

Integrating Regulatory Compliance and Program Quality into a Unified Framework via the Contact Hour Metric

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This research abstract will unite the conceptual framework and formulas utilized in determining compliance with the contact hour (CH) metric and the quality indicators (PQI) within the Child Care Early Education Heart Monitor (CCEEHM) assessment system (Fiene, 2025). It presents a mathematical modeling approach in revising the specific formula that are used to calculate the Contact Hour (CH) metric but by adding a program quality element. By doing this it changes a two-dimensional (2D) approach to a three-dimensional (3D) approach by adding in quality to the interactions between adult(s) and child(ren). The original CH is 2D in that it only measures the amount of time of interactions between the adult(s) and various child(ren) in a classroom. This enhancement to the Contact Hour metric (CH+) adds in a quality measure to determine if the interactions between the adult(s) and child(ren) are of a quality nature. This is specifically measured within the CCEEHM tool in which 10 PQIs are assessed (Fiene, 2025).

To start with the CH, the following questions are the key starting questions to ask of teaching staff who are responsible for a group of children in a specific classroom in a specific child care early education program:

1. When does your first teaching staff arrive or when does your facility open (TO1)?
2. When does your last teaching staff leave or when does your facility close (TO2)?
3. Number of teaching/caregiving staff (TA)?
4. Number of children on your maximum enrollment day (NC)?
5. When does your last child arrive (TH1)?
6. When does your first child leave (TH2)?

After getting the answers to these questions, the following formulae can be used to determine contact hours (CH) based upon the relationship between when the children arrive and leave (TH) and how long the facility is open (TO):

$$CH = ((NC (TO + TH)) / 2) / TA;$$

$$CH = (NC \times TO) / TA;$$

$$CH = ((NC \times TO) / 2) / TA;$$

$$CH = (NC^2) / TA$$

These above formulae are used to determine regulatory compliance and does not look at the quality of the specific interactions. So, it is still measuring a 2D interaction looking at the children present in a specific space and the teacher(s) responsible for their care. The table (Table 1) and figure (Figure 1) depict this interaction and the

potential results. In table 1 and figure 1, it clearly demonstrates the two-dimensional, regulatory compliance nature of the data over time. The CH provides a robust metric in being able to measure regulatory compliance in a very dynamic fashion rather than a static framework.

Insert Table 1

Insert Figure 1

In moving from a strict 2D CH to a 3D CH which would include program quality elements based upon the then CCEEHM--PQIs, the CH formula changes to $CH+ = 10PQI^3$. This formula's results would offset any over non-compliance in CH. It also assumes that $FC = \text{no non-compliance in licensing key indicators}$, $F- = 0$ and $F+ = -2$ or less based upon the Integrated Regulatory Framework (IRF) formula: $IRF = (FC) - (F) - (-2F+)$. This new result would potentially balance out the original CH equation especially if the CH result was over the acceptable level of regulatory compliance. In other words, it exceeded the Table of Conversions results (table 1). The new $CH+$ equation exerts a greater influence the higher the rating on all the 10 PQIs as measured in the CCEEHM tool. At lower values, it may not have as great an influence on the final result and if the program was out of compliance based on the table of conversions, the chances are they would remain there as well (See Tables 2 + 3 as part of the Appendix). $(CH+) - (CH)$ when CH has non-compliance based upon the Table of Conversions. If CH is in compliance then it has a result of 0 and has no effect on $CH+$. However, if CH exceeds compliance on the Table of Conversions then the result is added to $CH+$.

Insert Tables 2 + 3

The other way of looking at this is that the original 2D square (CH) is a measure of regulatory compliance while the 3D cube ($CH+$) is a measure of both regulatory compliance and program quality. And those sectors that deal with program quality could over-compensate the regulatory compliance or lack thereof because of their strength in the particular classroom and center based upon the teaching staff qualifications and teaching interactions. Each CH 2D square would have a $CH+$ 3D extension measuring the level of quality interactions (Fiene, 2025). The creation of the $CH+$ metric is an extension of the original Fiene (2025) methodology that was used to measure density by adding a square footage element to the original CH metric during the 2020 COVID19 Pandemic. This latest enhancement replaces that density addition with a program quality indicators enhancement.

References

Fiene (2025). *Child Care Early Education Heart Monitor*, Penn State Research Institute for Key Indicators Data Lab and the National Association for Regulatory Administration, unpublished manuscript and app.

