Growth of Electronic Medical Record



Percentage of Office-Based Physicians with Electronic Health Record Systems: United States (Hsiao & Hing, 2012).

Benefits of EMR

- Track data over time
- Identify patients who are due for preventive visits and screenings
- Monitor how patients measure up to certain parameters (e.g., vaccinations and blood pressure readings)
- Improve overall quality of care in practice

Retail Banking Context

Traditional retail banking products

- Saving Accounts
- Checking Accounts
- Currency Accounts
- etc.

Customer centric financial products

- Wealth Management
- Deposits
- Home Mortgages
- Credit Cards
- Loans
- etc.

Customer centric banking

- Customer demographics, buying behaviors and needs are changing and evolving.
- Banks need a 360-degree view of each customer to target the right products, cross-sell and adapt to customer’s changing needs.

Customer Lifetime Value (CLTV)

Usage of CLTV for Credit Card Issuer

- Borrowing behaviour
- Payment behaviour
- State: inactive, transact, revolve, delinquent and default (Aeron, Bhaskar, Sundararajan, Kumar, & Moorthy, 2008)

$$CLTV = \sum_{t=1}^{T} CV_t / (1+d)^t - \mathit{Attritionloss}$$

Contributed Value (CV) of a credit card customer
= Revenue from revolving period
+ Revenue from delinquency period
+ Revenue from borrowings
- Cost of maintenance
- Cost of funds
- Loss due to default (Aeron et al., 2008)

Generalized CLTV Models in the Literature

1) $$CLTV = \sum_{t=0}^{n} \frac{m_t * r_t}{(1+d)^t}$$ ------ (Berger & Nasr, 1998)

2) $$CLTV = \sum_{t=1}^{n} \frac{R_t - C_t}{(1+d)^{(t-0.5)}}$$ ------ (Jain & Singh, 2002)

3) $$CLTV = \frac{m * r}{(1+d-r)}$$ ------ (Zhang, Dixit, & Friedmann, 2010)

R_t = Revenue in period *t*

C_t = Total cost of generating the revenue R_t in period *t*

n = Total number of anticipated periods

d = Discount rate

m_t = Gross margin in period t

r_t = Retention rate in period t

CLTV in Insurance Industry

Insurance companies are also advancing beyond traditional measures and moving toward making decisions with CLTV (Fogarty, 2014).

Insurance companies reveal their applications of CLTV.

VIF vs. CLTV

VIF and CLTV are conceptually the same.

$$VIF = PVFP - CoC$$

$$= \boxed{\sum_{t=1}^{n} \frac{P_t}{(1+d)^{(t-0.5)}}} - \boxed{\sum_{t=1}^{n} \frac{CC_{t-1} * [d - i * (1-tax)]}{(1+d)^{(t-0.5)}}}$$

P_t = Profit (after tax and reinsurance)
d = Discount rate
CC_{t-1} = Cost of capital
i = Return on assets backing the capital
tax = Corporate tax rate

$$CLTV = \boxed{\sum_{t=1}^{n} \frac{R_t}{(1+d)^{(t-0.5)}}} - \boxed{\sum_{t=1}^{n} \frac{C_t}{(1+d)^{(t-0.5)}}}$$

d = Discount rate
R_t = Revenue in period t
C_t = Total cost in period t

(Jain & Singh, 2002)

New Aspects Brought by CLTV

1. CLTV focuses on the **customer** as the influencer of a company’s profitability rather than the **products and service-lines**.
2. CLTV can be applied to evaluate which **new** and **existing customers** to target and how much the firm can spend on acquiring and retaining them (Cokins, 2010; Fogarty, 2014).

A small portion of customers are generating most profit!

A US Medical Insurance Portfolio

$$Customer\ Lifetime\ Value^4 = \sum \frac{Premium^1 - Cost^2}{Discount\ Rate} \times Persistency\ Rate^3$$

Definition:

1. Expected **premium revenue** in next 36 months
2. Expected **future cost** in next 36 months
   - Operational cost
   - Expected insurer-paid medical cost
3. Probability that customer will stay in book in each month (of future 36 months)
4. CLTV is the summation of the above results

