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 be used as a rough estimate to identifying facilities that may be at greater risk to spreading an infectious disease, such as the COVID19 virus. 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 seven questions:

1. When does your first teaching staff arrive or when does your facility open?
2. When does your last teaching staff leave or when does your facility close?
3. Number of teaching/caregiving staff?
4. Number of children on your maximum enrollment day?
5. When does your last child arrive?
6. When does your first child leave?
7. Has any child or adult within your facility contracted the COVID19 virus?

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):

\[
(1) \ CH=((NC(TO+TH))/2)/TA; \quad (2) \ CH=(NCxTO)/TA; \quad (3) \ CH=((NCxTO)/2)/TA; \quad (4) \ CH=(NC^2)/TA
\]

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

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 if greater contact hours is correlated with the increased risk of the COVID19 virus. The COVID19 virus question is the dependent variable and is not used in the above formulae.

The following chart can be used by entering the following metrics (example in the table is based upon 2-10 enrolled children (NC)): the facility is open for 10 hours (TO) and then various scenarios are played out for how long the facility is at full enrollment (TH). Based upon these metrics an outcome rubric can be used where less CH is a positive (+), while high CH is a negative (-). For simplicity, the following chart is based upon one teaching staff (TA) being present. The chart on page 2 provides a more detailed depiction of various CH for a multitude of Adult-Child Ratios and the figure on page 3 shows a hypothesized relationship between CH and COVID19 infection rates.

### Contact Hour Score Generated from Above 4 Formulae and Potential Outcomes (COVID19 Infections)

<table>
<thead>
<tr>
<th>Contact Hours - CH Score</th>
<th>Formulae for CH Score</th>
<th>Potential Outcomes</th>
</tr>
</thead>
<tbody>
<tr>
<td>10</td>
<td>(2 (NC) x 10 (TO)) / 2</td>
<td>++ (None or few COVID19 Infections)</td>
</tr>
<tr>
<td>38</td>
<td>(5 (NC) x 5 (TH) + 10 (TO)) / 2</td>
<td>+ (Lower # of COVID19 Infections)</td>
</tr>
<tr>
<td>70</td>
<td>7 (NC) x 10 (TO)</td>
<td>+/- (Higher # of COVID19 Infections)</td>
</tr>
<tr>
<td>100</td>
<td>10 (NC) x 10 (TO)</td>
<td>-(Highest # of COVID19 Infections)</td>
</tr>
</tbody>
</table>
The previous chart on page 1 provided a theoretical view of how Contact Hours could be calculated, the following chart (see a graphic depiction of this table on page 7) provides the addition of the number of staff (TA) in the equation and enhances the Contact Hours metric by calculating a Relatively Weighted Contact Hours (RWCH).

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

This table is based upon the assumptions that the child care is 10 hours in length (TO) and that the full enrollment is present for the full 10 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 (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 and exceed group size standards.
Based upon the above tables classifications, the following figure provides a hypothesized relationship between the various contact hour (CH) levels of blue, green, yellow, and red and the ranges these color schemes represent as per COVID19 infections.

![Contact Hour (CH) Levels and COVID19 Infections](image)

The above figure's hypothesized results projects that as the level of Contact Hours (CH) increases, a corresponding increase in COVID19 infections in adults and children would also occur in the child care facility starting off slowly at the lowest level of CH (Blue), increasing slightly (Green), but then a steeper curve (Yellow), and steepest at the Red level where CH would be at the highest representing the greatest number of children and adults present over time.

The proposed pilot study will test this hypothesis to determine if this is the case or not.

**Notes:**

1. The seven (7) 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.

2. The results from this pilot study could lead to interesting planning for the future in which a particular threshold could be identified where the infection rates are too high or where infection rates begin.

Additional information regarding this methodology can be obtained from contacting: Dr Richard Fiene, Research Psychologist, Research Institute for Key Indicators, & Penn State University. [RFiene@RIKInstitute.com](mailto:RFiene@RIKInstitute.com) or [RJF8@psu.edu](mailto:RJF8@psu.edu). [http://RIKInstitute.com](http://RIKInstitute.com)
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 = total number of children NC
- ACR = children / adult

$ACR = \text{Adult Child Ratio}, \ GS = \text{Group Size}, \ RWCH = \text{Relatively Weighted Contact Hours}, \ NC = \text{Number of Children}.$

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

**Blue Level (++) (GS/CH = 10 - 50)** = 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.

**Green Level (+) (GS/CH = 60 - 100)** = this 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.
Yellow Level (+/-)(GS/CH = 110 - 190) = 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.

Orange Level (-)(GS/CH = 200 - 250) = 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?

Red Level (--)(GS/CH = 260 - 300) = 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 \( \frac{NC \times TO}{TA} = CH \)

If \( TH < TO \), then \( \frac{(NC \times (TO + TH))/2}{TA} = CH \); or if \( TH = 0 \), then \( \frac{(NC \times TO)/2}{TA} = CH \)

If \( TO = TH < NC \), then \( \frac{NC \times TH}{TA} = CH \)

If \( TO = TH > NC \), then \( \frac{NC \times TO}{TA} = CH \)