HUMAN SERVICES LICENSING MEASUREMENT, REGULATORY COMPLIANCE AND PROGRAM MONITORING SYSTEMS: ECPQI2M4©/DMLMA© MATH MODELING

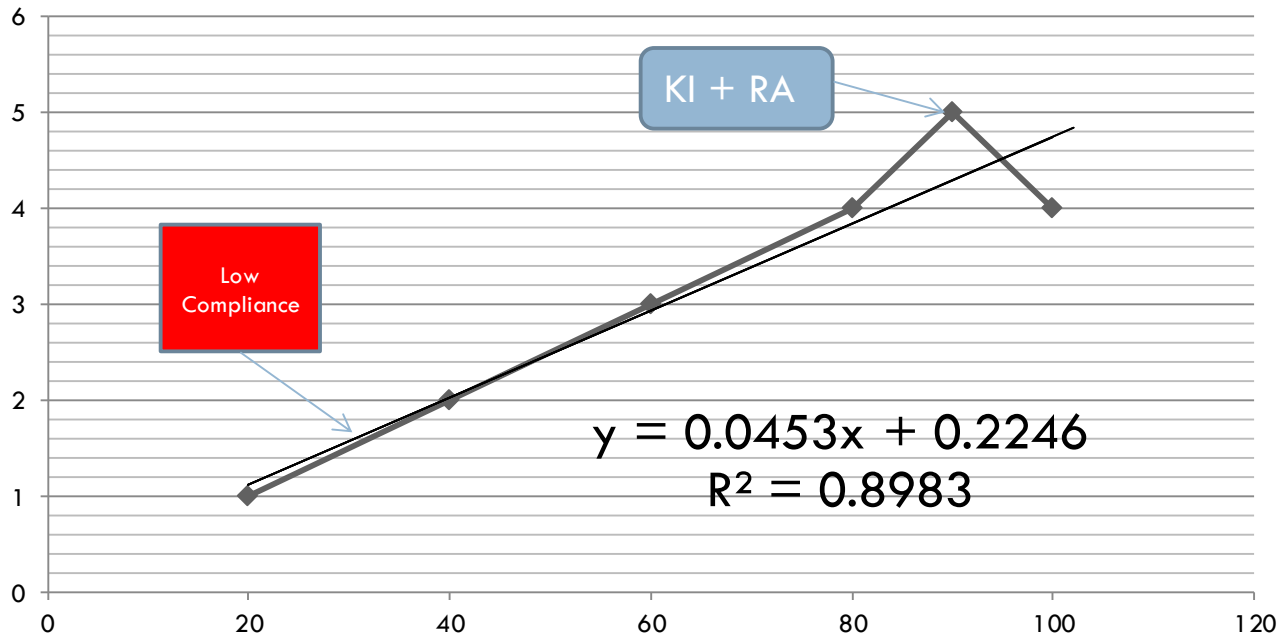**Richard Fiene, Ph.D.**

Research Psychologist
RIKI/NARA

Relationship between PC (CI) & PQ
(Fiene & Nixon, 1985)(Fiene, 1985)

PQ = ERS/CLASS

KI + RA

Low Compliance

$y = 0.0453x + 0.2246$
$R^2 = 0.8983$

PC = % Rule Compliance

Comparing HSPS Violations with CLASS Scores (Fiene, 2013c)

HSPS/CM Violations	IS	ES	CO	Number/Percent
0 (Full Compliance)	3.03	5.99	5.59	75/19%
1-2 (Substantial Compliance)	**3.15**	5.93	5.50	135/35%
3-8 (Mid-Compliance)	2.87	5.85	5.37	143/40%
9-19 (Lower Compliance)	2.65	5.71	5.32	28/6%
20-25 (Lowest Compliance)	2.56	5.52	4.93	3/1%
Significance	**$F = 4.92; p < .001$**	**$F = 4.918; p < .001$**	**$F = 4.174; p < .003$**	

CM Violations = Compliance Measure Violations (lower score = higher compliance)(higher score = lower compliance)

IS = Average CLASS IS (Instructional Support) Score

ES = Average CLASS ES (Emotional Support) Score

CO = Average CLASS CO (Classroom Organization) Score

#/% = Number of programs and Percent of programs at each level of compliance

PC & PQ Comparison of CC and PK (Fiene, 2013e)

PC = Child Care Licensing Compliance	**PQ = Pre-K Program Licensing Compliance**
□ **Licensing / ECERS-R**	□ **Licensing / ECERS-R**
□ 100 / 3.40 Full Compliance	□ 100 / 4.88 Full Compliance
□ 99 / 4.35	□ 99 / 4.13
□ 98 / 3.89 Substantial Compliance	□ 98 / 4.38 Substantial Compliance
□ 97 / 3.15	□ 97 / 3.99
□ 96 / 3.16	□ 96 / 4.36
□ 95 / 3.53	□ 95 / 4.60
□ 90 / 2.56 Medium Compliance	□ 90 / 3.43 Medium Compliance
□ 80 / 2.38 Low Compliance	□ 80 / 2.56 Low Compliance

DIFFERENTIAL MONITORING LOGIC MODEL & ALGORITHM (DMLMA©) (Fiene, 2012): A 4th Generation ECPQIM – Early Childhood Program Quality Indicator Model

CI x PQ => RA + KI => DM + PD => CO

Definitions of Key Elements:

CI = Comprehensive Licensing Tool (Health and Safety)(*Caring for Our Children*)
PQ *= ECERS-R, FDCRS-R, CLASS, CDPES* (Caregiver/Child Interactions/Classroom Environment)
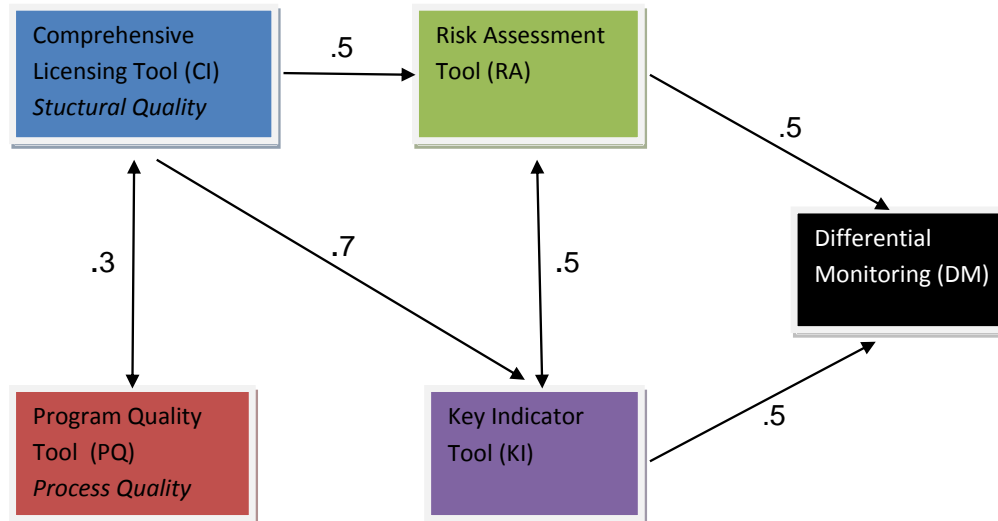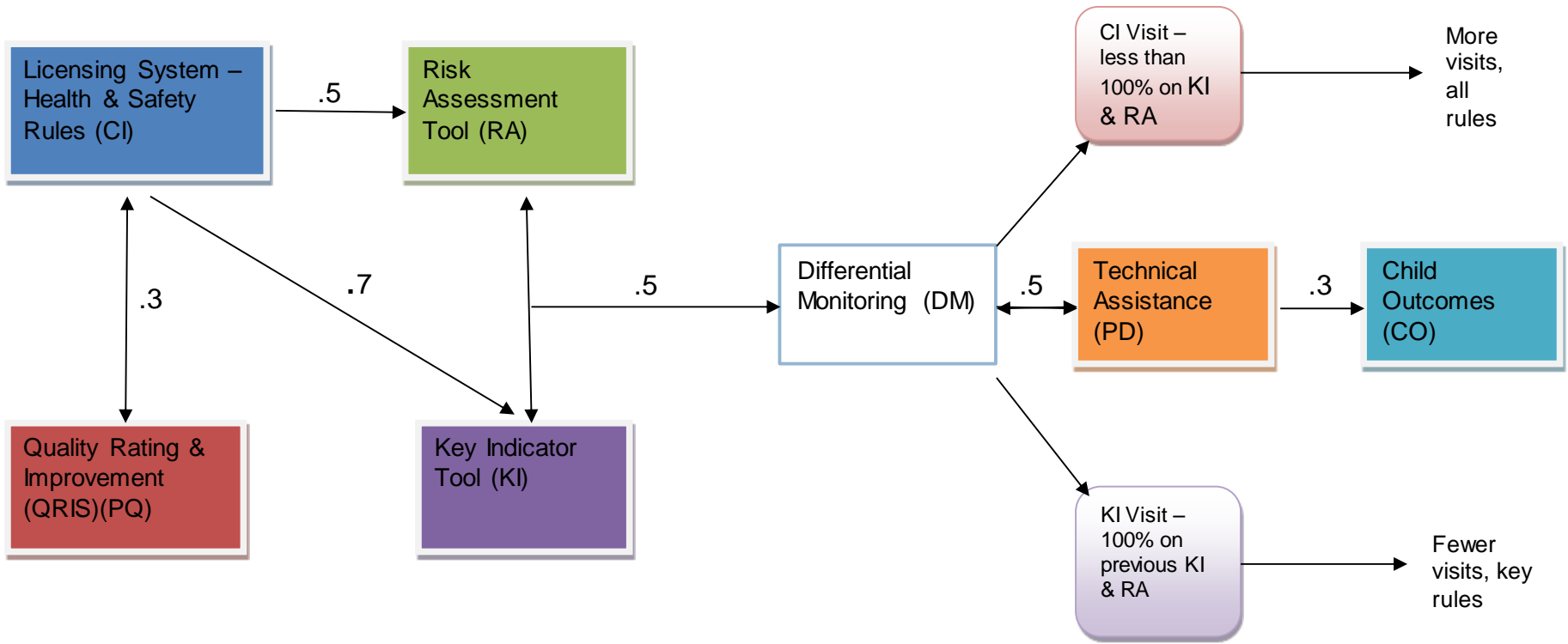RA = Risk Assessment, (High Risk Rules)(*Stepping Stones*)
KI = Key Indicators (Predictor Rules*)(13 Key Indicators of Quality Child Care*)
DM = Differential Monitoring, (How often to visit and what to review)
PD = Professional Development/Technical Assistance/Training
CO = Child Outcomes (See Next Slide for PD and CO Key Elements)

