

Appendix 1: Pre-analysis plan

The Pre-Analysis Plan (PAP) outlines the analytic models that will be used to analyze the data collected as part of the HiFive evaluation, the indicators that will be analyzed, and other technical considerations.

The primary research question the evaluation aims to answer is:

- Q. 1 Practice of iHWWs at critical times:** Does the *HiFive for HySan* intervention increase the prevalence of independent hand-washing with soap at critical times by pupils at school, when implemented with the WinS policy compared to when the WinS policy alone is implemented?

In addition, the evaluation aims to answer the following secondary research questions. All questions compare when *HiFive for HySan* is implemented with the WinS policy, to when the WinS policy alone is implemented.

- Q. 2.1 Practice of supervised group HWWs:** Does the *HiFive for HySan* intervention increase the frequency of daily supervised group handwashing activities in schools?
- Q. 2.2 Perceived critical times and motivations to practice iHWWs:** Does the *HiFive for HySan* intervention affect pupil perception of critical times and motivations to practice iHWWs at critical times?
- Q. 2.3 Availability of functional hand-washing and toilet facilities:** Does the *HiFive for HySan* intervention increase the availability of:
- a) Hand-washing facilities with soap and water?
 - b) Functional and clean toilet facilities at schools?

For each research question, the following topics are discussed in this pre-analysis plan:

- a) Research question
- b) Indicators, unit of analysis, and sample
- c) Analytic model
- d) Sub-group analysis
- e) Presentation of results

Research Question 1

1.a. Research question 1: When implemented with the WinS policy, does the *HiFive for HySan* intervention increase the prevalence of independent hand-washing with soap at critical times by pupils at school, relative to when the WinS policy alone is implemented?

1.b. Indicators, unit of analysis, and sample: Table 2 below provides a summary of the indicators for this research question, and the unit of analysis and sample corresponding to each indicator. These indicators are based on observed and reported data. The type of data available for each outcome and sample of pupils is indicated in Table 1 below.

Table 1. Data available for each outcome and pupil sample for research question 1

Outcome	Grade 1-3	Grade 4-6
<i>iHHWS after toilet use</i>	Observed	Observed + Reported
<i>iHHWS before eating</i>	-	Reported

Piloting of the data collection tools revealed that it is not possible to accurately observe pupil iHHWS before eating at sample schools. Many pupils eat at home, pupils eat at various times and in various locations within the school throughout the lunch break, and can wash their hands before eating at multiple hand-washing facilities. It is thus not possible to accurately observe whether a pupil washes their hand with soap before eating for multiple pupils during the lunch break at a given school.

Self-reported data from pupils will only be collected for pupils in grades 4-6. The reason for this is that pupils from lower grades may have trouble understanding the survey questions and may lack the attention span required to sit through the entire survey.

Note on the sample: Observation data will be explored separately for pupils from grades 1-3 and from grades 4-6. The intention with splitting the sample is to identify whether there is a differential impact of the HiFive intervention on these two grade groups.¹ This was identified as a key question of interest by UNICEF and DepEd to inform decisions regarding the grade(s) in which HiFive should be implemented in possible future rounds of implementation. The impact may differ between these two groups due to different levels of pupil engagement with HiFive activities, different receptiveness to motivators for hand-washing behavior targeted by the HiFive intervention, or different pre-existing pupil behaviors and perceptions around hand-washing.

Although the HiFive intervention was also implemented in kindergarten classes at HiFive schools, the evaluation does not aim to estimate the impact of HiFive on kindergarten pupils. This decision was taken together with UNICEF because kindergarten pupils are unlikely to engage in truly independent hand-washing behavior, and are often assisted by teachers.

Note on treatment compliance: Within a HiFive recipient school, though the intensity of HiFive exposure may vary across pupils, defining and measuring treatment compliance at the pupil level is challenging given the way program activities are implemented. Therefore, it is assumed that all pupils at a school implementing the HiFive intervention “received the treatment”. At the school level, it is also challenging to clearly define what minimum

¹ The approach to test the difference in impact of the program for these two sub-samples will be separate regressions for each sub-sample and then a test comparing the treatment effects across the two regressions (see sub-section 1.4 for more details). This will be performed instead of a single regression on the pooled sample with an interaction term between the treatment term and the sub-sample for the sake of simplicity, as the former approach would require multiple interaction terms for all co-variables, as well as three-way interactions when exploring other sub-groups.

implementation quality criteria should be met in order to consider a school to have “complied” with the treatment assignment. Data from checklists completed weekly by teachers at HiFive schools on implementation progress, and teacher and principal participation in HiFive training prior to HiFive implementation, may become available and provide some information on implementation quality. However, the reliability and availability of this data for all schools are likely to be insufficient to accurately capture “treatment compliance”. Depending on the availability and reliability of this data, indicators capturing this information may be included as additional co-variables in the regression model for research question 1.

Given an unclear definition of treatment compliance within and across schools, this evaluation will estimate Intent to Treat (ITT) impact estimates. It is assumed that this estimate will be a lower bound of the impact of the program for a perfectly compliant school.²

Note on sample weights: Sample weights will be included to account for the fact that the sampling probability of classes for a given grade is different across schools. Since a constant number of classes will be sampled for each grade in each school³, schools with more classes for a given grade will have a lower probability of being selected. This will be accounted for by using weights that represent the inverse probability of class selection. By doing so, each pupil observed or surveyed will have the same probability of inclusion into the sample.