Appendix
Table and Figure

Table 1: Contact Hour (CH) Conversion Table (RS Model(1.0)) (Fiene, 2020©)

Taking into Account Exposure Time and Density

Group Size, Staff Child Ratio, Number of Children and Staff

<----- Adult-Child Ratios (Relatively Weighted Contact Hours) ----->

NC	CH	1:1	2:1	3:1	4:1	5:1	6:1	7:1	8:1	9:1	10:1	11:1	12:1	13:1	14:1	15:1
1	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8
2	16	8	16	16	16	16	16	16	16	16	16	16	16	16	16	16
3	24	8	12	24	24	24	24	24	24	24	24	24	24	24	24	24
4	32	8	16	16	32	32	32	32	32	32	32	32	32	32	32	32
5	40	8	13	20	20	40	40	40	40	40	40	40	40	40	40	40
6	48	8	16	24	24	24	48	48	48	48	48	48	48	48	48	48
7	56	8	14	19	28	28	28	56	56	56	56	56	56	56	56	56
8	64	8	16	21	32	32	32	32	64	64	64	64	64	64	64	64
9	72	8	14	24	24	36	36	36	36	72	72	72	72	72	72	72
10	80	8	16	20	27	40	40	40	40	40	80	80	80	80	80	80
11	88	8	15	22	29	29	44	44	44	44	44	88	88	88	88	88
12	96	8	16	24	32	32	48	48	48	48	48	48	96	96	96	96
13	104	8	15	21	26	35	35	52	52	52	52	52	52	104	104	104
14	112	8	16	22	28	37	37	56	56	56	56	56	56	56	112	112
15	120	8	15	24	30	40	40	40	60	60	60	60	60	60	60	120
16	128	8	16	21	32	32	43	43	64	64	64	64	64	64	64	64
17	136	8	15	23	27	34	45	45	45	68	68	68	68	68	68	68
18	144	8	16	24	29	36	48	48	48	72	72	72	72	72	72	72
19	152	8	15	22	30	38	38	51	51	51	76	76	76	76	76	76
20	160	8	16	23	32	40	40	53	53	53	80	80	80	80	80	80
21	168	8	15	24	28	34	42	56	56	56	56	84	84	84	84	84
22	176	8	16	22	29	35	44	44	59	59	59	88	88	88	88	88
23	184	8	15	23	31	37	46	46	61	61	61	61	92	92	92	92
24	192	8	16	24	32	38	48	48	64	64	64	64	96	96	96	96
25	200	8	15	22	29	40	40	50	50	67	67	67	67	100	100	100
26	208	8	16	23	30	35	42	52	52	69	69	69	69	104	104	104
27	216	8	15	24	31	36	43	54	54	72	72	72	72	72	108	108
28	224	8	16	22	32	37	45	56	56	56	75	75	75	75	112	112
29	232	8	15	23	29	39	46	46	58	58	77	77	77	77	77	116
30	240	8	16	24	30	40	48	48	60	60	80	80	80	80	80	120

This table is based upon the assumptions that the child care is 8 hours in length (TO) and that the full enrollment is present for the full 8 hours (TH). This is unlikely to ever occur but it gives us a reference point to measure adult child contact hours in the most efficient manner. Based upon the relationship between TO and TH based upon the algorithms, select from one of the formulae from the previous page (formulae 1 - 4) to determine how well the actual Relatively Weighted Contact Hours (RWCH) match with this table. If the RWCH exceed the respective RWCH in this table, then the facility would be over ratio on ACR standards, in other words, they would be overpopulated.

(RS Model = 1.0)

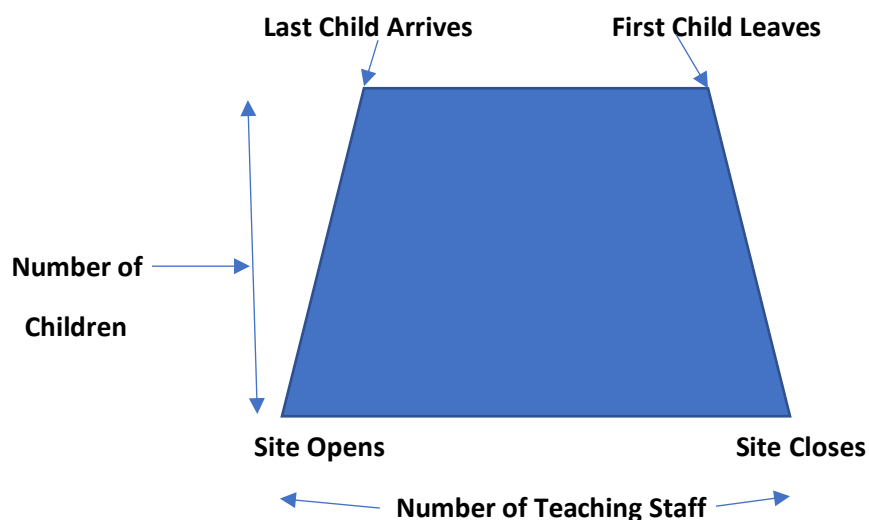
(TT Model = 0.5)

