A Composite Index for Evaluating Electronic Medical Records Systems: Work in Progress

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2. Background of the study

- As the number of hospitals using electronic medical records (EMR) systems
  - continues to rise, there is
  - A need for evaluation framework that
  - Allow comparison of effectiveness of EMR systems within and between hospitals

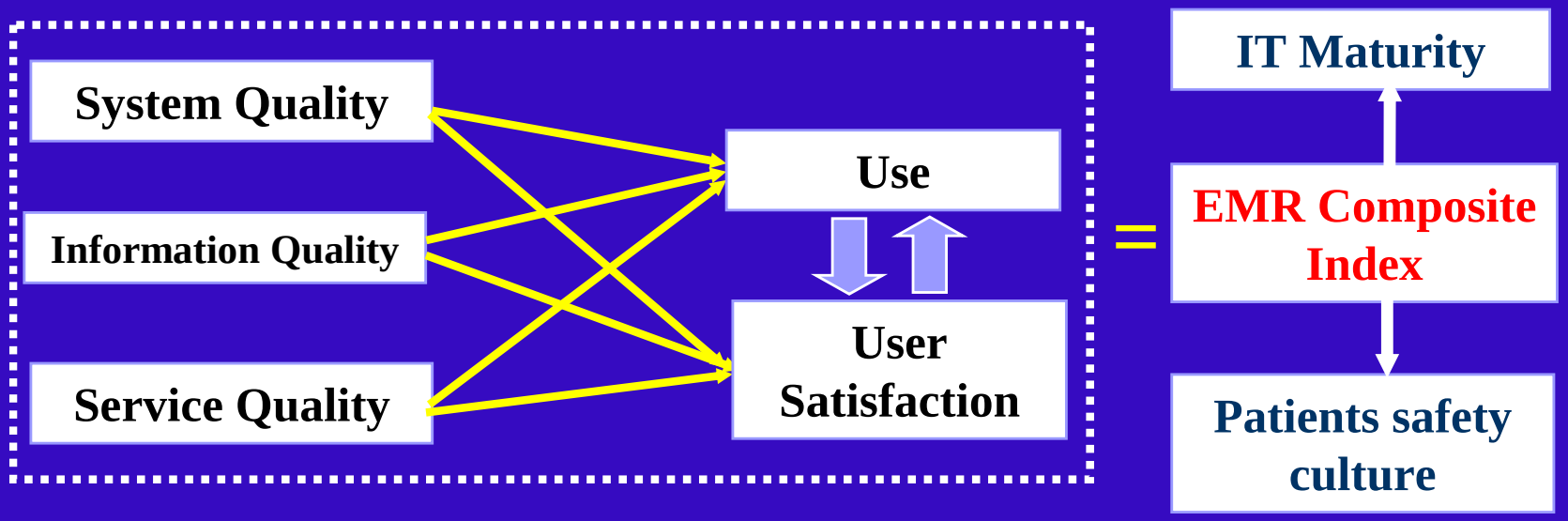
- Objective:

  To propose a framework for generating a Composite Index (C.I) for evaluating the effectiveness of EMR systems

3. The Framework:

- Involves:
  - Identification Constructs for EMR systems effectiveness
  - Identification of Items to measure the constructs
  - Calculating the Composite Index (C.I) for EMR systems effectiveness
  - Validation of the C.I

The Model



4. Methods I: Data collection

- 41from a total 69 (59.4%) hospitals returned questionnaires
- Data on IT maturity of EMR systems based on the JAHIS 5-level scale ("1" least computerized and "5" most computerized) and Patient safety culture were also collected
- 20 hospitals were selected for Composite Index (CI) calculation

  based on:

  – Whether all the 5 Target Group of users were represented
  – Whether at least 10% of doctors and /or 10% of nurses participated

5. Methods II: CI calculation

- **Principal component analysis (PCA) was the main analysis procedure because;**
  - **Items in the survey were not on the same scale**
  - **Different respondents were surveyed**
- **PCA was also used as a Data reduction and weighting process**

Benchmarking of hospitals

- **Data for the Composite Index was transformed using the "best performer" and "worst performer" approach**
- **To transform the data the following formula was used:**

$$r = 1-((Max-x) / Max) * F)$$

Where F = max / (max-min); x = original value; r = transformed value.