² The ITT impact estimate will be the overall population average treatment effect (the impact of HiFive for the average pupil in the sample). However, since class sizes vary across schools and since the treatment effect may be different in larger classes, the within-class average effects estimator may be estimated by averaging the impact within a class and then averaging across classes (the impact of HiFive for a pupil in the average class in the sample).

³ For classroom observations, one class in each grade in each school will be sampled independent of the total number of classes in the grade. For the pupil survey, 8 total pupils in each grade from up to 2 classes will be sampled.

Table 2: Outcome indicators for research question 1

Outcome category	Outcome	Metric	Unit	Sample	Analytic model ⁴ (LPM – linear probability model; OLS – ordinary least squares))
Independent hand-washing after toilet use	Pupil washed hands <i>with soap and water</i> after toilet use	Y.1 – binary variable for whether pupil was observed to wash hands <i>with water and soap</i> after toilet use	Pupil	Separately for: Grade 1-3 pupils Grade 4-6 pupils	LPM: Y = Y.1
		Y.2 – binary variable for whether pupil reported washing hands <i>with water and soap</i> after last toilet use at school (direct self-report)		Grade 4-6 pupils	LPM: Y = Y.2
		Y.3 – categorical variable containing the number of items out of a list that the respondent answers “yes” to, where item of interest is whether a pupil reported washing hands <i>with water and soap</i> after toilet use (list randomization)			OLS: Y = Y.3 & independent variable of interest is the interaction between intervention treatment status and list randomization status
	Pupil washed hands <i>with water</i> after toilet use	Y.1 – binary variable for whether pupil was observed to wash hands <i>with water</i> after last toilet use at school	Pupil	Separately for: Grade 1-3 pupils Grade 4-6 pupils	LPM: Y = Y.1
		Y.2 – binary variable for whether pupil reported washing hands <i>with water</i> after last toilet use at school (direct self-report)		Grade 4-6 pupils	LPM: Y = Y.2
Independent hand-washing before eating	Pupil washed hands <i>with soap and water</i> before eating	Y.1 – binary variable for whether pupil reported washing hands <i>with water and soap</i> before eating (direct self-report)	Pupil	Grade 4-6 pupils	LPM: Y = Y.1
		Y.2 – categorical variable containing the number of items out of a list that the respondent answers “yes” to, where item of interest is whether for whether pupil reported washing hands <i>with water and soap</i> before eating (list randomization)			OLS: Y = Y.2 & independent variable of interest is the interaction between intervention treatment status and list randomization status
		Y.3 – binary variable for whether pupil reported washing hands <i>with water and soap</i> before eating (covert recall)			LPM: Y = Y.3
	Pupil washed hands <i>with water</i> before eating	Y.1 – binary variable for whether pupil reported washing hands <i>with water</i> before eating (direct self-report)	Pupil	Grade 4-6 pupils	LPM: Y = Y.1
		Y.2 – binary variable for whether pupil reported washing hands <i>with water</i> before eating (covert recall)			LPM: Y = Y.2

The analytic models used to answer research question 1 will also include the co-variates listed in Table 3 below.

⁴ Unless otherwise stated, the independent variable of interest is treatment assignment.

Table 3: Control variables for research question 1

Unit	Co-variate	Metric	Hypothesized relationship to outcome
School	District	X.1 – categorical variable where each value category represents the school district where the school is located	School district is associated with geographic location, which may be associated with varying levels of rurality, access to water, socio-economic status of teachers and pupils, or support received from DepEd division office.
	Number of pupils enrolled (pre-intervention)	X.2 – continuous variable to represent the number of pupils enrolled at the elementary school prior to HiFive intervention ⁵	Given that school budget is partially determined by number of pupils enrolled, and that larger schools tend to be located in urban or semi-urban areas, school resources and the school pupil and teacher population may vary depending on school size. This will be estimated using information reported by principals during end-line school visits or using the data reported in the DepEd Online Monitoring System (OMS), depending on how reliably information reported by principals can be collected.
	WinS implementation quality index score (pre-intervention)	X.3 – index variable between 0 and 11 composed of 11 binary indicators related to WASH conditions at the school, as reported in OMS data by principals prior to HiFive intervention ⁶	Higher score indicates a higher level of reported quality of WinS implementation, and may thus be associated with a higher level of hand-washing infrastructure and supplies, as well as more consistent implementation of WinS program activities involving pupils, such as group hand-washing and tooth-brushing.
Class	Number of pupils in the classroom	X.4 – continuous variable where value represents the number of pupils present in the classroom during the observation period	Classroom size may be associated with school resources and teacher quality or attention, which may influence pupil opportunity and incentives to wash hands with soap. Further, if hand-washing with soap at critical times is considered to be a norm (or habit) that HiFive contributes to establish and/or sustain, and if the class is considered as the primary ‘social unit’ for this norm, the number of pupils in this social unit may influence the likelihood of the norm arising and persisting.
Pupil	Gender	X.5 – binary variable for whether pupil observed is female	Traditional gender roles tend to involve more tasks that may require hand-washing for girls than boys, such as cooking or cleaning, and may thus facilitate building hand-washing habits among girls.
	Grade	X.6 – categorical variable where each value category represents the grade of the pupil observed/surveyed	HiFive activities targeted at changing pupil behavior may be more engaging and/or effectively convey intended messages to pupils of lower or higher grade.
	Pupil surveyed in the morning or afternoon	X.7 – binary variable for whether pupil was surveyed in the morning	Pupils surveyed in the morning are asked to recall events from the previous day while pupils surveyed in the afternoon are asked to recall events from earlier on the same day, thus responses reported by pupils surveyed in the morning may be associated with higher imprecision. Pupils will not be surveyed on Mondays to avoid recall periods exceeding 24 hours since last school day.

