Contact Hour Pilot Study Design Proposal (v3.1)

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The purpose of this proposal is to develop the key parameters for testing out the Contact Hour (CH) methodology in a series of facilities to determine its efficacy. The pilot will determine if this CH methodology has any merit in being able to measure regulatory compliance with adult-child ratios. Since monitoring of facilities will not be occurring during the COVID19 pandemic are there ways to measure the research question in the previous sentence. Yes there is and it is based upon the Contact Hour (CH) methodology and involves asking the following six questions (The six questions should be asked of each grouping that is defined by a classroom or a well-defined group within each classroom tied to a specific adult-child ratio.):

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):

$$\text{(1) } CH = ((NC\,(TO + TH)) / 2) / TA;$$

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

$$\text{(3) } CH = ((NC \times TO) / 2) / TA;$$

$$\text{(4) } CH = (NC^2) / TA$$

Where: CH = Contact Hours; NC = Number of Children; TO = Total number of hours the facility is open (TO2 - TO1); TA = Total number of teaching staff, and TH = Total number of hours at full enrollment (TH2 - TH1).

By knowing the number of contact hours (CH) it will be possible to rank order the exposure time of adults with children. This metric could then be used to determine that the greater contact hours is correlated with the increased non-regulatory compliance with adult-child ratios as determined in the below chart on page 2.

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Contact Hour (CH) Conversion Table (Fiene, 2020©)

Caring for Our Children for Ill Children

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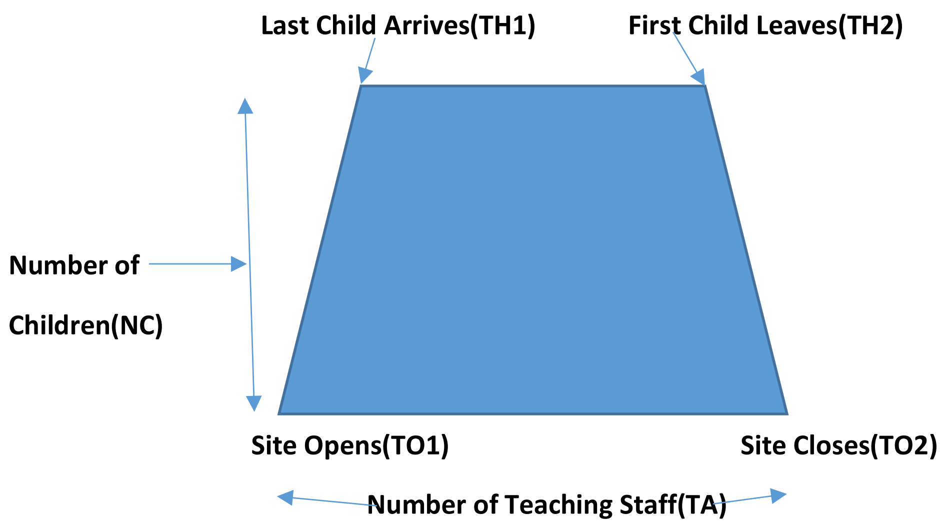
<------------------- Adult-Child Ratios (Relatively Weighted Contact Hours) --------------->

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, 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.

Contact Hour (CH) Diagram Example



The above diagram 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 distribution which will depict these changes.

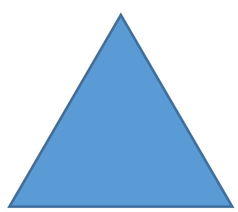
Contact Hour Research Notes
Appendix

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

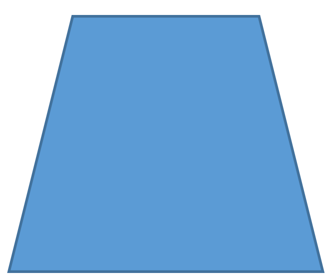
- RWCH = ACR
- CH = GS = NC
- NC and CH are highly correlated
- ACR and GS are static, not dynamic
- CH makes them dynamic by making them 2-D by adding in Time (T)
- ΣACR = GS
- GS = total number of children NC
- ACR = children / adult

