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|  | **2013** |
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| **[ Modeling Frequency in the vMR]** |
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# The FHIR Schedule Type

The vMR shall model frequency along the lines taken by FHIR. This decision was taken given the greater expressivity of FHIR Schedule type and also as a first step towards harmonizing the two models in the future.

FHIR currently models frequency as follows (As of the 11/07/2013 specification revision):

<**[[name]](http://www.hl7.org/implement/standards/fhir/datatypes-definitions.html" \l "Schedule" \o "A schedule that specifies an event that may occur multiple times. Schedules are not used for recording when things did happen, but when they are expected or requested to occur.)** xmlns="http://hl7.org/fhir">

<!-- from Element: [extension](http://www.hl7.org/implement/standards/fhir/extensibility.html) -->

<[**event**](http://www.hl7.org/implement/standards/fhir/datatypes-definitions.html#Schedule.event)><!-- **0..\*** [Period](http://www.hl7.org/implement/standards/fhir/datatypes.html#Period) When the event occurs --></event>

<[**repeat**](http://www.hl7.org/implement/standards/fhir/datatypes-definitions.html#Schedule.repeat)> <!-- **?? 0..1** Only if there is none or one event -->

<[**frequency**](http://www.hl7.org/implement/standards/fhir/datatypes-definitions.html#Schedule.repeat.frequency) value="[[integer](http://www.hl7.org/implement/standards/fhir/datatypes.html#integer)]"/><!-- **?? 0..1** Event occurs frequency times per duration -->

<[**when**](http://www.hl7.org/implement/standards/fhir/datatypes-definitions.html#Schedule.repeat.when) value="[[code](http://www.hl7.org/implement/standards/fhir/datatypes.html#code)]"/><!-- **?? 0..1** [Event occurs duration from common life event](http://www.hl7.org/implement/standards/fhir/event-timing.html) -->

<[**duration**](http://www.hl7.org/implement/standards/fhir/datatypes-definitions.html#Schedule.repeat.duration) value="[[decimal](http://www.hl7.org/implement/standards/fhir/datatypes.html#decimal)]"/><!-- **?? 1..1** Repeating or event-related duration -->

<[**units**](http://www.hl7.org/implement/standards/fhir/datatypes-definitions.html#Schedule.repeat.units) value="[[code](http://www.hl7.org/implement/standards/fhir/datatypes.html#code)]"/><!-- **1..1** [The units of time for the duration](http://www.hl7.org/implement/standards/fhir/units-of-time.html) -->

<[**count**](http://www.hl7.org/implement/standards/fhir/datatypes-definitions.html#Schedule.repeat.count) value="[[integer](http://www.hl7.org/implement/standards/fhir/datatypes.html#integer)]"/><!-- **?? 0..1** Number of times to repeat -->

<[**end**](http://www.hl7.org/implement/standards/fhir/datatypes-definitions.html#Schedule.repeat.end) value="[[dateTime](http://www.hl7.org/implement/standards/fhir/datatypes.html" \l "dateTime)]"/><!-- **?? 0..1** When to stop repeats -->

</repeat>

</[name]>

The formal definition of Schedule in FHIR is as follows:

See also [Base Definition](http://www.hl7.org/implement/standards/fhir/datatypes.html#Schedule), [Examples](http://www.hl7.org/implement/standards/fhir/datatypes-examples.html#Schedule) and [Mappings](http://www.hl7.org/implement/standards/fhir/datatypes-mappings.html#Schedule).