⁵ This variable may be converted to an ordinal variable to mitigate random error due to imprecision in the number of pupils reported.

⁶ See Table 7 in the *Sampling* section of the evaluation design document for a description of 11 indicators and additional information on the online monitoring system (OMS)

1.c. Analytic model

1.c.i. Specification for LPM: The effect of the treatment on the outcome variables listed in Table 2 for which the analytic model indicated is the Linear Probability Model will be measured by conducting the following regression:

$$Y_{ij} = \beta_0 + \beta_1 T_j + \vec{\beta}_2 \vec{X}_{2ij} + \varepsilon_{ij}$$

Where:

Y_{ij} denotes the outcome variable for pupil i in school j , classified as a binary variable, as specified in Table 2: Outcome indicators for research question 1

Outcome category	Outcome	Metric	Unit	
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- T_j denotes the treatment variable (binary variable for whether school j received the HiFive intervention)
- \vec{X}_{2ij} represents a vector of pupil, school, and class level co-variables as specified in Table 3
- ε_{ij} denotes the pupil error term i , clustered at the school-level to reflect the fact that the treatment assignment was at the school level
- β_n denotes the coefficients determined by the regression model (β_1 is coefficient of interest)

Stata commands: The Stata commands that will be used to estimate the stated model are as follows:

```
regress ihwws received_hifive i.grade gender num_pupil_school i.district wins_score
[pweight=weight], cluster(school_id)7
```

1.c.ii. Specification for OLS analytic model: An ordinary least squares model will be used to analyze the self-reported hand-washing list randomization survey question.

To clarify terminology, the group that is randomized to receive the 5 item list question set with the sensitive question will be called the **veiled response group** and the group with the 4 item list question set without the sensitive question will be called the **direct response group**.

The average number of “yes list items” in the direct response group between HiFive treatment and comparison groups are expected to be the same, as there is no apparent theoretical reason why the HiFive intervention may influence responses to the non-sensitive items.⁸ Table 4 lists the list randomization questions included in the pupil survey.

⁷ For observed variables, *num_pupil_class* will also be included as co-variate. For reported variables, *survey_am* will be included as co-variate.

⁸ In case the analysis uncovers a relation between treatment assignment and the non-sensitive list items, this will be controlled for using a difference-in-difference analytic model.

Table 4. Question set for list randomization in pupil survey

Outcome of interest	Questions (sensitive question in italics)
<i>iHWWS before eating</i>	1. The last time you left school, did you leave the school after 5pm? 2. The last time you had recess, did you play any sports? 3. The last time you had lunch at the school, did you leave any garbage behind after eating? 4. The last time you went to class, did you bring a book-bag? 5. <i>The last time you ate lunch on a school day, did you wash your hands with soap immediately before you started eating?</i>
<i>iHWWS after toilet use</i>	1. The last time you had a test, did you study the day before the test? 2. The last time you had homework, did you finish it on time? 3. The last time you had lunch at the school, did you throw any food you did not want to finish? 4. The last time you had recess, did you leave your classroom? 5. <i>The last time you used a toilet at school, did you wash your hands with soap immediately after using the toilet?</i>

This analytic model will be estimated using the following regression:

$$Y_{ij} = \beta_0 + \beta_1 L_i + \beta_2 (T_j \times L_i) + \vec{\beta}_3 \vec{X}_{3ij} + \varepsilon_{ij}$$

Where:

- Y_{ij} denotes the number of “yes list items” for pupil i in school j , classified as a categorical variable
- T_j denotes the treatment variable (binary variable for whether school j received the HiFive intervention)
- L_i denotes the list randomization status (binary variable for whether pupil i was in the veiled response group or direct response group)
- \vec{X}_{3ij} represents a vector of pupil, school and class level co-variables as specified in Table 2
- ε_{ij} denotes the pupil error term i , clustered at the school-level to reflect the fact that individuals within schools may have correlated outcomes
- β_n denotes the coefficients determined by the regression model (β_2 is coefficient of interest)

Stata commands: The Stata commands that will be used to estimate the stated model are as follows:

```
regress report_ihwws list_r_status received_hifive#list_r_status i.grade gender
num_pupil_school num_pupil_class i.district wins_score survey_am [pweight=weight],
cluster(school_id)
```

1.d. Sub-group analysis: the impact of the HiFive intervention on the outcomes of iHWWS after toilet use and before eating will be estimated using the analytic model described in sub-section 1.c, for each of the two samples corresponding to grade groups (grades 1-3 and

grades 4-6). The impact for these two grade groups will be compared to assess whether the effect of the treatment is different across grade groups.

In addition, within each sample, sub-group analysis will be conducted to compare the average impact of HiFive by:

- pupil opportunity to practice hand-washing with soap
- pupil gender
- WinS implementation quality index score
- class size

1.d.i. Treatment impact by grade group: The impact of the HiFive intervention on the outcomes of iHWWS after toilet use and before eating will be estimated separately for pupils grade 1-3 and grade 4-6. To test whether the impact of the HiFive intervention on these key outcomes was statistically significantly different in the two samples, the impact estimates in the two models corresponding to the two different samples will be compared by testing the equality of the regression coefficients.