Licensing System – Health & Safety Rules (CI)

Risk Assessment Tool (RA)

.5

.3

.7

.5

Quality Rating & Improvement (QRIS)(PQ)

Key Indicator Tool (KI)

Differential Monitoring (DM)

CI Visit – less than 100% on KI & RA

More visits, all rules

.5

Technical Assistance (PD)

.3

Child Outcomes (CO)

KI Visit – 100% on previous KI & RA

Fewer visits, key rules

$$\sum CI \times \sum PQ \Rightarrow \sum RA + \sum KI \Rightarrow \sum DM + \sum PD \Rightarrow CO$$

DIFFERENTIAL MONITORING LOGIC MODEL & ALGORITHM (DMLMA©) (Fiene, 2014): A 4th Generation ECPQIM – Early Childhood Program Quality Indicator Model
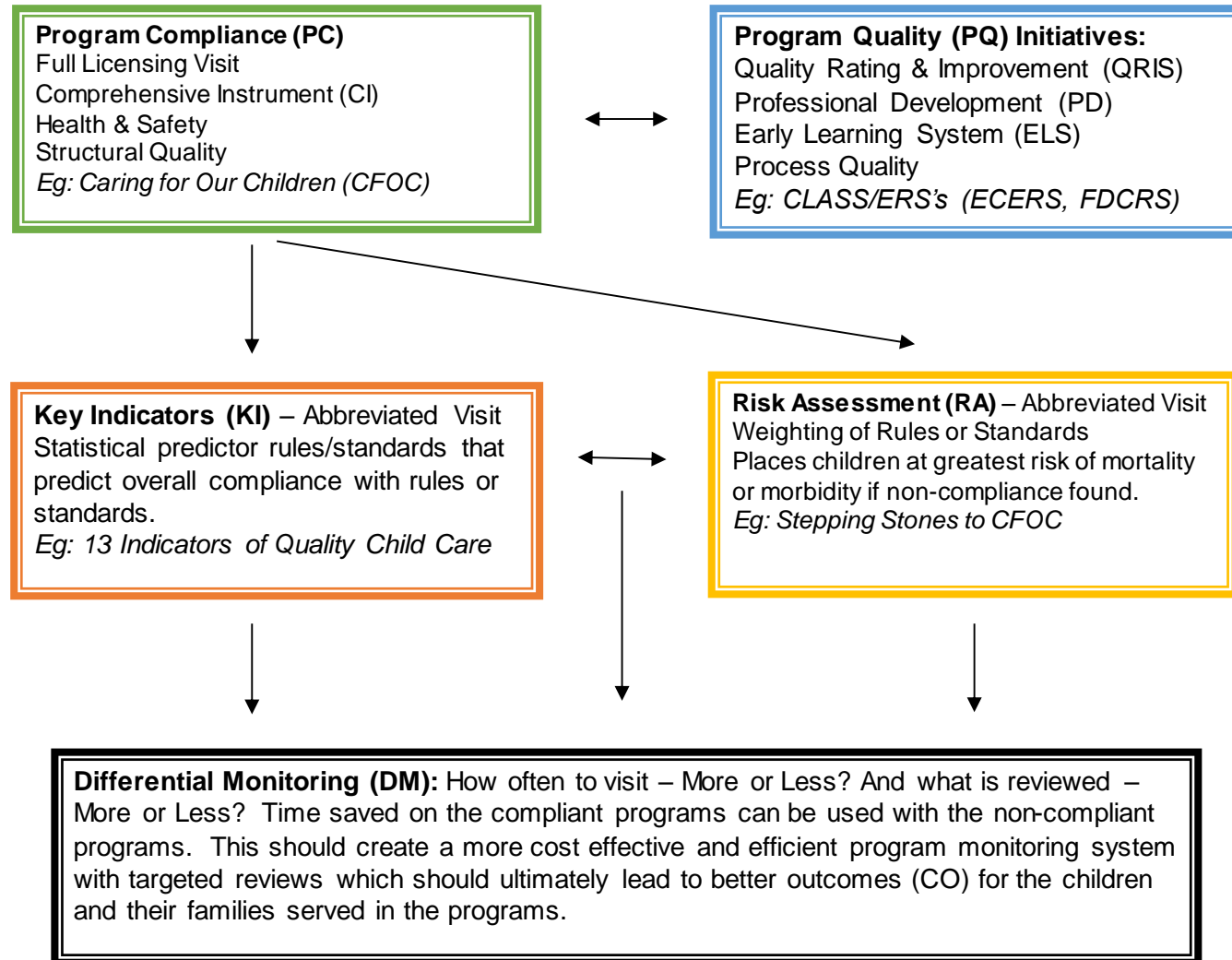
CI x PQ(PD) => RA + KI => DM => CO

Definitions of Key Elements:

CI = Comprehensive Licensing Tool (Health and Safety)(*Caring for Our Children*)(Structural Quality)
PQ = Program Quality Initiatives *(ECERS-R, FDCRS-R, CLASS, CDPES, QRIS, Accreditation)* (Process Quality)
PD = Program Quality Initiatives (cont) - Professional Development/Technical Assistance/Training
RA = Risk Assessment, (High Risk Rules/Standards)(*Stepping Stones*)
KI = Key Indicators (Predictor Rules/Standards*)(13 Key Indicators of Quality Child Care*)
DM = Differential Monitoring, (How often to visit and what to review)
CO = Child Outcomes (Developmental, Health, & Safety Outcomes)
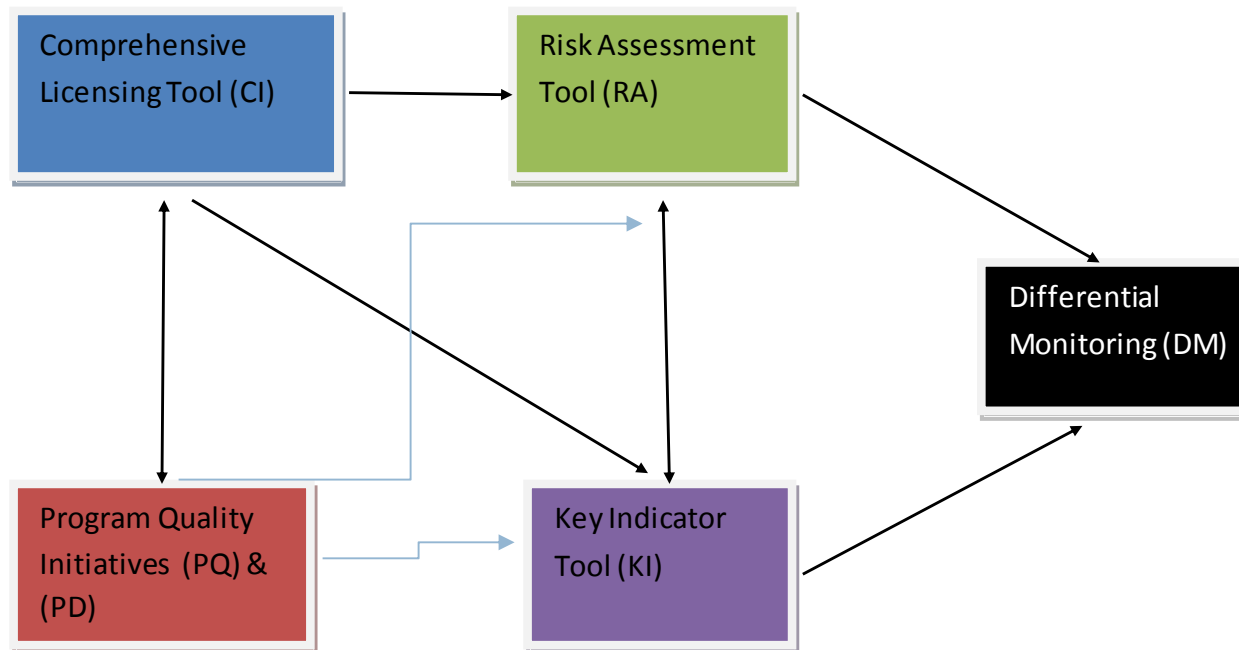
Early Childhood Program Quality Indicator Model (ECPQIM4©): Differential Monitoring Logic Model (DMLM©)(Fiene, 2014)