Sample/Data Collection Methods

Child care attendance data was explored and collected in partnership with the Washington State Department of Children, Youth, and Families (DCYF). A convenient sample of center and school age providers was initially identified through the use of the state subsidy electronic payment system. All providers who accept Working Connections Child Care subsidies are required to use and track child attendance using an electronic attendance system. Providers may use an electronic sign in and out system provided by the state or opt to use another system. For this validation process, the sample was identified from the attendance tracking system provided and operated by DCYF and was inclusive of providers who use the system to track attendance of both subsidy and private pay children. The search resulted in approximately 100 providers within the State of Washington who have opted to use the electronic check-in system for all children regardless of payment type.

The sample was prioritized by identifying a single week since the Covid-19 outbreak began and from there the highest attendance day for that week was chosen for each provider. From this narrowed data set, it was determined the exact time the last child for the chosen day checked in, when the first child left, how many children were in attendance that day and the regular operating hours of the center or school age program. Because the attendance tracking system does not also track staffing attendance, it was necessary to contact each provider by phone in order to gather data inclusive of when the first staff arrived and when the last staff left and the total staff working that day. All responses were voluntary. Additionally, providers confirmed operating hours (many had been temporarily adjusted due to lowered demand during the gubernatorial stay at home order). Finally, providers reported if a child or staff member had tested positive for Covid-19. Of the 100 phone calls, the final sample was inclusive of 88 licensed providers statewide. Twelve providers either did not answer the call or opted to not answer the questions.

Figure 1: Contact Hour Diagram Paradigm and Schematic



The above diagram (Figure 1) depicts how the number of staff and children help to construct the contact hour formula. Depending on when the children arrive and leave could change the shape from a trapezoid to a rectangle or square or triangle. Please see the following potential density distributions which could impact these changes in the above contact hour diagram (Figure 1).

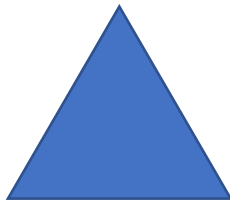
Potential Density Distributions Taking into Account Number of Children, Staff, and Exposure Time

Here are some basic key relationships or elements related to the Contact Hour (CH) methodology.

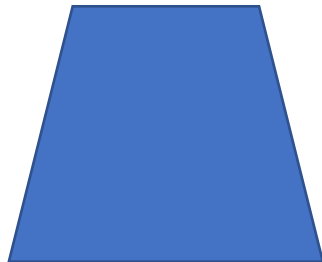
- $RWCH = ACR$
- $CH = GS = NC$
- NC and CH are highly correlated
- ACR and GS are static, not dynamic
- CH makes them dynamic by making them 2-D by adding in Time (T)
- $\Sigma ACR = GS$
- $GS = \text{total number of children } NC$
- $ACR = \text{children} / \text{adult}$

ACR = Adult Child Ratio, GS = Group Size, RWCH = Relatively Weighted Contact Hours, NC = Number of Children.

Possible Density Displays of Contact Hours (Horizontal Axis = Time (T); Vertical Axis = NC):



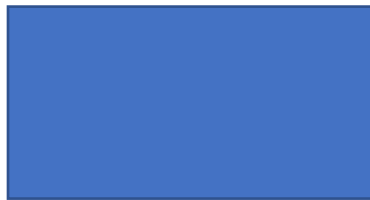
This density distribution should result in the lowest CH but probably not very likely to occur. Essentially what would happen is that full enrollment would be a single point which means that the last child arrives when the first child is leaving. Very unlikely but possible. (TT Model Reference(0.5))



This density distribution is probably the most likely scenario when it comes to CH in which the children gradually, albeit rather steeply, arrive at the facility and also leave the facility gradually. They don't all show up at the same time nor leave at the same time. However, the arriving and leaving will be a rather close time frame. (TT Model)



This scenario is unlikely but is used as the reference point for CH because it provides the most efficient model. This is where all the children arrive and leave at the same time. Very unlikely, but I guess it could happen. The important element here is its efficiency in that all contact hours are covered, so although a lesser amount of CH is not as efficient it does demonstrate compliance with ACR and GS which is one of the purposes of CH. As the bottom two distributions will demonstrate, CHs above this level would either depict a program that is open for an extended time or where there are too many children present and the facility is out of compliance with GS and/or ACR. (RS Model Reference(1.0))