Stata commands: The Stata commands that will be used to estimate the stated model are as follows (assuming estimation of the LPM):

```
regress ihwws received_hifive i.grade gender num_pupil_school i.district wins_score
[iweight=weight] if class4_6==0
est store A
```

```
regress ihwws received_hifive i.grade gender num_pupil_school i.district wins_score
[iweight=weight] if class4_6==1
est store B
```

```
suest A B, vce(cluster school_id)
```

```
lincom [B_mean]received_hifive - [A_mean] received_hifive
```

1.d.ii. Treatment impact by pupil opportunity to practice hand-washing with soap: In order to estimate the average effect of the HiFive intervention on the outcome of independent hand-washing after toilet use among pupils who had the opportunity (i.e. had access to a hand-washing facility with water and soap within classroom), sub-group analysis will be conducted using the following regression:

$$Y_{ij} = \beta_0 + \beta_1 T_j + \beta_2 O_i + \beta_3 (T_j \times O_i) + \overrightarrow{\beta_4 X_{4ij}} + \varepsilon_{ij}$$

Where:

- Y_{ij} denotes the outcome variable for pupil i in school j , classified as a binary variable
- T_j denotes the treatment variable (binary variable for whether school j received the HiFive intervention)
- O_i is a dummy variable denoting whether pupil i is in a classroom with a functioning handwashing facility with soap

- \vec{X}_{4ij} represents a vector of pupil, school, and class level co-variates as specified in Table 2
- ε_{ij} denotes the pupil error term i , clustered at the school-level to reflect the fact that the treatment assignment was at the school level
- β_n denotes the coefficients determined by the regression model (β_3 is the coefficient of interest)

The coefficient of interest for this regression will be interpreted as the impact of the HiFive intervention on the probability of pupils practicing iHWWS when they have the opportunity to do so (have access to water and soap). It will be clearly stated that this estimate does not account for the fact that pupil opportunity for iHWWS may be influenced by the HiFive intervention through its possible impact on the availability of functioning handwashing facilities with soap. Therefore, the comparison of pupils in classes where the treatment induced accessibility to pupils in classes of comparison schools that have accessible, functioning handwashing facilities with soap, would not be a pure comparison as treatment classrooms that were influenced by the treatment may have other unobservable characteristics correlated to pupil hand-washing behavior (such as pupil requests for additional soap or teacher motivation to provide soap for hand-washing). This would confound the treatment effect and lead to a biased estimate of the impact of the program.

Whether the treatment leads to an increase in the availability of functioning hand-washing facilities with soap will be tested as part of research question 2.3(a). Taken together, the results from this sub-group analysis and from the analytic model used for research question 2.3(a) will help to understand the extent to which any measured HiFive impact on hand-washing was driven by (i) increasing pupil opportunity to iHWWS, and/or (ii) increasing likelihood that pupils use the opportunity to wash hands with soap.

Stata commands: The Stata commands that will be used to estimate the stated model are as follows:

```
regress report_ihwws received_hifive##opportunity i.grade gender num_pupil_school
i.district wins_score num_pupil_class [pweight=weight], cluster(school_id)
```

1.d.iii. Treatment impact by pupil gender: In order to compare the average effect of the HiFive intervention on the outcomes of independent hand-washing after toilet use and before eating between girl and boy pupils, sub-group analysis will be conducted using the following regression:

$$Y_{ij} = \beta_0 + \beta_1 T_j + \beta_2 F_i + \beta_3 (T_j \times F_i) + \beta_4 \vec{X}_{4ij} + \varepsilon_{ij}$$

Where:

- F_i is a dummy variable denoting whether pupil i is female
- \vec{X}_{4ij} represents a vector of pupil, school, and class level co-variates as specified in Table 2, excluding pupil gender
- All other regression terms are defined as they were in the previous regression specification and β_3 is the coefficient of interest.

Stata commands: The Stata commands that will be used to estimate the stated model are as follows:

```
regress report_ihwws received_hifive##gender i.grade num_pupil_school i.district
wins_score [pweight=weight], cluster(school_id)9
```

1.d.iv. Treatment impact by WinS implementation quality index score: In order to compare the average effect of the HiFive intervention on the outcome of independent hand-washing after toilet use across different levels of WinS implementation quality, sub-group analysis will be conducted using the following regression:

$$Y_{ij} = \beta_0 + \beta_1 T_j + \beta_2 W_j + \beta_3 (T_j \times W_j) + \vec{\beta}_4 \vec{X}_{4ij} + \varepsilon_{ij}$$

Where:

- W_j is an ordinal variable between 0 and 11 denoting the WinS implementation quality index score for school j
- \vec{X}_{4ij} represents a vector of pupil, school, and class level co-variables as specified in Table 2, excluding WinS implementation quality index score
- All other regression terms are defined as they were in the previous regression specification and β_3 is the coefficient of interest.

Stata commands: The Stata commands that will be used to estimate the stated model are as follows:

```
regress report_ihwws received_hifive##c.wins_score i.grade gender num_pupil_school
i.district [pweight=weight], cluster(school_id)10
```

1.d.v. Treatment impact by classroom size: Sub-group analysis will also be conducted to compare the treatment effect for differing classroom sizes. This will be conducted using the following regression specification:

$$Y_{ij} = \beta_0 + \beta_1 T_j + \beta_2 C_i + \beta_3 (T_j \times C_i) + \vec{\beta}_4 \vec{X}_{4ij} + \varepsilon_{ij}$$

Where:

- C_i is a continuous variable indicating the size of pupil i 's class
- \vec{X}_{4ij} represents a vector of pupil, school, and class level co-variables as specified in Table 2, excluding class size
- All other regression terms are defined as they were in the previous regression specification and β_3 is the coefficient of interest.