Program Compliance (PC)
Full Licensing Visit
Comprehensive Instrument (CI)
Health & Safety
Structural Quality
Eg: Caring for Our Children (CFOC)

Program Quality (PQ) Initiatives:
Quality Rating & Improvement (QRIS)
Professional Development (PD)
Early Learning System (ELS)
Process Quality
Eg: CLASS/ERS's (ECERS, FDCRS)

Key Indicators (KI) – Abbreviated Visit
Statistical predictor rules/standards that predict overall compliance with rules or standards.
Eg: 13 Indicators of Quality Child Care

Risk Assessment (RA) – Abbreviated Visit
Weighting of Rules or Standards
Places children at greatest risk of mortality or morbidity if non-compliance found.
Eg: Stepping Stones to CFOC

Differential Monitoring (DM): How often to visit – More or Less? And what is reviewed – More or Less? Time saved on the compliant programs can be used with the non-compliant programs. This should create a more cost effective and efficient program monitoring system with targeted reviews which should ultimately lead to better outcomes (CO) for the children and their families served in the programs.

Differential Monitoring Scoring Protocol (DMSP)©

Score	Systems Present
0	No systems in place.
2	KI or RA in place and not linked.
4	(KI & RA in place but not linked) or (PC + PQ are linked).
6	(KI & RA in place) & (KI + RA are linked).
8	(KI & RA in place but not linked) & ((PC + PQ) are linked).
10	All systems in place and linked.

10 POINTS

ALL SYSTEMS IN PLACE AND LINKED.

Example
HEAD START

8 POINTS

KI & RA IN PLACE BUT NOT LINKED; AND PC & PQ LINKED.

Example
Georgia

6 POINTS

KI & RA IN PLACE & LINKED.

Examples
Illinois
New York

4 POINTS

KI & RA IN PLACE BUT NOT LINKED OR PC & PQ LINKED.

Example
None

2 POINTS

KI OR RA IN PLACE.

Examples
Colorado
Kansas

0 POINTS

NO SYSTEMS

Differential Monitoring Scoring Protocol (DMSP)©
Point Assignment

Score	Systems Present and Point Assignment
0	No systems in place.
2	(KI (1)) & (KI -> DM (1)) or ((RA (1)) & (RA -> DM (1))
4	(PC + PQ (4)) or (KI (1) & (KI -> DM (1)) & (RA (1) & (RA -> DM (1))
6	(KI + RA -> DM (4)) & (KI (1)) & (RA (1))
8	(KI (2) & RA (2)) & (PC + PQ (4)).
10	(KI + RA -> DM (4)) & (KI (1)) & (RA (1)) & (PC + PQ (4))

_____

KI (Key Indicators); RA (Risk Assessment); PC (Program Compliance/Licensing); PQ (Program Quality Initiatives; DM (Differential Monitoring).

SYSTEMS (pts)	MODEL	GA	NY	HS	IL	KS	CO
KI (1)	1	-	1	1	1	1	1
RA (1)	1	1	1	1	1	-	-
KI + RA -> DM (4) KI + RA (2)	4	2	4	4	4		
PC + PQ (4)	4	4	-	4	-	-	-
KI -> DM (1)						1	1
RA -> DM (1)		1				-	-
TOTAL (10)	10	8	6	10	6	2	2

Validation Approaches (Zellman & Fiene, 2012)

- **First Approach (Standards)**
  - **CI x *Caring for Our Children/Stepping Stones/13 Key Indicators of Quality Child Care***
- **Second Approach (Measures)**
  - **CI x RA + KI x DM**
- **Third Approach (Outputs)**
  - **PQ x CI**
- **Fourth Approach (Outcomes)**
  - **CO = PD + PQ + CI + RA + KI**

DMLMA© Expected Thresholds

DMLMA© Expected Thresholds	DMLMA© Key Elements Examples
□ .70+	□ CI x KI
□ .50+	□ RA x CI; RA x DM; RA x KI; DM x KI; DM x PD
□ .30+	□ PQ x CI; PQ x CO; RA x CO; KI x CO; CI x CO

DMLMA Expected Thresholds Matrix*

	PQ	RA	KI	DM	PD	CO
CI	0.3	0.5	0.7	0.5	0.5	NS
PQ				0.3	0.3	NS
RA			0.5	0.5	0.5	0.3
KI				0.5	0.5	0.3
DM					0.5	
PD						0.4

A Validation Study: State Example (Fiene, 2013e)

Validation Approach/Research Question	CCC Actual (Expected*)		FCC Actual (Expected)
1 STANDARDS/Key Indicators	VALIDATED		VALIDATED
KI x CR	.49 (.50+)		.57 (.50+)
KI x LS	.78 (.70+)		.87 (.70+)
2 MEASURES/Core Rules/ACDW	VALIDATED		VALIDATED
CR x LS	.69 (.50+)		.74 (.50+)
CR x ACDW	.76 (.50+)		.70 (.50+)
3 OUTPUTS/Program Quality	VALIDATED		NOT VALIDATED
ECERS-R/PK x LS	.37 (.30+)	FDCRS x LS	.19 (.30+)
ECERS-R/PS x LS	.29 (.30+)		------
ECERS-R/PK x CR	.53 (.30+)	FDCRS x CR	.17 (.30+)
ECERS-R/PS x CR	.34 (.30+)		------

*See below for the expected r values for the *DMLMA©* thresholds which indicate the desired correlations between the various tools.

DMLMA© Thresholds:

High correlations (.70+) = LS x KI.

Moderate correlations (.50+) = LS x CR; CR x ACDW; CR x KI; KI x ACDW.

Lower correlations (.30+) = PQ x LS; PQ x CR; PQ x KI.

Validation of Key Indicator Systems

Figure 1	Providers who fail the Key Indicator review	Providers who pass the Key Indicator review	Row Totals
Providers who fail the Comprehensive review	W	X	
Providers who pass the Comprehensive Review	Y	Z	
Column Totals			Grand Total

Annotations for Figure 1

- A couple of annotations regarding Figure 1.

- **W + Z** = the number of agreements in which the provider passed the Key Indicator review and also passed the Comprehensive review.

- **X** = the number of providers who passed the Key Indicator review but failed the Comprehensive review. This is something that should not happen, but there is always the possibility this could occur because the Key Indicator Methodology is based on statistical methods and probabilities. We will call these False Negatives (FN).

- **Y** = the number of providers who failed the Key Indicator review but passed the Comprehensive review. Again, this can happen but is not as much of a concern as with "**X**". We will call these False Positives (FP).

National Validation Data

Figure 2	Providers who fail the Key Indicator review	Providers who pass the Key Indicator review	Row Total
Providers who fail the Comprehensive review	25	1	26
Providers who pass the Comprehensive Review	7	17	24
Column Total	32	18	50

Formula for Agreement Ratio

- To determine the agreement ratio, we use the following formula:

$$\frac{A}{A + D}$$

- Where A = Agreements and D = Disagreements.

- Based upon Figure 2, A + D = 42 which is the number of agreements; while the number of disagreements is represented by B = 1 and C = 7 for a total of 8 disagreements. Putting the numbers into the above formula:

$$\frac{42}{42 + 8}$$

Or

.84 = Agreement Ratio

- The False Positives (FP) ratio is .14 and the False Negatives (FN) ratio is .02. Once we have all the ratios we can use the ranges in Figure 3 to determine if we can validate the Key Indicator System. The FP ratio is not used in Figure 3 but is part of the Agreement Ratio.