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

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



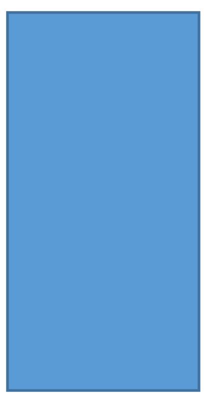
This density distribution should result in the lowest CH but probably not very likely to occur. Essentially what would happen is that full enrollment would be a single point which means that the last child arrives when the first child is leaving. Very unlikely but possible.



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.

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.

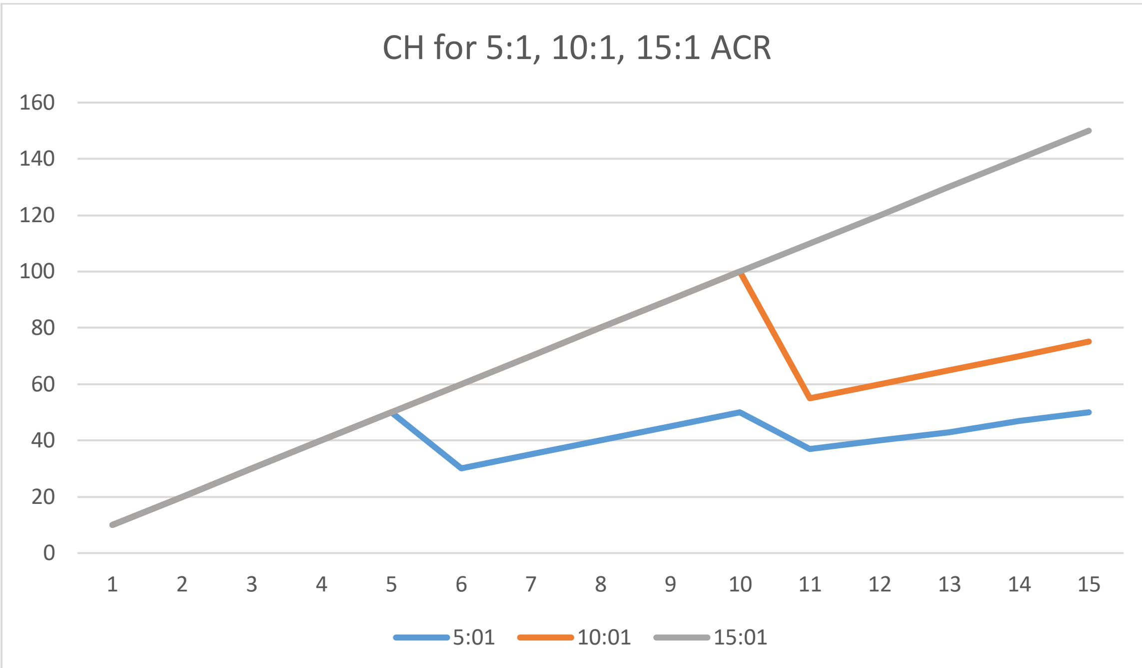
This distribution would indicate that the facility is open for an extended time and exceeds the number of total CH as depicted in the reference square standard. Although not out of compliance with GS or ACR, this could become a determining factor when looking at the potential overall exposure of adults 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?



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.

There is some overlap in the RWCH (Table 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.

The below graph depicts the contact hours for three different adult to child ratios 5:1, 10:1 and 15:1. CH is along the vertical axis, with NC along the horizontal axis.



This graphic depicts how with the addition of staff, the CH drop off accordingly.