⁹ For observed variables, *num_pupil_class* will also be included as co-variate. For reported variables, *survey_am* will be included as co-variate.

¹⁰ For observed variables, *num_pupil_class* will also be included as co-variate. For reported variables, *survey_am* will be included as co-variate.

Stata commands: The Stata commands that will be used to estimate the stated model are as follows:

```
regress report_ihwws received_hifive##c.num_pupil_class wins_score i.grade gender  
num_pupil_school i.district [pweight=weight], cluster(school_id)
```

1.e. Presentation of results: a regression table will be included for each specification to describe the correlation between key indicators of interest and co-variates. Data visualisations describing the level of the outcomes variables in the treatment and control group may also be included.

Research Question 2.1

2.1.a Research question 2.1: Does the *HiFive for HySan* intervention increase the frequency of daily supervised group handwashing activities in schools?

2.1.b. Indicators, unit of analysis and sample: Table 5 below provides a summary of the indicators for this research question, and the unit of analysis and sample corresponding to each indicator. These indicators are based on data reported by pupils during the pupil survey and supervised group hand-washing activities observed by surveyors during their observation of pupil hand-washing behavior inside classrooms, as specified in Table 3.¹¹

¹¹ Note, research question 2.1 will also include sample weights as in the previous research question.

Table 5: Outcome indicators for research question 2.1

Outcome category	Outcome	Metric	Unit	Sample	Analytic model ¹² (LPM – linear probability model; OLS – ordinary least squares)
Group hand-washing activity with soap	Class conducted group hand-washing activity	Y.1 – binary variable for whether class was observed to conduct supervised group hand-washing activity with soap with more than half of the pupils participating during day of observation	Class	Separately for: Grade 1-3 pupils Grade 4-6 pupils	LPM: $Y = Y.1$
		Y.2 – binary variable for whether more than half of pupils surveyed within the same class reported that their class conducted a supervised group hand-washing activity with soap during the previous school day (a minimum of 3 pupils will be surveyed per class)	Class	Grade 4-6 pupils	LPM: $Y = Y.2$

The analytic model used to answer research question 2.1 will also include the following class and school level co-variates, as they were defined in the analytic model for research question 1 (see Table 3):

- **Class-level variables:** grade; class size
- **School-level variables:** school district; number of pupils enrolled (pre-intervention); WinS implementation quality index score (pre-intervention)

¹² Unless otherwise stated, the independent variable of interest is treatment assignment.

2.1.c. Analytic model: The effect of treatment on the outcome variables listed in Table 5 for which the analytic model indicated is the Linear Probability Model will be measured by conducting the following regression:

$$Y_{kj} = \beta_0 + \beta_1 T_j + \overrightarrow{\beta_2} \overrightarrow{X}_{2kj} + \varepsilon_{kj}$$

Where:

- Y_{kj} denotes the outcome variable for class k in school j , classified as a binary variable, as specified in Table 5
- T_j denotes the treatment variable (binary variable for whether school j received the HiFive intervention)
- \overrightarrow{X}_{2kj} represents a vector of class and school level co-variates as specified in sub-section 2.1.c
- ε_{kj} denotes the class error term k , clustered at the school-level to reflect the fact that the treatment assignment was at the school level
- β_n denotes the coefficients determined by the regression model (β_1 is coefficient of interest)

Stata commands: The Stata commands that will be used to estimate the stated model are as follows:

*regress report_ghw received_hifive grade num_pupil_school i.district wins_score [pweight=weight], cluster(school_id)*¹³

2.1.d. Sub-group analysis: no sub-group analysis is planned for this research question.

2.1.e. Presentation of results: a regression table will be included for each specification to describe the correlation between key indicators of interest and co-variates. Data visualisations describing the level of the outcomes variables in the treatment and control group may also be included.

¹³ For observed variables, *num_pupil_class* will also be included as co-variate. For reported variables, *survey_am* will be included as co-variate.

Research Question 2.2

2.2.a. Research question 2.2: Does the *HiFive for HySan* intervention affect pupil perception of critical times and motivations to practice iHWWS at critical times?

2.2.b. Indicators, unit of analysis and sample: Table 6 below provides a summary of the indicators for this research question, and the unit of analysis and sample corresponding to each indicator. These indicators are based on data reported by pupils during the pupil survey, as specified in Table 5.¹⁴

¹⁴ Note, research question 2.2 will also include sample weights, as is the case for research question 1.