Thresholds for Validating Key Indicators for Licensing Rules

Agreement Ratio Range	False Negative Range	Decision
(1.00) – (.90)	.05+	Validated
(.89) – (.85)	.10 - .06	Borderline
(.84) – (.00)	.11 or more	Not Validated

State Example of Violation Data (Fiene, 2013d)

Violation Data in Centers and Homes by Regional Location

Region	Centers		Homes	
	Violations*	Number	Violations*	Number
1	9.30	109	2.42	117
2	8.32	191	4.63	120
3	5.31	121	3.94	138
4	5.57	61	3.02	125

* = Average (Means)

Violation Data in Centers and Homes by Type of Licensing Inspection

License Type	Centers		Homes	
	Violations*	Number	Violations*	Number
Initial	7.44	36	3.35	20
Renewal	7.07	368	3.53	469
Amendment	9.51	55	4.00	2
Correction	6.71	14	3.00	8
Temporary	11.22	9	4.00	1

* = Average (Mean)

Head Start: Content Area Correlations (Fiene, 2013c)

		CHS	ERSEA	FCE	FIS	GOV	SYS
CDE		.33**	.26**	.06ns	.14**	.13*	.33**
CHS			.29**	.18**	.09ns	.25**	.51**
ERSEA				.15**	.10*	.27**	.38**
FCE					.01ns	.17**	.23**
FIS						.13*	.23**
GOV							.38**

International Study of Child Care Rules (Fiene, 2013a)
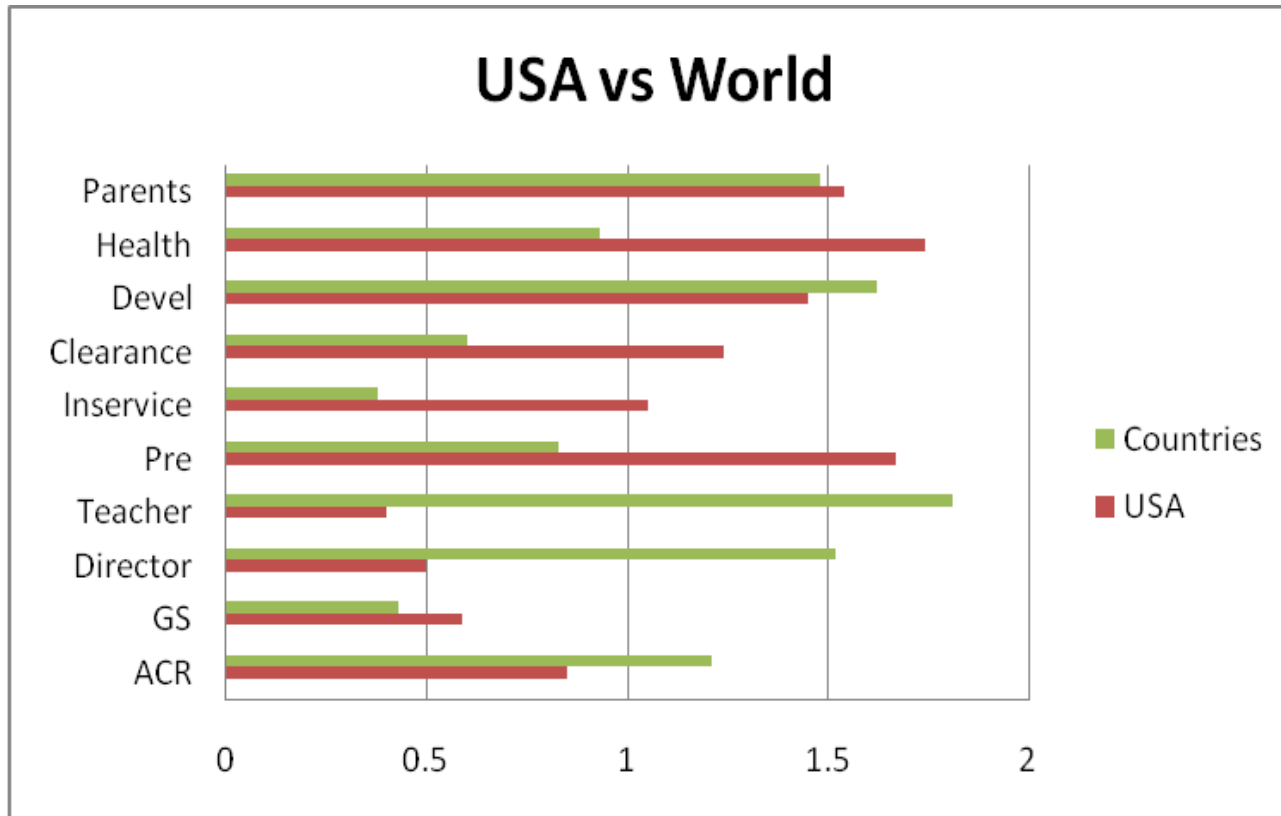
International Study Benchmarks

Benchmark	Countries	USA	Significance
ACR (R1)	1.1220	0.8462	not significant
GS (R2)	0.4063	0.5865	not significant
Director (R3)	**1.5625**	0.5000	t = 7.100; p < .0001
Teacher (R4)	**1.6563**	0.4038	t = 7.632; p < .0001
Preservice (R5)	0.9375	**1.6731**	t = 4.989; p < .001
Inservice (R6)	0.6563	**1.0481**	t = 2.534; p < .02
Clearances (R7)	0.6094	**1.2404**	t = 3.705; p < .01
Development (R8)	1.6406	1.4519	not significant
Health (R9)	0.9844	**1.7404**	t = 6.157; p < .0001
Parent (R10)	1.5000	1.5385	not significant

Parent = Parent Involvement (R10)

Health = Health and safety recommendations (R9)

Development = Six developmental domains (R8)

Clearances = Background check (R7)

Inservice = 24 hours of ongoing training (R6)

Preservice = Initial orientation training (R5)

Teacher = Lead teacher has CDA or Associate degree (R4)

Director = Directors have bachelor's degree (R3)

GS = Group size NAEYC Accreditation Standards met (R2)

ACR = Staff child ratios NAEYC Accreditation Standards met (R1)

NECPA/ERS's/QRIS (Fiene, 1996)

	STAR 1	STAR 2	STAR 1 and 2 Combined	STAR 3	STAR 4
NECPA Score (without Infant/Toddler Section	n = 21 Mean = 647.04 Range: 408.99 to 887.54 s.d.: 163.79	n = 4 Mean: 648.1 Range: 365.84 to 881.93 s.d.: .220.87	n = 25 Mean: 647.21 Range: 365.84 to 887.54 s.d.: .168.69	n = 2 Mean: 824.27 Range: 789.13 to 859.40 s.d.: .49.69	n = 23 Mean: 752.93 Range: 427.36 to 894.32 s.d.: 132.12
ECERS-R Score	n = 20 Mean: 3.92 Range: 2.40 to 5.68 s.d.: .97	n = 4 Mean: 3.52 Range: 3.45 to 3.66 s.d.: .094	n = 24 Mean: 3.86 Range: 2.40 to 5.68 s.d.: .896	n = 2 Mean: 5.67 Range: 5.45 to 5.88 s.d.: .304	n = 23 Mean: 5.35 Range: 2.95 to 6.36 s.d.: ..867
NECPA Score (Infant/Toddler Only)	n = 6 Mean: 83.50 Range: 59 to 138 s.d.: 30.81	n = 1 Mean: 79.0	n = 7 Mean: 82.86 Range: 59.0 to 138.0 s.d.: 28.17	n = 0	n = 7 Mean: 134.0 Range: 102.0 to 163.0 s.d.: 21.66
ITERS-R	n = 9 Mean: 3.72 Range: 2.81 to 5.22 s.d.: .706	n = 1 Mean: 5.01	n = 10 Mean: 3.85 Range: 2.81 to 5.22 s.d.:.781	n = 1 Mean: 4.29	n = 12 Mean: 5.15 Range: 3.21 to 6.39 s.d.: .821

Key Indicator Formula Matrix

Use data from this matrix in the formula on the next slide in order to determine the phi coefficients.

	Providers In Compliance with specific standard	*Programs Out Of Compliance with specific standard*	*Row Total*
High Group = top 25%	*A*	*B*	*Y*
Low Group = bottom 25%	C	D	*Z*
Column Total	*W*	*X*	**Grand Total**

Key Indicator Matrix Expectations

- **A + D > B + C**

- **A + D** $=$ 100% is the best expectation possible.

- If **C** has a large percentage of hits, it increases the chances of other areas of non-compliance (False positives).

- If **B** has a large percentage of hits, the predictive validity drops off considerably (False negatives).

Key Indicator Statistical Methodology

$$\phi = (A)(D) - (B)(C) \div \sqrt{(W)(X)(Y)(Z)}$$

A = High Group + Programs in Compliance on Specific Compliance Measure.
B = High Group + Programs out of Compliance on Specific Compliance Measure.
C = Low Group + Programs in Compliance on Specific Compliance Measure.
D = Low Group + Programs out of Compliance on Specific Compliance Measure.