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| **Schedule** | |
| Definition | A schedule that specifies an event that may occur multiple times. Schedules are not used for recording when things did happen, but when they are expected or requested to occur. |
| [Control](http://www.hl7.org/implement/standards/fhir/conformance-rules.html#conformance) | 1..1 |
| Requirements | Need to able to track schedules. There are several different ways to do scheduling: one or more specified times, a simple rules like three times a day, or to say, x before/after meals. |
| Comments | A schedule can be either a list of events - intervals on which the event occurs, or a single event with repeating criteria or just repeating criteria with no actual event. |
| Invariants | **Defined on this element** **Inv-1**: There can only be a repeat element if there is none or one event (xpath: not(exists(f:repeat)) or count(f:event) < 2) |
| **Schedule.event** | |
| Definition | Identifies specific time periods when the event should occur. |
| [Control](http://www.hl7.org/implement/standards/fhir/conformance-rules.html#conformance) | 0..\* |
| [Type](http://www.hl7.org/implement/standards/fhir/datatypes.html) | [Period](http://www.hl7.org/implement/standards/fhir/datatypes.html#Period) |
| Requirements | Some schedules are just explicit lists of times. |
| **Schedule.repeat** | |
| Definition | Identifies a repeating pattern to the intended time periods. |
| [Control](http://www.hl7.org/implement/standards/fhir/conformance-rules.html#conformance) | 0..1 |
| Requirements | Many schedules are determined by regular repetitions. |
| Comments | If present, the Schedule.event indicates the time of the first occurrence. |
| Invariants | **Defined on this element** **Inv-2**: Either frequency or when SHALL be present, but not both (xpath: exists(f:frequency) != exists(f:when)) **Inv-3**: At most, only one of count and end can be present (xpath: not(exists(f:count) and exists(f:end))) **Affect this element** **Inv-1**: There can only be a repeat element if there is none or one event (xpath: not(exists(f:repeat)) or count(f:event) < 2) |
| **Schedule.repeat.frequency** | |
| Definition | Indicates how often the event should occur. |
| [Control](http://www.hl7.org/implement/standards/fhir/conformance-rules.html#conformance) | 0..1 |
| [Type](http://www.hl7.org/implement/standards/fhir/datatypes.html) | [integer](http://www.hl7.org/implement/standards/fhir/datatypes.html#integer) |
| Invariants | **Affect this element** **Inv-2**: Either frequency or when SHALL be present, but not both (xpath: exists(f:frequency) != exists(f:when)) |
| **Schedule.repeat.when** | |
| Definition | Identifies the occurrence of daily life that determine timing. |
| [Control](http://www.hl7.org/implement/standards/fhir/conformance-rules.html#conformance) | 0..1 |
| [Binding](http://www.hl7.org/implement/standards/fhir/terminologies.html) | EventTiming : Real world event that the schedule relates to (see [http://hl7.org/fhir/event-timing](http://www.hl7.org/implement/standards/fhir/event-timing.html) for values) |
| [Type](http://www.hl7.org/implement/standards/fhir/datatypes.html) | [code](http://www.hl7.org/implement/standards/fhir/datatypes.html#code) |
| Requirements | Timings are frequently determined by occurrences such as waking, eating and sleep. |
| Invariants | **Affect this element** **Inv-2**: Either frequency or when SHALL be present, but not both (xpath: exists(f:frequency) != exists(f:when)) |
| **Schedule.repeat.duration** | |
| Definition | How long each repetition should last. |
| [Control](http://www.hl7.org/implement/standards/fhir/conformance-rules.html#conformance) | 1..1 |
| [Type](http://www.hl7.org/implement/standards/fhir/datatypes.html) | [decimal](http://www.hl7.org/implement/standards/fhir/datatypes.html#decimal) |
| Requirements | Some activities are not instantaneous and need to be maintained for a period of time. |
| Invariants | **Defined on this element** **Inv-4**: duration SHALL be a positive value (xpath: @value > 0 or not(@value)) **Affect this element** **Inv-4**: duration SHALL be a positive value (xpath: @value > 0 or not(@value)) |
| **Schedule.repeat.units** | |
| Definition | The units of time for the duration. |
| [Control](http://www.hl7.org/implement/standards/fhir/conformance-rules.html#conformance) | 1..1 |
| [Binding](http://www.hl7.org/implement/standards/fhir/terminologies.html) | UnitsOfTime : A unit of time (units from UCUM) (see [http://hl7.org/fhir/units-of-time](http://www.hl7.org/implement/standards/fhir/units-of-time.html) for values) |
| [Type](http://www.hl7.org/implement/standards/fhir/datatypes.html) | [code](http://www.hl7.org/implement/standards/fhir/datatypes.html#code) |
| **Schedule.repeat.count** | |
| Definition | A total count of the desired number of repetitions. |
| [Control](http://www.hl7.org/implement/standards/fhir/conformance-rules.html#conformance) | 0..1 |
| [Type](http://www.hl7.org/implement/standards/fhir/datatypes.html) | [integer](http://www.hl7.org/implement/standards/fhir/datatypes.html#integer) |
| Requirements | Repetitions may be limited by end time or total occurrences. |
| Comments | An end need not be specified. |
| Invariants | **Affect this element** **Inv-3**: At most, only one of count and end can be present (xpath: not(exists(f:count) and exists(f:end))) |
| **Schedule.repeat.end** | |
| Definition | When to stop repeats. |
| [Control](http://www.hl7.org/implement/standards/fhir/conformance-rules.html#conformance) | 0..1 |
| [Type](http://www.hl7.org/implement/standards/fhir/datatypes.html) | [dateTime](http://www.hl7.org/implement/standards/fhir/datatypes.html#dateTime) |
| Requirements | Repetitions may be limited by end time or total occurrences. |
| Comments | An end need not be specified. |
| Invariants | **Affect this element** **Inv-3**: At most, only one of count and end can be present (xpath: not(exists(f:count) and exists(f:end))) |