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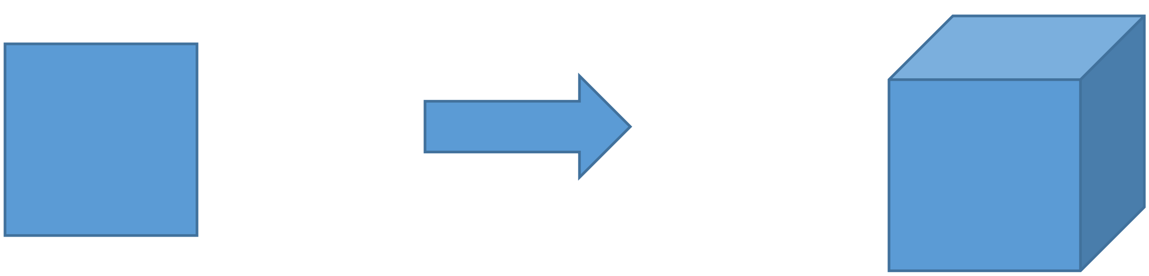
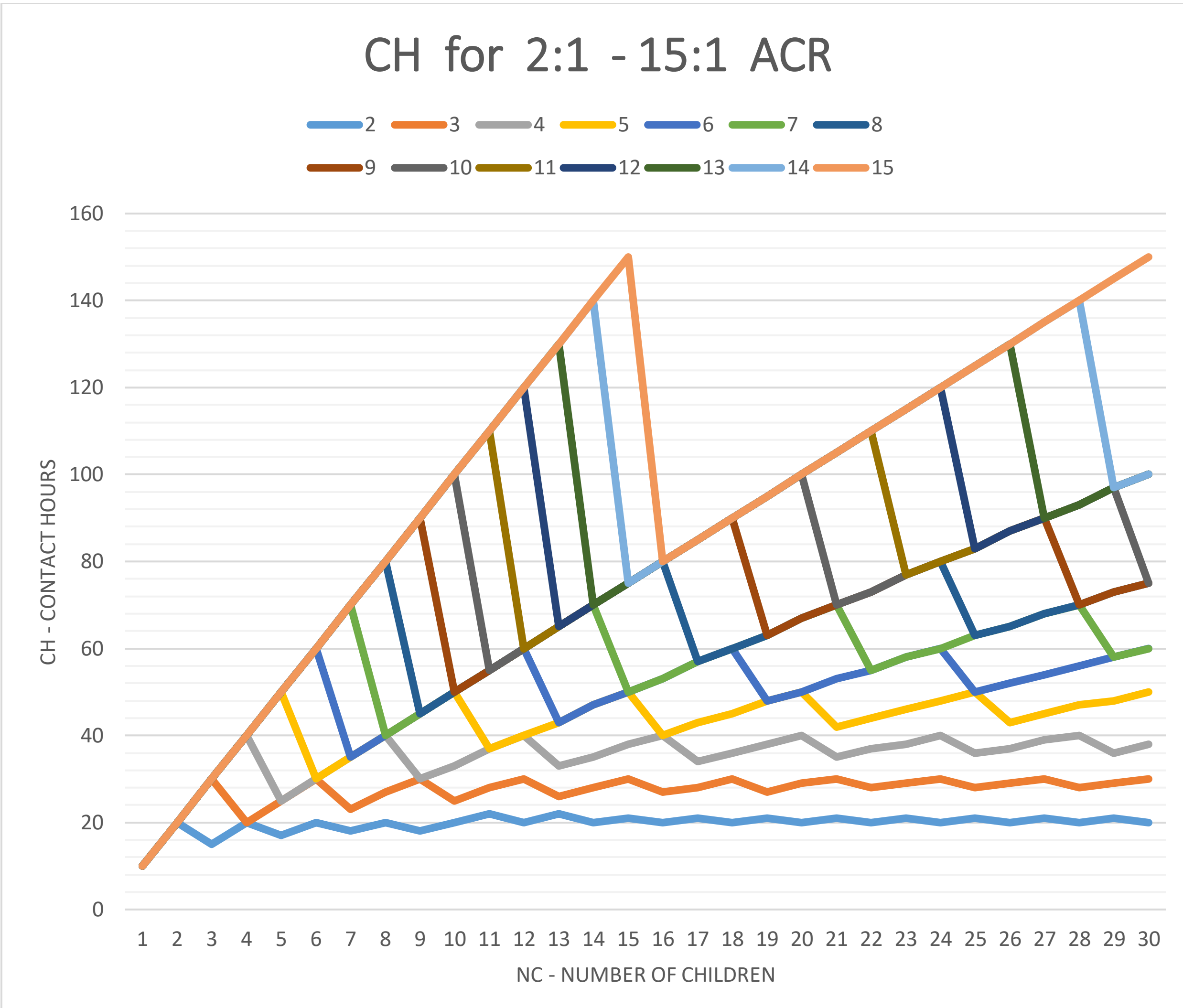
A possible extension or the next level to the CH methodology is to move from 2-D to 3-D and make the CH block format rather than area format. It could be used to describe the trilemma of accessibility, affordability and quality more fully. It could be a means for determining the unit cost at a much finer level and could then be used to make more informed decisions about the real cost of services.