W = Total Number of Programs in Compliance on Specific Compliance Measure.
X = Total Number of Programs out of Compliance on Specific Compliance Measure.
Y = Total Number of Programs in High Group.
Z = Total Number of Programs in Low Group.

Key Indicator Coefficient Ranges

KI Coefficient Range	Characteristic of Indicator	Decision
(+1.00) – (+.26)	**Good Predictor - Licensing**	**Include**
(+1.00) – (+.76)	*Good Predictor – QRIS*	*Include*
(+.25) – (-.25)	**Unpredictable - Licensing**	**Do not Include**
(+.75) – (-.25)	*Unpredictable - QRIS*	*Do not Include*
(-.26) – (-1.00)	**Terrible Predictor**	**Do not Include**

Head Start Key Indicators (Fiene, 2013c)

CM	Phi	ES	CO	IS	Total Violations
CDP4.1	.28***	.10*	ns	ns	.30***
CHS1.1	.39***	.15**	.16**	ns	.39***
CHS1.2	.33***	.18**	.15**	.10*	.36***
CHS2.1	.49***	.18**	.15**	ns	.54***
CHS3.10	.39***	.11*	.11*	ns	.24***
PRG2.1	.31***	.11*	ns	ns	.46***
SYS2.1	.47***	.15**	.16**	.14**	.55***
SYS3.4	.58***	.13*	.10*	ns	.36***

P < .05

• **p < .01*

****p< .001*

Key Indicator (KI) Formula Matrix for ECERS Item 16 – Children Communicating

These data are taken from a 2002 Program Quality Study (Fiene, et al) completed in Pennsylvania. The phi coefficient was 1.00. The first time this has occurred in generating key indicators. It was replicated in a 2006 QRIS – Keystone STARS Evaluation.

	Providers with a 5 or higher on Item 16	Programs with a 3 or less on Item 16	Row Total
High Group – 5.00+	117	0	117
Low Group – 3.00 or less	0	35	35
Column Total	117	35	152

Box Plot of ECERS Item 16
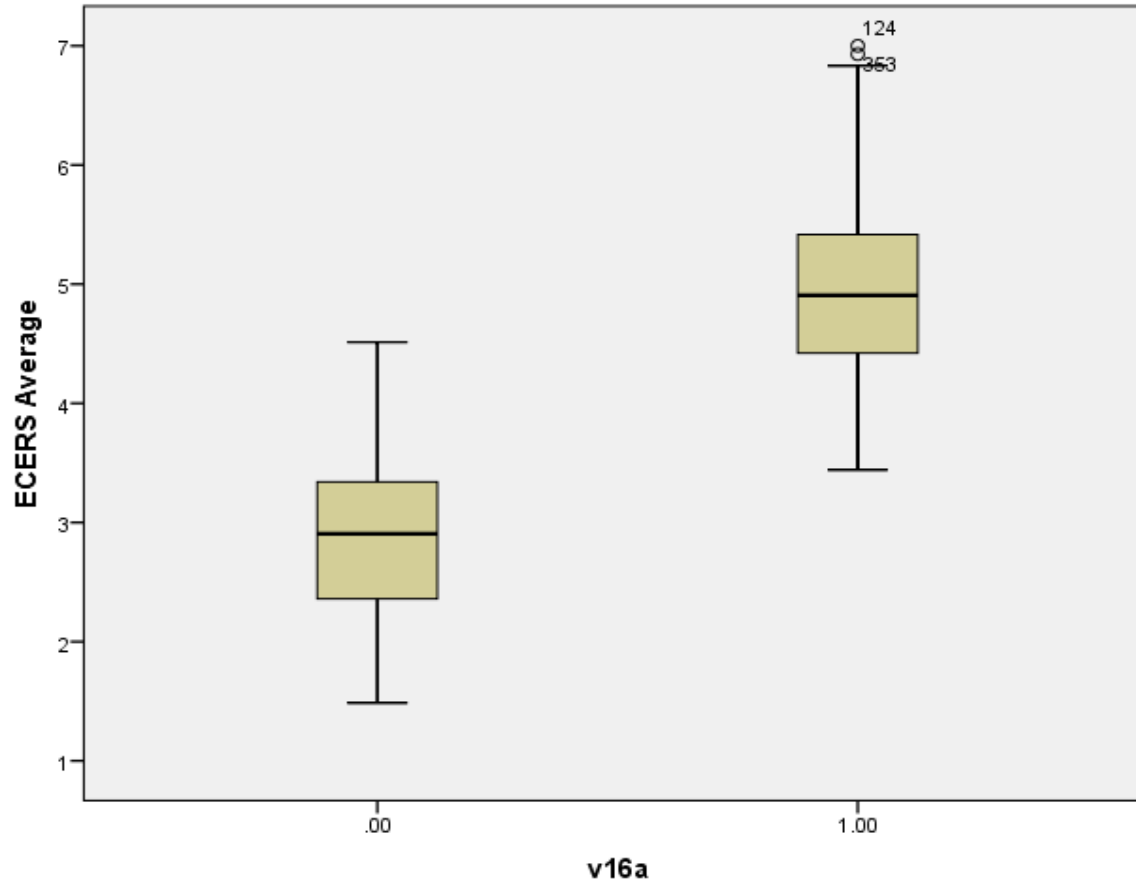
Box Plot of ECERS Item 39
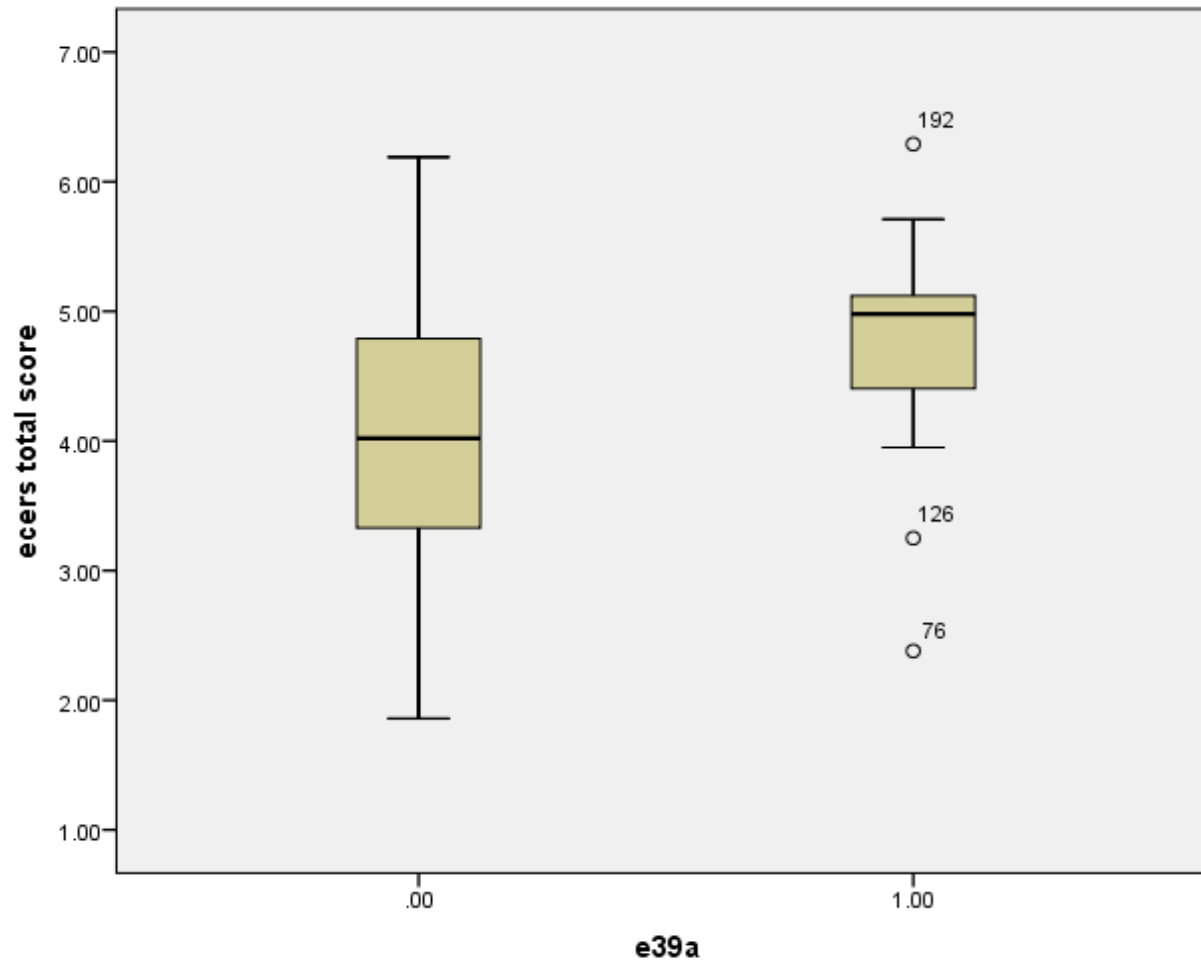
Normal & Skewed Data
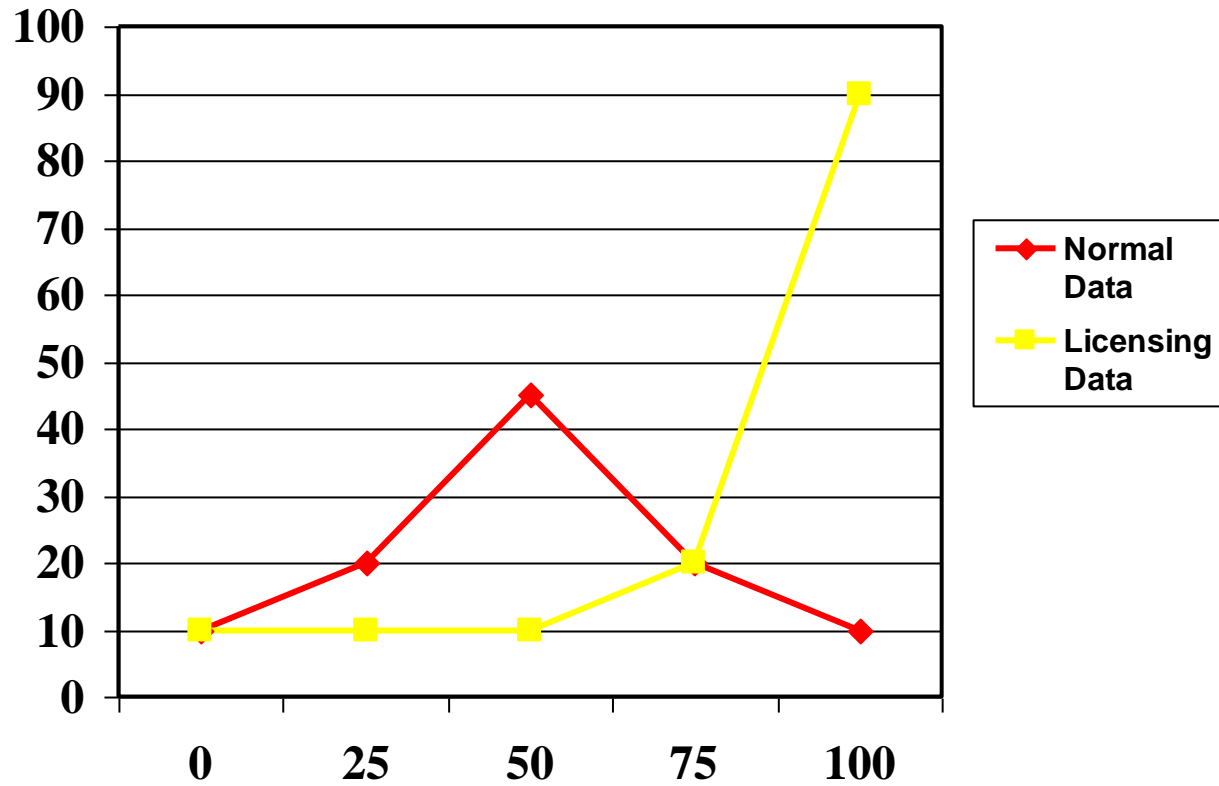
ECERS Total Scores