This distribution would indicate that the facility is open for an extended time and exceeds the number of total CH as depicted in the reference square standard. Although not out of compliance with GS or ACR, this could become a determining factor when looking at the potential overall exposure of adults and children when we are concerned about the spread of an infectious diseases, such as what happened with COVID19. Are facilities that high CH because of a scenario distribution of this type more prone to the spread of infectious diseases? (RS Model)



This depiction clearly indicates a very high CH and non-compliance with ACR and GS. This is the reason for designing the CH methodology which was to determine these levels of regulatory compliance as its focus. (RS Model)

There is some overlap in the RWCH (Table 1 on page 2) in moving across the various levels, that occurs because of the change in group size (GS) where an overall group size (GS) could influence the overall CH by increasing NC.

**Tables 2+3: Early Learning and Child Care Quality Key Indicator Instrument
(SK Quality Tool) Scoring Summary**

Child Care Centre Name:

Program Quality Indicator	Score (1-4)
1	
2	
3	
4	
5	
6 (Preschool groups only)	
7 (Infant/toddler groups only)	
8 (Preschool groups only)	
9	
10	
Total Score	
Program Quality Level	

Interpreting the Score = Program Quality Level

Determine the appropriate Column for the child care centre based on the age groups of children in the centre. This will also correspond to the number of program quality indicators that were assessed. Find the assessed score under the appropriate column to determine the quality level.

Quality Level	Infant/Toddler (No Preschool groups) 8 indicators assessed	Preschool (No Infant/Toddler Groups) 9 indicators assessed	Infant/Toddler and Preschool Groups 10 indicators assessed
High	Score of 28 or higher	Score of 32 or higher	Score of 36 or higher
Medium-High	Score of 22-27	Score of 26-31	Score of 30-35
Medium-Low	Score of 12-21	Score of 16-25	Score of 20-29
Low	Score of 11 or less	Score of 15 or less	Score of 19 or less

After completing the observations, reviewing all documentation, and interviewing staff, when necessary, please transfer all the results to the Summary Table below. If there was not an infant classroom, please note here, no infant classroom: _____. If there was not a toddler classroom, please note here, no toddler classroom: _____. If there was not a preschool classroom, please note here, no preschool classroom: _____.

<u>Key Q Indicator</u>	<u>Quality Indicator Content</u>	<u>Scale Source</u>	<u>Potential Score</u>	<u>Actual Score</u>
QKI 1	Professional Development	NAEYC	1-4	1, 2, 3, 4
QKI 2	The Environment	Saskatchewan	1-4	1, 2, 3, 4
QKI 3	Curriculum and Assessment	NAEYC	1-4	1, 2, 3, 4
QKI 4	Family Engagement I	QRIS	1-4	1, 2, 3, 4
QKI 5	Family Engagement II	QRIS	1-4	1, 2, 3, 4
QKI 6	Communication (Preschool)	ECERS	1-4 or NA	1, 2, 3, 4, +, NA
QKI 7	<i>Infant Classroom</i>	<i>ITERS</i>	<i>1-4 or NA</i>	1, 2, 3, 4, +, NA
QKI 8	Reasoning Skills (Preschool)	ECERS	1-4 or NA	1, 2, 3, 4, +, NA
QKI 9	Listen Attentively	CIS	1-4	1, 2, 3, 4
QKI 10	Speak Warmly	CIS	1-4	1, 2, 3, 4

Notes:

Use *ITERS* if: (Infants) (B-1yr)

Use *ITERS* if: (Toddlers) (1yr-2yr)

Use *ECERS* if: (Preschoolers) (3yr+)

PQIAI/Infant (administer QKI items 1-5, 7, 9-10) (Scores 8-32)

PQIAI/Toddler or Preschool (administer QKI items 1-5, 7, 9-10) (Scores 8-32) or (administer QKI items 1-6, 8-10) (Scores 9-36). Mixed age group (administer QKI items 1-10) (Scores 10-40)

PQIAI/Preschool (administer QKI items 1-6, 8-10) (Scores 9-36)

All the above 10 quality indicators (PQIAI) have been taken from other sources having been identified in Quality Indicator Studies conducted by Dr Richard Fiene from 1980 – 2020. Please refer to the source documents for details on their creation: *ECERS*, *ITERS*, *QRIS/INQUIRE*, *CIS/Arnett*, *NAEYC*, *SASKATCHEWAN PLAY & EXPLORATION*. For additional information, reports, and publications related to these studies, please go to <https://rikoinstitute.com/publication>