Table 6: Outcome indicators for research question 2.2

Outcome category	Outcome	Metric	Unit	Sample	Analytic model ¹⁵ (LPM – linear probability model; OLS – ordinary least squares)
Perceived critical times to practice iHWWS	Pupil reported <i>before eating</i> as critical time to practice hand-washing with soap	Y.1 – binary variable for whether pupil reported before eating as critical time for hand-washing	Pupil	Grade 4-6 pupils	LPM with Y=Y.1
	Pupil reported <i>after toilet use</i> as critical time to practice hand-washing with soap	Y.1 – binary variable for whether pupil reported after toilet use as critical time for hand-washing			LPM with Y=Y.1
Motivations to practice iHWWS at critical times	Reported reasons for hand-washing with soap <i>before eating</i>	Y.1-4 – set of binary variables for whether pupil reported each of the following ‘motivators’ as reason for hand-washing with soap <i>after toilet use</i> : Y.1 – affiliation; Y.2 – disgust; Y.3 – attractiveness, and Y.4 – preventing contamination of germs	Pupil	Grade 4-6 pupils	LPM with: (i) Y=Y.1; (ii) Y=Y.2; (iii) Y=Y.3; (iv) Y=Y.4
	Reported reasons for hand-washing with soap <i>after toilet use</i>	Y.1 – set of binary variables for whether pupil reported one or more of following ‘motivators’ as reason for hand-washing with soap <i>before eating</i> : Y.1 – affiliation; Y.2 – disgust; Y.3 – attractiveness, and Y.4 – preventing contamination of germs			LPM with: (i) Y=Y.1; (ii) Y=Y.2; (iii) Y=Y.3; (iv) Y=Y.4
Beliefs and expectations around hand-washing at critical times	Beliefs and expectations around hand-washing with soap <i>before eating</i>	Y.1 – ordinal variable with scale for pupil belief on whether other pupils in same class should wash their hands with soap immediately <i>before eating</i> (1: Yes, definitely – 5: No, definitely not)	Pupil	Grade 4-6 pupils	OLS with Y=Y.1
		Y.2 – ordinal variable with scale for pupil belief on share of other pupils in same class who wash their hands with soap immediately <i>before eating</i> (1: All of them – 5: None of them)			OLS with Y=Y.2
	Beliefs and expectations around hand-washing with soap <i>after toilet use</i>	Y.1 – ordinal variable with scale for pupil belief on whether other pupils in same class should wash their hands with soap immediately <i>after toilet use</i> (1: Yes, definitely – 5: No, definitely not)			OLS with Y=Y.1
		Y.2 – ordinal variable with scale for pupil belief on share of other pupils in same class who wash their hands with soap immediately <i>after toilet use</i> (1: All of them – 5: None of them)			OLS with Y=Y.2
Barriers to practice iHWWS at critical times	Reasons reported for not hand-washing with soap <i>before eating</i>	Y.1 – categorical variable where each value category represents a reason reported for not washing hands before last instance of eating at school	Pupil	Grade 4-6 pupils	Frequency distribution (descriptive)
	Reasons reported for not hand-washing with soap <i>after toilet use</i>	Y.1 – categorical variable where each value category represents a reason reported for not washing hands after last instance of toilet use at school			Frequency distribution (descriptive)

¹⁵ Unless otherwise stated, the independent variable of interest is treatment assignment.

The analytic model used to answer research question 2.2 will also include the following co-variables, as they were defined in the analytic model for research question 1 (see Table 3):

- **Pupil-level variables:** gender, grade
- **School-level variables:** school district; number of pupils enrolled (pre-intervention); WinS implementation quality index score (pre-intervention)

2.2.c. Analytic model

2.2.c.i. Specification for LPM: The effect of treatment on the outcome variables listed in Table 6 for which the analytic model indicated is the Linear Probability Model will be measured by conducting the following regression:

$$Y_{ij} = \beta_0 + \beta_1 T_j + \vec{\beta}_2 \vec{X}_{2ij} + \varepsilon_{ij}$$

Where:

- Y_{ij} denotes the outcome variable for pupil i in school j , classified as a binary variable, as specified in Table 6
- T_j denotes the treatment variable (binary variable for whether school j received the HiFive intervention)
- \vec{X}_{2ij} represents a vector of school and pupil level co-variables as specified in sub-section 2.2.b.
- ε_{ij} denotes the pupil error term i , clustered at the school-level to reflect the fact that the treatment assignment was at the school level
- β_n denotes the coefficients determined by the regression model (β_1 is coefficient of interest)

Stata commands: The Stata commands that will be used to estimate the stated model are as follows:

```
regress report_critical_t received_hifive i.grade gender num_pupil_school i.district  
wins_score survey_am [pweight=weight], cluster(school_id)
```

2.2.c.ii. Specification for OLS analytic model: The effect of treatment on the outcome variables listed in Table 6 for which the analytic model indicated is Ordinary Least Squares will be measured by conducting a regression similar as that indicated in sub-section 2.2.c.i., with the outcome indicator Y_{ij} denoting a ordinal variable between 1 and 5, and interpreted as a continuous variable.

2.2.d. Sub-group analysis: no sub-group analysis is planned for this research question.

2.2.e. Presentation of results: a regression table will be included for each specification to describe the correlation between key indicators of interest and co-variables. Data visualisations describing the level of the outcomes variables in the treatment and control group may also be included.

Research Question 2.3

2.3.a. Research question 2.3: Does the *HiFive for HySan* intervention increase the availability of:

- a) Hand-washing facilities with soap and water?
- b) Functional and clean toilet facilities at schools?

2.3.b. Indicators, unit of analysis and sample: Table 7 below provides a summary of the indicators for this research question, and the unit of analysis and sample corresponding to each indicator. These indicators are based on surveyor observations of toilet and hand-washing facilities at the schools visited, as specified in Table 7.