Mean = 4.24
Std. Dev. = .938
N = 209
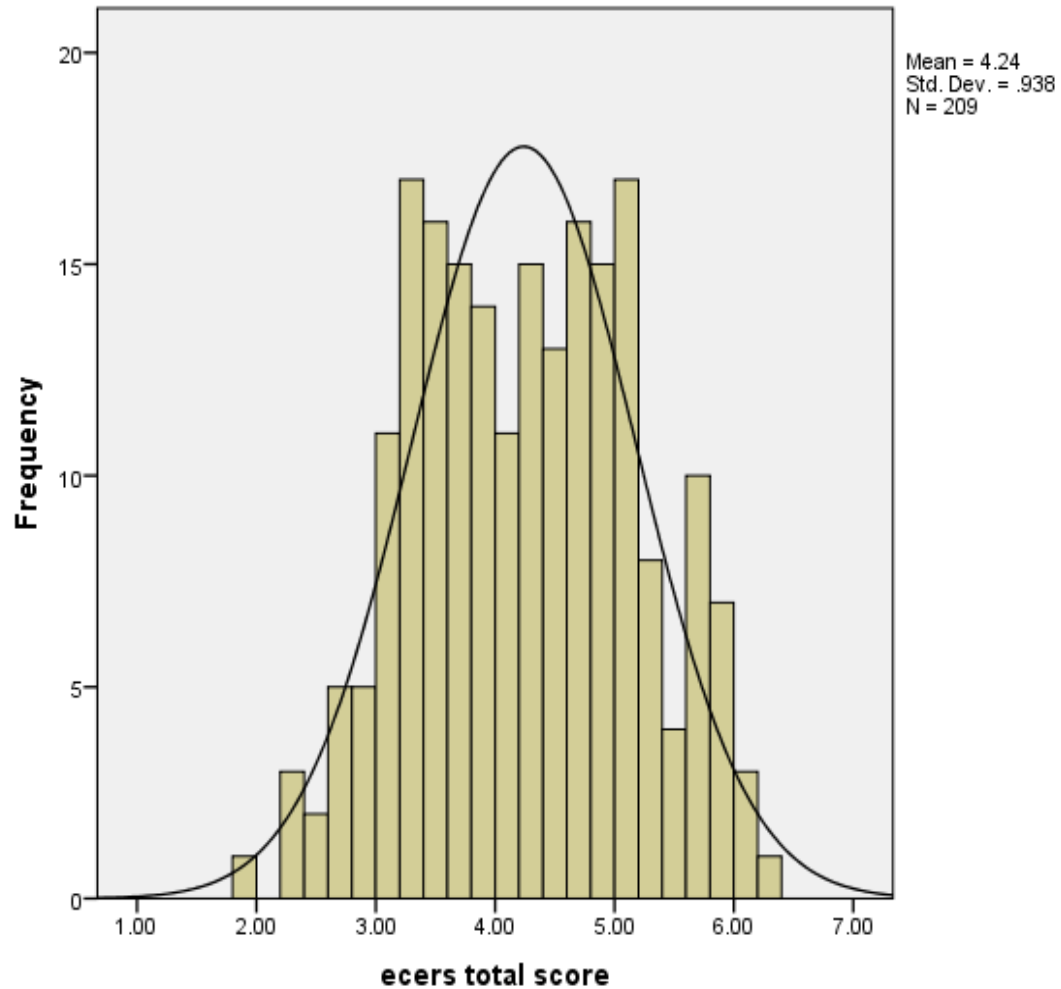
State's Family CC Home Licensing
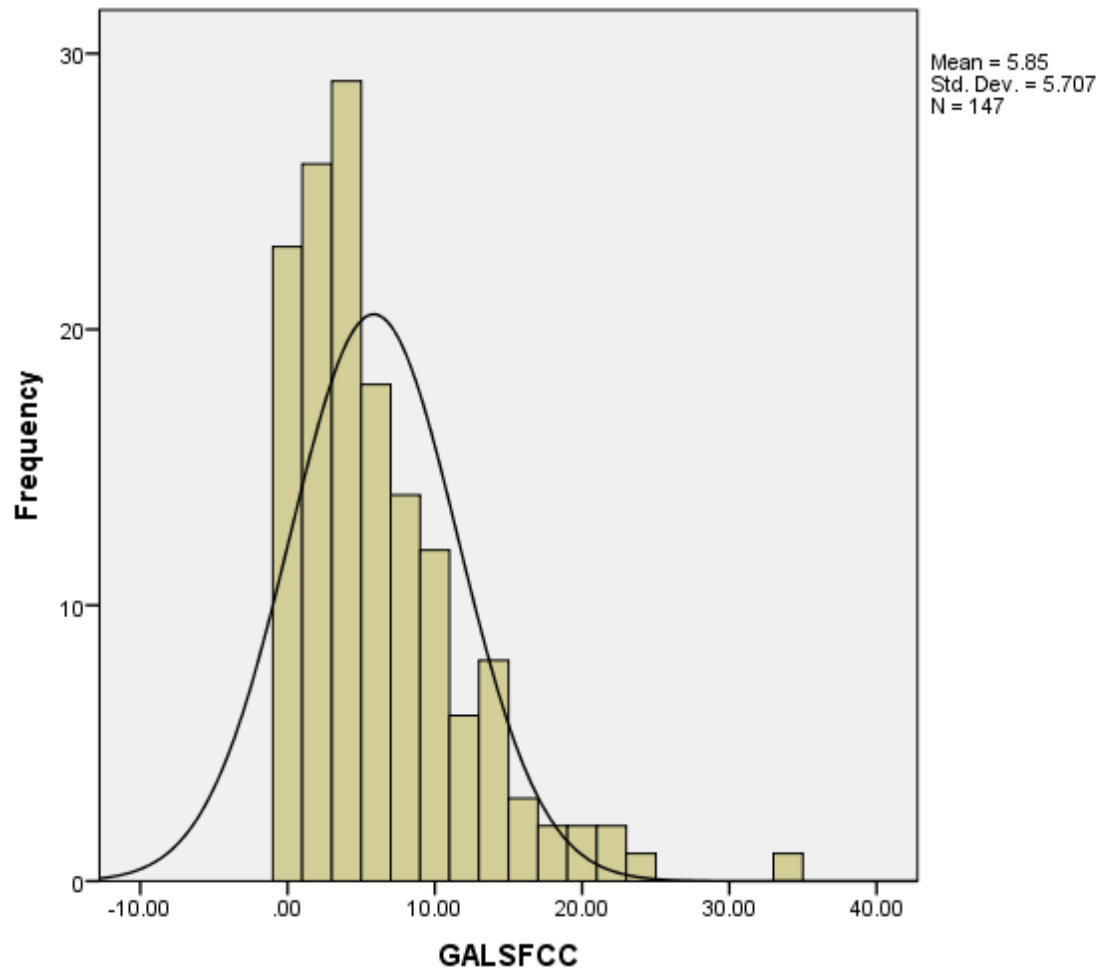
Head Start Performance Standards