Thus for x = max, r = 1-0 = 1

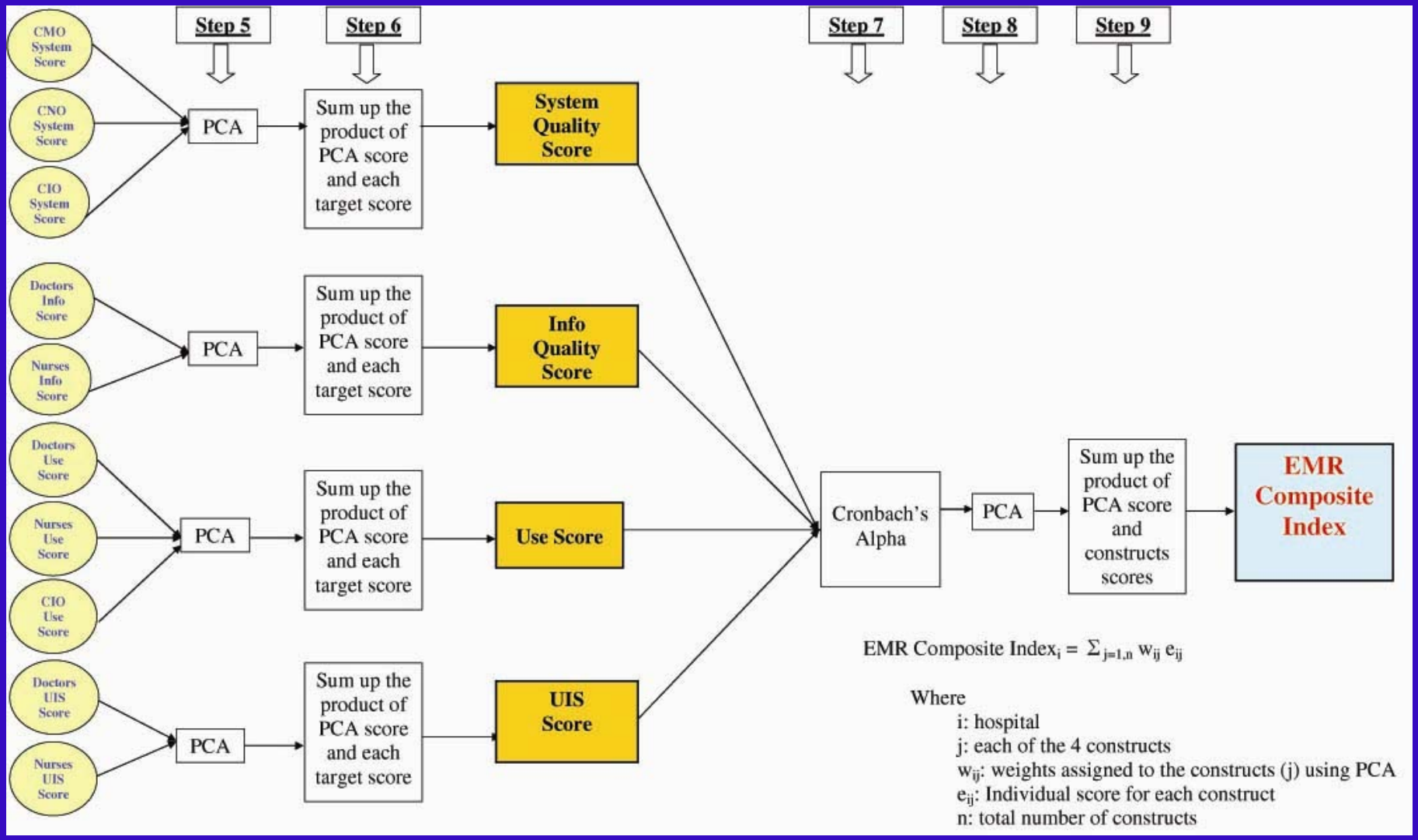
x = min, r = 1-1 = 0

6. EMR Composite Index Construction process

Constructs	No. Items	Scale	1st step	2nd step	3rd step	User group Scores
System quality Is checking drug allergy computerized?	269	Yes/no	Average	Cronbach's alpha	PCA	CIO, CMO, CNO
Information quality does the information content meet your needs?	23	5-point Likert	Factor analysis	Cronbach's alpha	PCA	Dr, NS
Service quality Is the system always up and running?	4	5-point Likert	Factor analysis	Cronbach's alpha	PCA	Dr, NS
Use How often do you use the system to check drug information?	68	5-point Likert	Factor analysis	Cronbach's alpha	PCA	Dr, NS
User satisfaction Overall, are you satisfied with the EMR system in your hospital?	31	5-point Likert	Factor analysis	Cronbach's alpha	PCA	Dr, NS

CIO-Chief Info Officer; CMO-Chief Medical Officer; CNO-Chief Nursing Officer; Dr-Doctor; NS-Nurse