Table 7: Outcome indicators for research question 2.3

Outcome category	Outcome	Metric	Unit	Sample	Analytic model ¹⁶ (LPM – linear probability model; OLS – ordinary least squares)
(a) Availability of hand-washing facilities with water and soap	Availability of functioning hand-washing facilities <i>with soap</i>	Y.1 – continuous variable where value represents the ratio of pupils-to-facilities (observed functioning hand-washing facility outlets <i>with soap</i>) at the school	School	All schools	OLS with Y=Y.1
	Availability of functioning hand-washing facilities	Y.1 – continuous variable where value represents the ratio of pupils-to-facilities (observed functioning hand-washing facility outlets) at the school			OLS with Y=Y.1
	Presence of functional hand-washing facility <i>with soap</i> near toilet facility	Y.1 – binary variable for whether there is a functioning hand-washing facility with water <i>and soap</i> inside classroom for classroom toilet facilities and within 10 meters of functioning toilet facility for block toilet facilities	Toilet facility	All toilet facilities at school	LPM with Y=Y.1
	Presence of functional hand-washing facility near toilet facility	Y.1 – binary variable for whether there is a functioning hand-washing facility with water inside classroom for classroom toilet facilities and within 10 meters of functioning toilet facility for block toilet facilities			LPM with Y=Y.1
(b) Availability of functional and clean toilet facilities	Availability of functioning toilet facilities	Y.1 – continuous variable where value represents the ratio of pupils-to-facilities (observed functioning toilet facilities) at the school	School	Grade 4-6 pupils	LPM with Y=Y.1
	Condition of functioning toilet facilities	Y.1 – Linear composite variable between 0 and 4 corresponding to the number of the following conditions observed in the toilet facility: (i) There is water available for flushing near toilet (ii) Water in toilet bowl is clear (iii) There is a door that can be closed (iv) There is a fixed partition (permanent walls)	Toilet facility	All toilet facilities at school	OLS with Y=Y.1

¹⁶ Unless otherwise stated, the independent variable of interest is treatment assignment.

The analytic model used to answer research question 2.3 will also include the following co-variables, as they were defined in the analytic model for research question 1 (see Table 3):

- **School-level variables:** school district; WinS implementation quality index score (pre-intervention)

In addition, for outcomes for which the unit indicated in Table 7 is the toilet facility and the analytic model is LPM, the following will be included as co-variables:

- **School-level variable:** number of pupils enrolled at the school (pre-intervention)
- **Facility-level variable:** Location of the toilet facility observed, defined as a categorical variable where each value category represents which of following location the classroom facility is inside a classroom from grade 1-6, or outside a classroom.

2.3.c. Analytic model

2.3.c.i. Specification for LPM: The effect of treatment on the outcome variables listed in Table 7 for which the analytic model indicated is the Linear Probability Model will be measured by conducting the following regression:

$$Y_{kj} = \beta_0 + \beta_1 T_j + \vec{\beta}_2 \vec{X}_{2kj} + \varepsilon_{kj}$$

Where:

- Y_{kj} denotes the outcome variable for facility k in school j , classified as a binary variable, as specified in Table 6
- T_j denotes the treatment variable (binary variable for whether school j received the HiFive intervention)
- \vec{X}_{2kj} represents a vector of school and facility level co-variables as specified in subsection 2.3.b
- ε_{kj} denotes the facility error term k , clustered at the school-level to reflect the fact that the treatment assignment was at the school level
- β_n denotes the coefficients determined by the regression model (β_1 is coefficient of interest)

Stata commands: The Stata commands that will be used to estimate the stated model are as follows:

```
regress hw_facility_near received_hifive facility_loc num_pupil_school i.district wins_score,
cluster(school_id)
```

2.3.c.ii. Specification for OLS analytic model: The effect of treatment on the outcome variables listed in Table 7 for which the analytic model indicated is OLS will be measured by conducting the following regression:

$$Y_j = \beta_0 + \beta_1 T_j + \vec{\beta}_2 \vec{X}_{2j} + \varepsilon_j$$

Where:

- Y_j denotes the outcome variable for school j , classified as a binary variable, as specified in Table 6
- T_j denotes the treatment variable (binary variable for whether school j received the HiFive intervention)
- \vec{X}_{2j} represents a vector of school level co-variables as specified in sub-section 2.3.b
- ε_j denotes the school error term
- β_n denotes the coefficients determined by the regression model (β_1 is coefficient of interest)

Stata commands: The Stata commands that will be used to estimate the stated model are as follows:

regress pupil_toilet_ratio received_hifive i.district wins_score num_pupil_school

2.3.d. Sub-group analysis

2.3.d.i. Treatment impact by toilet facility location: In order to compare the average effect of the HiFive intervention on the outcome of presence of a functioning hand-washing facility with soap near school toilets between classroom toilets and out-of-classroom toilets, sub-group analysis will be conducted using the following regression:

$$Y_{kj} = \beta_0 + \beta_1 T_j + \beta_2 L_k + \beta_3 (T_j \times L_k) + \beta_4 \vec{X}_{4j} + \varepsilon_{kj}$$

Where:

- Y_{kj} denotes the outcome variable for toilet facility k in school j , classified as a binary variable, as specified in Table 6
- T_j denotes the treatment variable (binary variable for whether school j received the HiFive intervention)
- L_k is a dummy variable denoting whether toilet facility k is located inside a classroom
- \vec{X}_{4j} represents a vector of school level co-variables as specified in sub-section 2.3.b, excluding location of toilet facility
- ε_{kj} denotes the facility error term k , clustered at the school-level to reflect the fact that the treatment assignment was at the school level
- β_n denotes the coefficients determined by the regression model (β_3 is coefficient of interest)

Stata commands: The Stata commands that will be used to estimate the stated model are as follows:

regress facility_soap_present received_hifive##loc_facility num_pupil_school i.district wins_score, cluster(school_id)

2.3.d.i. Treatment impact by WinS implementation quality index score: In order to compare the average effect of the HiFive intervention on the outcome of presence of a functioning hand-washing facility with soap near school toilets across different levels of WinS implementation quality, sub-group analysis will be conducted using the following regression:

$$Y_{kj} = \beta_0 + \beta_1 T_j + \beta_2 W_j + \beta_3 (T_j \times W_j) + \beta_4 \vec{X}_{4kj} + \varepsilon_j$$

Where:

- W_j is an ordinal variable between 0 and 11 denoting the WinS implementation quality index score
- \vec{X}_{4kj} represents a vector of school and facility level co-variates as specified in sub-section 2.3.b, excluding WinS implementation quality index score
- All other regression terms are defined as they were in the previous regression specification and β_3 is the coefficient of interest.