Mean = 3.33
Std. Dev. = 3.769
N = 422
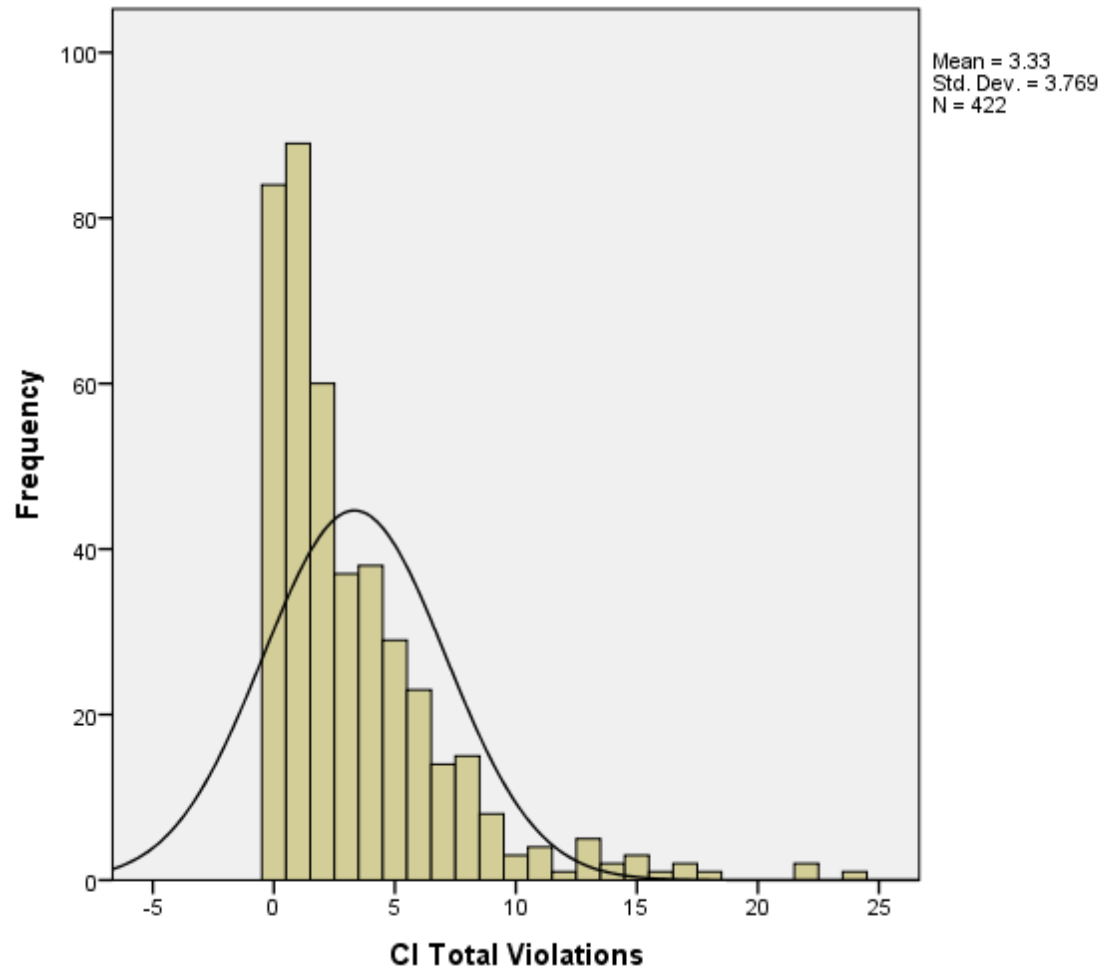
ERS, QRIS, Licensing Comparisons
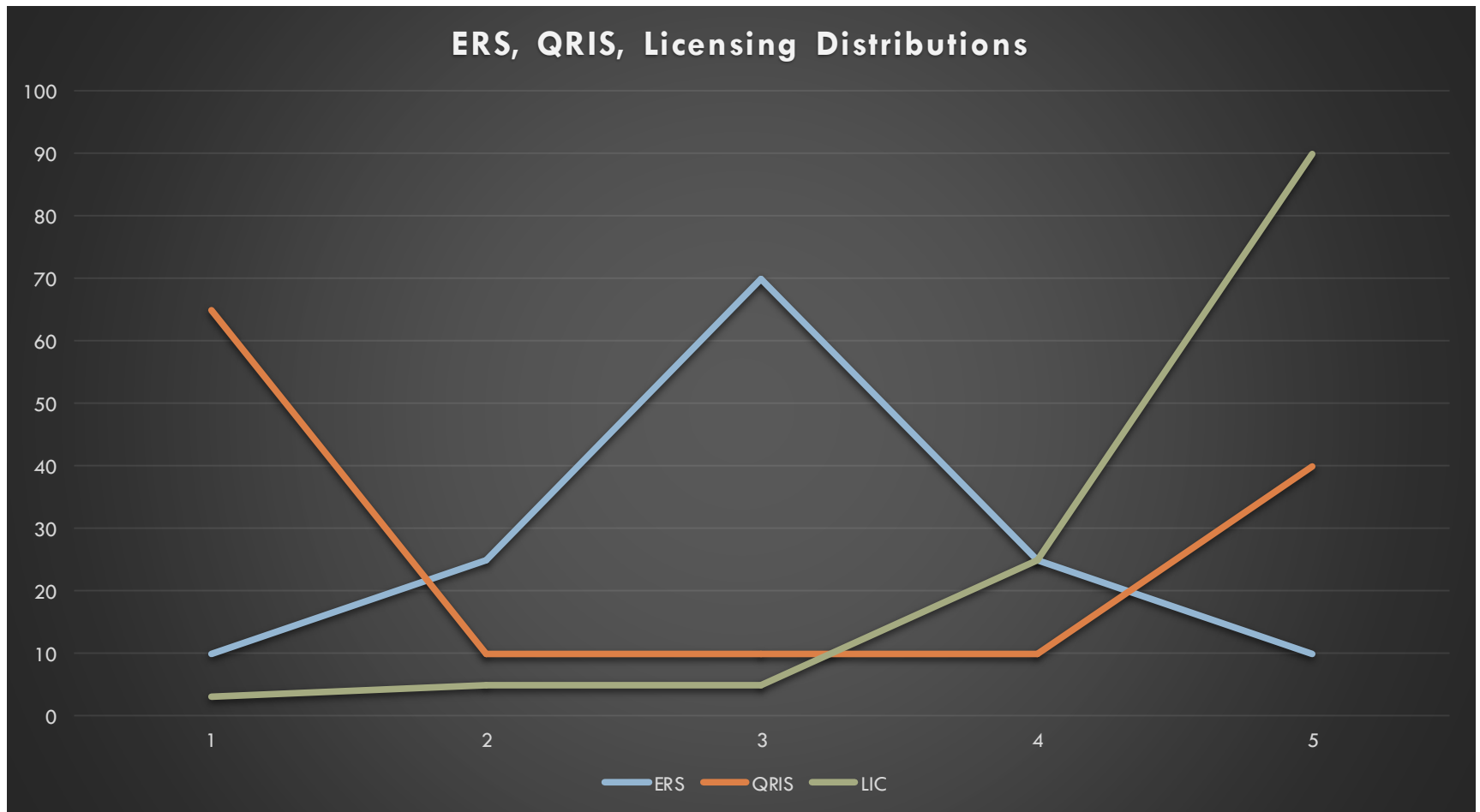
Math Model for Computing ACR

- CH = (NC (TH+TO)) / 2) / (1/TA)

- Where:
  - CH = Contact Hours
  - NC = total number of children on the maximum enrollment day.
  - TO = total number of hours the center is open.
  - TH = total number of hours at full enrollment.
  - TA = total number of teaching staff.