# The vMR Deprecated Frequency Type

The vMR Frequency type closely aligned with the FHIR representation of Schedule. However, it lacked some of the required expressivity of frequency necessary to represent chemotherapy regimens. Given its close similarity to the FHIR Schedule type, the workgroup has decided to deprecate the current approach in favor for a slightly modified version of the FHIR Schedule type. The previous representation of Frequency is shown below:



# The Proposed vMR Schedule Type

The FHIR Schedule type has been modeled as follows in the vMR. While the expressivity of the FHIR Schedule class is fully retained, the vMR also the representation of frequency as both a code (e.g., ‘BID’, ‘Q8h’) and an interval. Furthermore, the vMR version of schedule retains the intervalIsImportant BL attribute to distinguish between cases such as BID/Q8H. To support both representations, the BaseRepeat abstract class has been introduced. Its two concrete representations are RepeatAsInterval and RepeatAsCode.



# Examples

## Example 1

We need to be able to set ranges for chemo regimens, such as

Gemcitabine + Cisplatin

* Gemcitabine 1000 mg/m2 intravenously over 30-60 min day 1, 8 and 15
* Cisplatin 70 mg/m2 iv day 2
* Every 4weeks x 6 cycles (i.e., times)"

Note that the actual offset expression is outside the scope of the vMR and would be expressed using an expression language such as the one provided by the Health eDecision initiative.

<Schedule>

<event start=20131101/>

<cycle> [0..\*]

<cycleDuration …>

<cycleRepetition>

<frequency value=’1’/>

<duration value=’4’/>

<units value=’w’/>

<count value=’6’/>

</cycleRepetition>

<offset pointInCycle=’1’ offsetUnit=’d’ span=’14’ unit=’d’>

<repeat>

<frequency value=’1’/>

<duration value=’1’/>

<units value=’d’/>

<intervalIsImportant value=false/>

</repeat>

</offset>

<offset administrationOffset =’8’ offsetUnit=’d’ span=’1’ unit=’d’/>

<offset administrationOffset =’15’ offsetUnit=’d’ span=’1’ unit=’d’/>

</cycle>

<repeat>

<frequency value=’1’/>

<duration value=’4’/>

<units value=’w’/>

<count value=’6’/>

</repeat>

</Schedule>

## Example 1-1

Let me use a couple of examples to illustrate my questions about the ability of vMR to support certain kinds of data models for orders (i.e., within an order set).  First, let's consider the following chemotherapy regimen:

[ ] Cyclophosphamide + DOXOrubicin + Fluorouracil (CAF) Regimen (cycled every 28 days)

     ♦ cyclophosphamide 100 milligram/meter squared orally once a day on days 1 to 14 of cycle

     ♦ DOXOrubicin 30 milligram/meter squared intravenously once on days 1 and 8 of cycle

     ♦ fluorouracil 500 milligram/meter squared intravenously once on days 1 and 8 of cycle

Considerations:

* The checkbox would be at the level of the regimen, not each individual medication--that is, it implies a Boolean AND relationship (i.e., all or none)
* Need a data element to codify that the regimen is cycled every 28 days (e.g., Cycle Duration)
* In addition to common data elements like drug, dose, dose unit, route, and frequency, need a data element for timing to represent which days of the cycle to administer which meds; also need to decide if you say "on days 1 to 14 of cycle" or if you say "day X to Y of cycle" or "day X and Y of cycle"
* Need an information model that ties together all the data elements of this kind of order, and it would be a different information model than other non-chemotherapy orders where the user does not need to specify things like cycle duration.

## Example 2

For frequency, we need to be able to define time ranges. For example, History and Physical every 6 to 12 months. There is no Snomed code for 6 - 12 months, and it's not possible to capture this using the frequencyAsInterval.

<Schedule>

<repeat>

<frequency low=’1’ high=’2’/> Need IVL\_INT instead of INT

<duration value=’1’/>

<units value=’y’/>

<intervalIsImportant value=’true’/>

<intervalPrecision value=’1’ unit=’month’/>

</repeat>

</Schedule>

## Example 3

The following shows how to represent common frequencies where the interval may or may not matter in both interval and code forms.

### TID

<Schedule>

<frequency value=’3’/>

<duration value=’1’/>

<units value=’d’/>

<intervalIsImportant value=’false’/>

</Schedule>

Or

<Schedule>

<repeatCode originalText=’TID’/>

</Schedule>

### Q8H

<Schedule>

<frequency value=’3’/>

<duration value=’1’/>

<units value=’d’/>

<intervalIsImportant value=’true’/>

</Schedule>

Or

<Schedule>

<repeatCode originalText=’Q8H’/>

</Schedule>