The move from 2-D (GS, ACR) to 3-D (GS, ACR, Quality) and its potential impacts.

The following graph depicts the Contact Hours (CH) for all the various Adult-Child ratios (ACR) in the Table on page 2 of this paper.



From the above graph it clearly shows how CHs vary with the number of children present. Please note the various slopes of the respective lines for each of the ACRs.

This is a listing of the algorithms for determining which formula to use in order to calculate the Contact Hours (CH). NC = Number of Children; TO = Total number of hours facility is open; TH = Total number of hours at full enrollment; TA = Total number of adult staff:

If TO = TH = NC, then (NC x TO)/TA = CH

If TH < TO, then ((NC (TO + TH))/2)/TA = CH; or If TH = 0, then ((NC x TO)/2)/TA = CH

If TO = TH < NC, then (NC x TH)/TA = CH

If TO = TH > NC, then (NC x TO)/TA = CH

Contact Hour Models

								RS Model - ACRCH		
NC	TA	TO	TH	TO+TH	(TOTH)N	CH	*RWCH*	5:01	10:01	15:01
10	2	8	8	16	160	80	*40*	40	80	80
20	1	8	2	10	200	100	*100*	40	80	80
30	3	8	8	16	480	240	*80*	40	80	120
5	1	8	8	16	80	40	*40*	40	40	40
15	2	8	8	16	240	120	*60*	40	60	120
25	1	8	8	16	400	200	*200*	40	67	104

						TT Model - ACRCH		
NC	TA	TO	NCxTO	CH	*RWCH*	5:01	10:01	15:01
10	2	8	80	40	*20*	20	40	40
20	1	8	160	80	*80*	20	40	40
30	3	8	240	120	*40*	20	40	60
5	1	8	40	20	*20*	20	20	20
15	2	8	120	60	*30*	20	30	60
25	1	8	200	100	*100*	20	33	52

TT Model = CH=((NC(TO+TH))/2)/TA=RWCH; CH=((NCxTO)/2)/TA=RWCH; if TH<TO or if TH=0

RS Model = CH=(NCxTO)/TA=RWCH; CH=(NC2)/TA=RWCH; if TO=TH=NC or if TO=TH<NC or if TO=TH>NC

Decisions:

Green = meets or under with all ACRs

Yellow = meets, under and over with ACRs

Red = over with all ACRs

Legend: *NC = Number of Children in attendance*

TA = Number of Teaching Staff

TO = Number of hours site is open

TH = Number of hours site at full enrollment

CH = Contact Hours with Children

RWCH = Relatively Weighted Contact Hours with Staff

Questions:

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

TO = TO2-TO1

TH = TH2-TH1

Table of Conversions - RS Model - ACRCH (Relatively Weighted Contact Hours)

NC	CH	1:01	2:01	3:01	4:01	5:01	6:01	7:01	8:01	9:01	10:01	11:01	12:01	13:01	14:01	15:01
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

RS Model = 1.0

TT Model = 0.5