# Relationship between Child Care Income and Quality Measures (Fiene, 2002b)

Correlations

		ITERS	ARNETT	KIDI	BLOOM	DIR16
ITERS	Pearson Correlation	1.000	.599**	.107	.368*	.661**
	Sig. (2-tailed)	.	.000	.568	.038	.000
	N	49	45	31	32	37
ARNETT	Pearson Correlation	.599**	1.000	.108	.507**	.483**
	Sig. (2-tailed)	.000	.	.578	.004	.004
	N	45	46	29	30	34
KIDI	Pearson Correlation	.107	.108	1.000	-.035	.311
	Sig. (2-tailed)	.568	.578	.	.851	.130
	N	31	29	32	32	25
BLOOM	Pearson Correlation	.368*	.507**	-.035	1.000	.451*
	Sig. (2-tailed)	.038	.004	.851	.	.021
	N	32	30	32	33	26
DIR16	Pearson Correlation	.661**	.483**	.311	.451*	1.000
	Sig. (2-tailed)	.000	.004	.130	.021	.
	N	37	34	25	26	39

**. Correlation is significant at the 0.01 level (2-tailed).

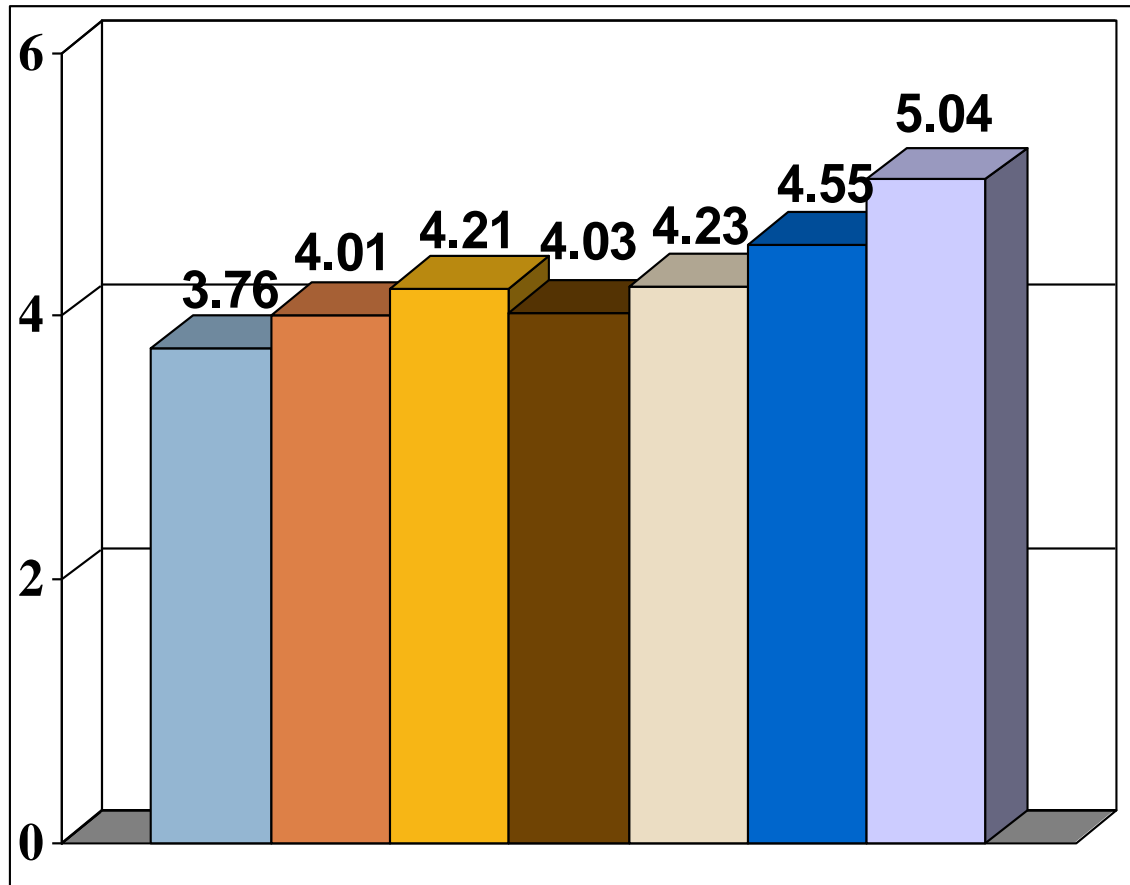*. Correlation is significant at the 0.05 level (2-tailed).

Infant-Toddler Teacher Mentoring

ITERS/HOME Post-Test Scores
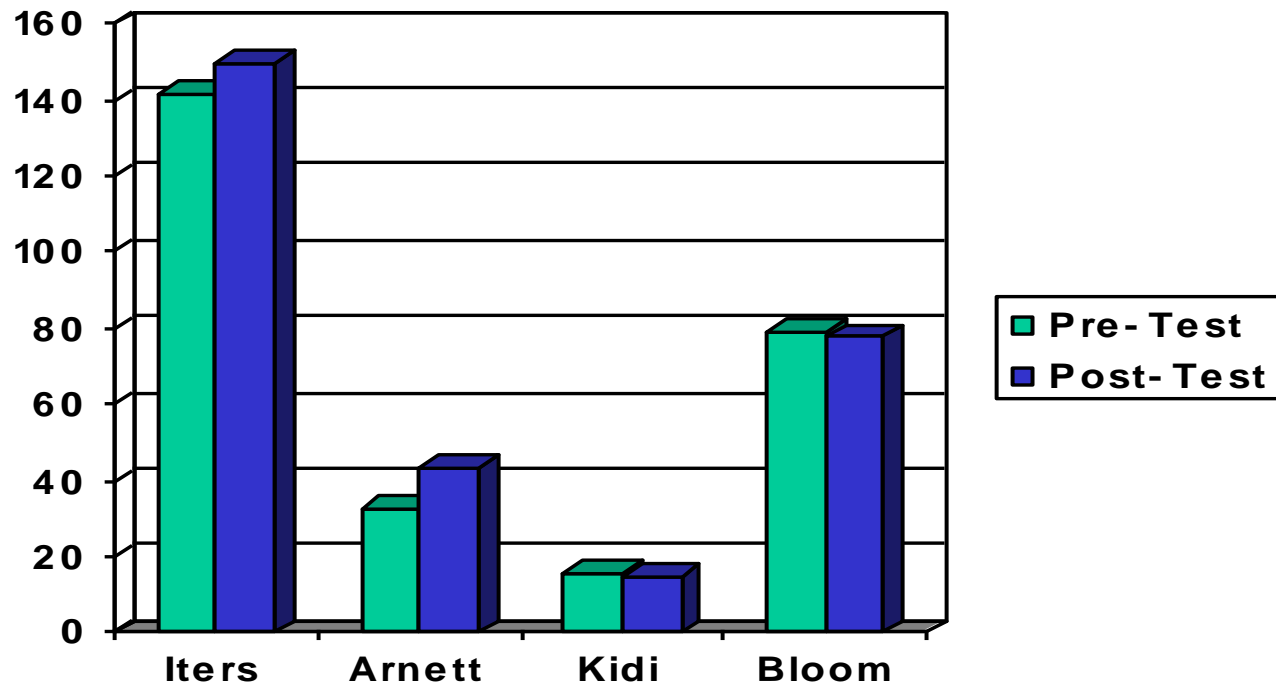
Bar chart of ITERS/HOME post-test scores:

- Workshops (6 hrs): 3.76
- Certificate + Mentoring (18+6 hrs): 4.01
- Mentoring Caregiver (70 hrs): 4.21
- Mentoring Director (50 hrs): 4.03
- Mentoring Parents (45 hrs): 4.23
- Mentoring Caregiver + Parent (135 hrs): 4.55
- Mentoring Caregiver + Parent + Director (225 hrs): 5.04

Correlation of Accreditation, Licensing, & Training with Child Outcomes

	Quality ECERS	Training EWECS/CCECD	Accreditation NECPA/NAEYC	Licensing SS
Slosson	.23*	.33*/.34*	.29*/ .30*	.19
CBI-INT	.25*	.15/.14	.41*/ .21*	.08
TELD	.09	.28*/.22*	.31*/ .35*	.22*
ALI	.44*	.01/ .11	.13/ .04	.06
PBQ	.37*	.32*/.23*	.44*/.40*	.29*
CBI-SOC	.26*	.21* /.20*	.19/ .23*	.18

- p < .05
- Kontos & Fiene (1987).