7. EMR composite Index Calculation

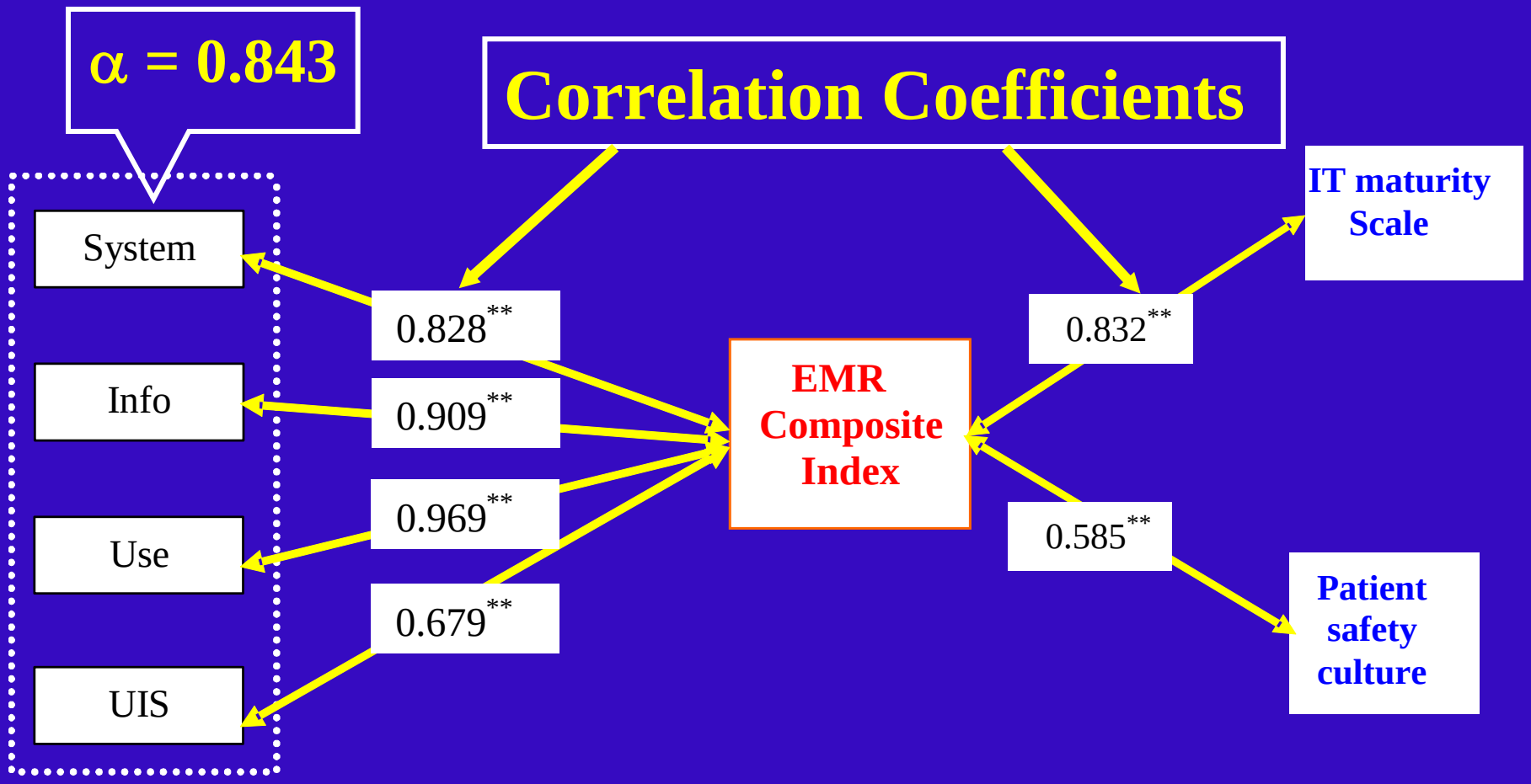


Info=information; use=extent of use of EMR system; UIS=user of information satisfaction

8. Results: EMR Composite Index (CI)

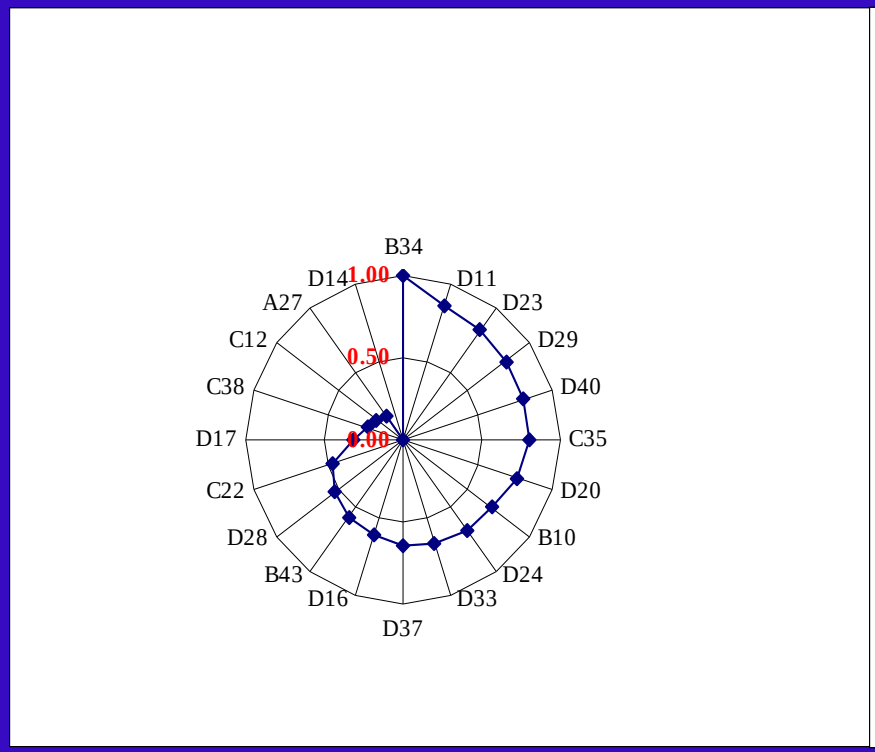
No.	Hospital code	System quality	Information quality	Use	User satisfaction	CI	IT maturity	Patient safety
1	B34	86.9	60.3	73.8	62.1	81.6	4.0	71.0
2	D11	64.4	64.5	67.8	72.5	77.9	3.0	75.1
3	D23	84.5	55.9	70.8	57.0	77.2	5.0	64.6
4	D29	82.0	58.3	69.9	56.3	76.9	3.0	76.4
5	D40	86.1	54.0	71.7	53.2	76.4	4.0	69.7
6	C35	85.6	55.0	68.2	56.9	76.3	3.0	67.7
7	D20	79.3	55.3	68.4	58.3	75.3	3.0	55.8
8	B10	76.2	56.2	67.0	55.9	73.7	3.0	72.5
9	D24	72.8	56.2	64.5	60.6	73.2	3.0	52.3
10	D33	77.1	53.9	65.0	56.6	72.7	3.0	43.5
11	D37	80.6	51.7	67.1	51.7	72.3	3.0	75.1
12	D16	73.4	52.5	65.7	55.2	71.2	3.0	64.2
13	B43	75.9	51.3	65.5	52.6	70.7	3.0	63.3
14	D28	72.7	51.6	64.7	51.7	69.5	3.0	59.9
15	C22	73.4	51.2	59.1	51.8	67.7	3.0	63.3
16	D17	55.2	51.4	55.9	57.5	63.6	2.5	63.3
17	C38	61.1	48.4	51.1	53.2	61.5	2.5	49.4
18	C12	64.4	42.8	57.1	46.7	60.8	2.0	55.6
19	A27	66.7	44.1	51.4	46.9	60.0	2.5	60.2
20	D14	53.2	42.7	47.1	49.5	55.4	2.5	63.3