A US Medical Insurance Portfolio

Customer Data Elements for CLTV Projection

Policy Information

Past Medical Claims

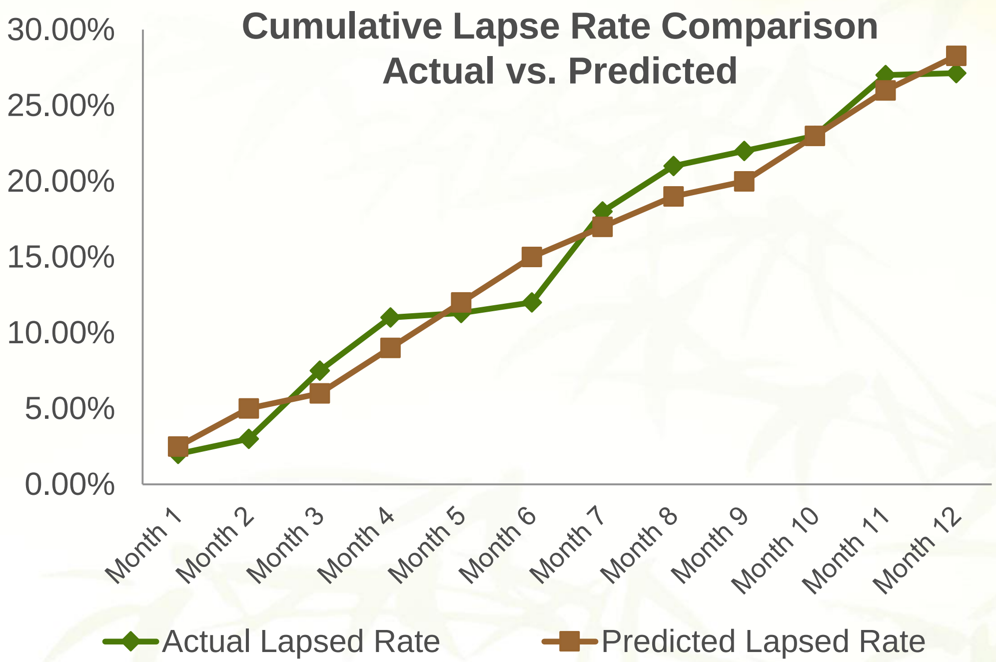
Customer Interaction Data

Past Premium Records

Customer Demographic and Residence Geographic Data

CLTV Component Validation ─ Persistency Rate

Graph 1: Persistency model validation

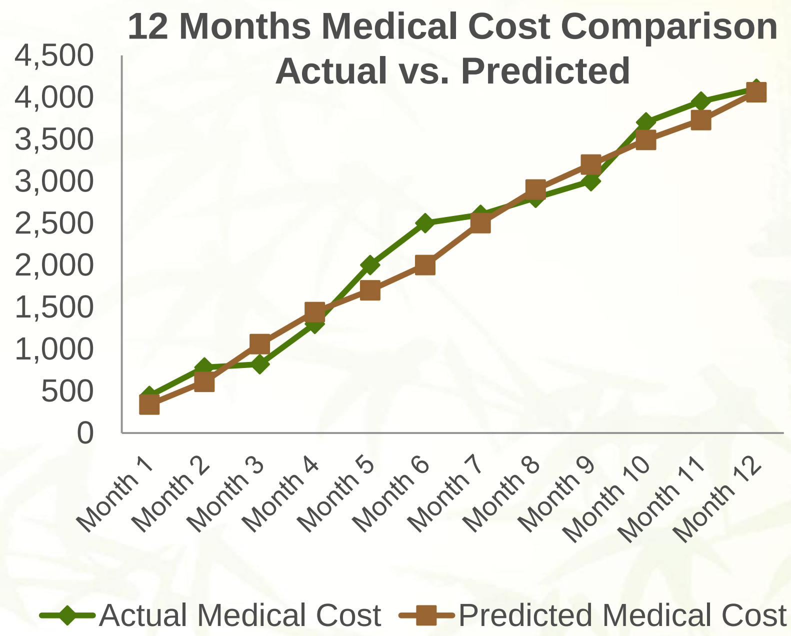


One year actual lapse rate	27.13%
One year predicted lapse rate	28.28%
Difference	**1.15%**

CLTV Component Validation — Insurer-Paid Medical Cost

- Age: 23~35
- Male
- Married
- 2~4 children

Graph 2: Insurer–paid medical cost model validation



One year actual medical cost	$ 4100
One year predicted medical cost	$ 4060
Difference	$ -40

Insight:

- Past medical data are good predictors.
- Cross-validated with Medical Loss Ratio (MLR)

Benefits of CLTV Application

- Understand the potential value of customers
- Customize different strategies
- Offer insights in managing existing customer base
- Save acquisition and retention efforts

Maximize Customer Profitability

References

- Aeron, H., Bhaskar, T., Sundararajan, R., Kumar, A., & Moorthy, J. (2008). A metric for customer lifetime value of credit card customers. *Journal of Database Marketing & Customer Strategy Management*, *15*(3), 153-168.
- Berger, P. D., & Nasr, N. I. (1998). Customer lifetime value: marketing models and applications. *Journal of interactive marketing*, *12*(1), 17-30.
- Cokins, G. (2010). *How to measure and manage customer value and customer profitability* [White paper]. Retrieved from http://www.sas.com/en_us/whitepapers/how-to-measure-and-manage-customer-value-105639.html
- Fogarty, D. J. (2014). *Customer Lifetime Value: Bridging the Gap between Business Analytics and Actuarial Science*. Unpublished manuscript.
- Hannan, T. J. (1996). Electronic medical records. *Health Informatics: An Overview*, 133-148.
- Hsiao, C. J., & Hing, E. (2012). *Use and Characteristics of Electronic Health Record Systems Among Office-based Physician Practices, United States, 2001-2012*. US Department of Health and Human Services, Centers for Disease Control and Prevention, National Center for Health Statistics.
- Jain, D., & Singh, S. S. (2002). Customer lifetime value research in marketing: A review and future directions. *Journal of interactive marketing*, *16*(2), 34-46.
- Zhang, J. Q., Dixit, A., & Friedmann, R. (2010). Customer loyalty and lifetime value: an empirical investigation of consumer packaged goods. *The Journal of Marketing Theory and Practice*, *18*(2), 127-140.