Stata commands: The Stata commands that will be used to estimate the stated model are as follows:

```
regress facility_soap_present received_hifive##wins_score num_pupil_school i.district
loc_facility, cluster(school_id)
```

2.3.e. Presentation of results: a regression table will be included for each specification to describe the correlation between key indicators of interest and co-variates. Data visualisations describing the level of the outcomes variables in the treatment and control group may also be included.

Multiple hypothesis testing correction

Given the large number of hypotheses being tested across the primary and secondary research questions in the study, the analysis will be adjusted for multiple inference. The correction will impose a more conservative threshold for statistical significance since standard cutoffs would likely result in a significant outcome by chance alone (i.e. false positives).¹⁷ Normal, uncorrected, p-values will also be reported.

Table 8 and

¹⁷ One possible method to correct p-values is the Benjamini & Hochberg method, however other methods (e.g. the free step down resampling method) may be used.

Table 9 below summarize the outcomes described for each research question above, and indicates the number of hypotheses being tested with each “family” of outcomes¹⁸. The analysis will correct p-values based on the number of hypotheses being tested for each family of outcomes.

Table 8: Number of hypotheses tested for each family of outcomes for research question 1

Q	Outcome category	Outcomes from main model	# of outcome indicators	# of group comparisons in sub-group analysis	Total hypotheses tested within a “family” of outcomes
Q.1	Independent hand-washing <u>after toilet use</u>	Pupil washed hands <i>with soap and water</i> after toilet use	1	5	7
		Pupil washed hands <i>with water</i> after toilet use	1	-	
	Independent hand-washing <u>before eating</u>	Pupil washed hands <i>with soap and water</i> before eating	1	2	4
		Pupil washed hands <i>with water</i> before eating	1	-	

¹⁸ The creation of outcome families is a subjective process and the following decisions were made in identifying the families described in Table 8 and Table 9, keeping in mind the primary goal of the evaluation, which is to inform UNICEF and DepEd program decisions: First, for Q.1, all indicators of the same outcome were classified as only 1 outcome indicator. This is because the different indicators will be triangulated during the analysis to interpret the measured impact on the outcome. Second, behavior, beliefs, and motivations for hand-washing before eating and after toilet use are classified as separate outcome families, as these are defined as two distinct critical times in the HiFive intervention, and it is not obvious that these outcomes would move in parallel as a result of the intervention.

Table 9: Number of hypotheses tested for each family of outcomes for research questions 2.1, 2.2 and 2.3

Q	Outcome category	Outcomes from main model	# of outcome indicators	# of group comparisons in sub-group analysis	Total hypotheses tested within a “family” of outcomes
Q2.1	Group hand-washing activity with soap	Class conducted group hand-washing activity	2	2	4
Q2.2	Perceived critical times to practice iHWWS	Pupil reported <i>before eating</i> as critical time to practice hand-washing with soap	1	-	1
		Pupil reported <i>after toilet use</i> as critical time to practice hand-washing with soap	1	-	1
	Motivations to practice iHWWS at critical times	Reported reasons for hand-washing with soap <i>before eating</i>	4	-	4
		Reported reasons for hand-washing with soap <i>after toilet use</i>	4	-	4
	Beliefs and expectations around hand-washing at critical times	Pupil belief on whether other pupils in same class should wash their hands with soap immediately <i>after toilet use</i>	1	-	2
		Pupil belief on share of other pupils in same class who wash their hands with soap immediately <i>after toilet use</i>	1	-	
		Pupil belief on whether other pupils in same class should wash their hands with soap immediately <i>before eating</i>	1	-	2
		Pupil belief on share of other pupils in same class who wash their hands with soap immediately <i>before eating</i>	1	-	
Q2.3	(a) Availability of hand-washing facilities with water and soap	Availability of functioning hand-washing facilities <i>with soap</i>	1	-	6
		Availability of functioning hand-washing facilities	1	-	
		Presence of functional hand-washing facility <i>with soap</i> near toilet facility	1	2	
		Presence of functional hand-washing facility near toilet facility	1	-	
	(b) Availability of functional and clean toilet facilities	Availability of functioning toilet facilities	1	-	2

Limitations and corrections to the analysis

Outliers and Missing Values: Missing values can take the form of non-response (e.g. uncompleted surveys), partial response (e.g. “Don’t know” responses), or errors in the data. Minimal missing data is expected since the digital survey forms include constraints that require data to be entered before the enumerator can proceed with data collection. If co-variates have missing values for some observations, a dummy variable will be generated and included in the analytic model, and missing values for co-variates will be replaced with 0¹⁹.

Cross-tabulations: cross-tabulations of variables may be conducted to provide additional insights on the relationship between variables within the sample of schools surveyed.

Additional Hypothesis Testing: Additional analyses may be conducted following the conclusion of data collection if additional questions of interest arise. Any analyses that are not specified in this pre-analysis plan will be indicated and justified as such.

¹⁹ Alternatively, and depending on the number missing values across co-variates, multiple imputation may be used to account for missing values in the analysis.