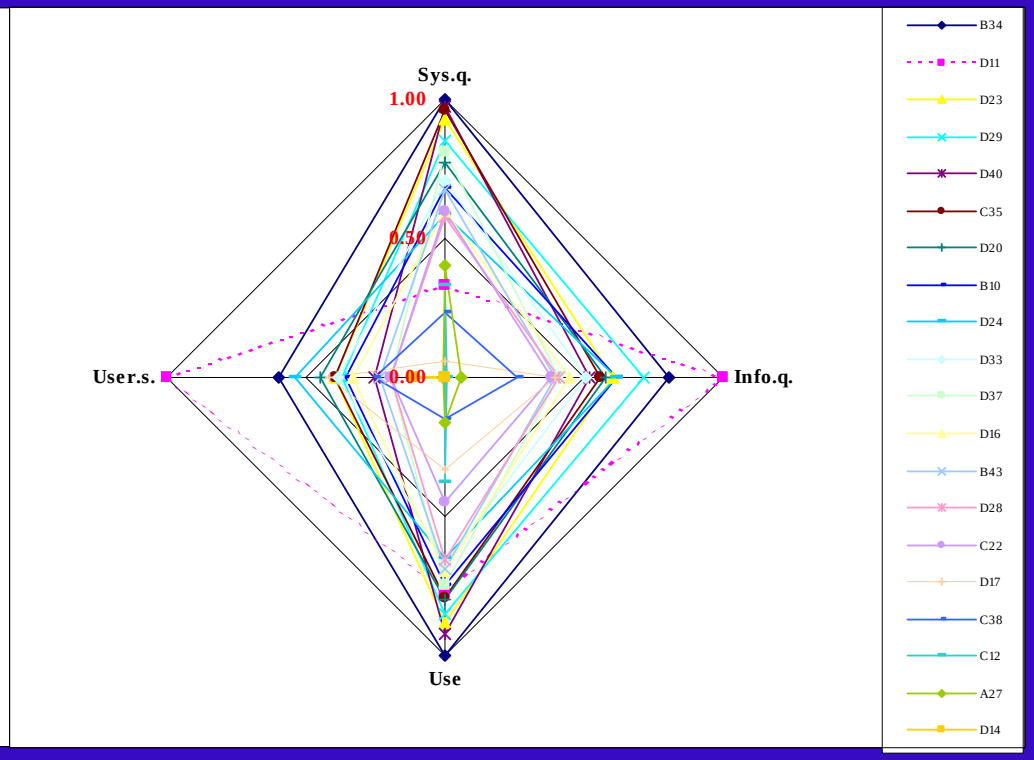
9. Validation of the CI



**p-value < 0.01 level (2-tailed Pearson correlation)

10. Benchmarking of the hospitals using CI





Sys.q=system quality; info.q=information quality; user s=user satisfaction

11. Discussion and conclusion

- These initial results show that:
  - The CI is internally consistent
  - has good construct validity, and
  - is sensitive to differences between hospitals

- Proposed a framework for evaluating effectiveness of EMR systems by;
  - Identifying relevant constructs, and
  - Describing a procedure for CI generation
- The CI can:
  - Provide a detailed scorecard for EMR systems, and
  - Allow analyst to pinpoint areas of strengths and weakness to guide computerization

12. References, Acknowledgement & Contact

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