1. Purpose

The CareConnect profiles are made available under the Apache License, Version 2.
This document provides a set of guidelines for FHIR developers when creating a FHIR profile that uses a CareConnect Profile as the base resource.
The guidance takes the form of recommended rules, which can be applied when creating a CareConnect derived profile. Each rule will have a unique reference number to allow easier identification of non-compliance.
Note: Where there is a stated or implied conformance rule in the FHIR standard then the derived profile must conform to said rule. The assumption is made in this document that the CareConnect base profile is FHIR compliant.

2. When to Create a Derived Profile

The CareConnect profiles may be used “as is” without changes, however for many implementations there will be a desire to constrain the profiles. The following list gives some examples of when to create a derived profile:

- Restricting the cardinality of the element; e.g. the base might allow 0..*, and a particular application might support 1..2
- Ruling out use of an element by setting its maximum cardinality to 0
- Restricting the contents of an element to a single fixed value
- Making additional constraints on the content of nested elements within the resource expressed as XPath statements or FPath for STU3 in the future.
- Restricting the types for an element that allows multiple types
- Requiring a typed element or the target of a resource reference to conform to another structure profile (declared in the same profile, or elsewhere)
- Specifying a binding to a different terminology value set (dependant on the binding strength).
- Providing refined definitions, comments/usage notes and examples for the elements defined in a CareConnect Profile to reflect the usage of the element within the context of the derived profile
- Providing more specific or additional mappings (for example to HL7 v3) for the resource when used in a particular context
- Declaring that one or more elements in the structure must be “supported”
- Declaring one or more elements in the structure as “summary” elements
- Creating element patterns

There are limitations on what can be constrained in a profile these are currently documented at https://www.hl7.org/fhir/profiling.html#5.1.0.7

3. Definitions

The keywords MUST, MAY, and SHOULD are to be interpreted as described in RFC2119:
MUST: This word, or the terms "REQUIRED" or "SHALL", means that the definition is an absolute requirement of the specification.
MUST NOT: This phrase, or the phrase "SHALL NOT", mean that the definition is an absolute prohibition of the specification.
SHOULD: This word, or the adjective "RECOMMENDED", means that there may exist valid reasons in particular circumstances to ignore a particular item, but the full implications Must be understood and carefully weighed before choosing a different course.
SHOULD NOT: This phrase, or the phrase "NOT RECOMMENDED" mean that there may exist valid reasons in particular circumstances when the particular behaviour is acceptable or even useful, but the full implications should be understood and the case carefully weighed before implementing any behaviour described with this label.
MAY: This word, or the adjective “OPTIONAL”, means that an item is truly optional. One developer may choose to include the item because a particular implementation requires it or because the developer feels that it enhances the implementation while another developer may omit the same item.
Within this document where the keywords are used they appear in capitals and bold MUST, MAY, SHOULD, SHOULD NOT etc.

Derived Profile

Within the scope of this document, a derived profile is defined as a profile that is derived from a CareConnect profile and is deemed a valid constraint of that profile.

LocalName

The term LocalName used within this document relates to a string used by a FHIR developer to identify the usage of the derived profile. This string should identify the use case or usage of the derived profile as required by the local implementation. How this is done is covered later in this document.

4. How to Create a Derived Profile in Forge

To create a derived profile in Forge (14.4 and above) the following steps should be undertaken:

1. Select the new derived profile option
2. Browse to the folder where the CareConnect profile to be constrained is held
3. Select the profile

4. Rename the profile as per the section on Naming Derived Profiles
5. Constrain the profile using the rules contained in this document.

Rule 001	The base value URL **SHOULD** contain the URL of the CareConnect profile used as the base resource.
Example	example : <base value="https://fhir.hl7.org.uk/StructureDefinition/CareConnect-Practitioner-1"/> .

5. Naming Conventions

Rule 002	When creating a new derived profile the following LocalNaming convention **SHOULD** be followed:
Comments	CareConnect_”-“_”LocalName”_”-“_”ResourceName”_”-“_” Version”. The version number may be different to the base CareConnect profile, see versioning section below.
Example	For example if the base profile was CareConnect-Practitioner-1 then the constrained profile for a “LocalName” of ADW could be: CareConnect-ADW-Practitioner-1.

6. Versioning

Rule 003	Versioning of derived profiles **SHOULD** be the same as the CareConnect guidelines:

Comments	

FHIR-VER-01: Versioning of Profiles and Resources

Nationally defined FHIR profiles will be versioned during development using Git, and this will follow the standard GitFlow model.

The versioning for published artefacts will broadly follow “semantic versioning” standards: http://semver.org/

The major and minor versions will be visible, and the patch version MAY also be exposed.

Version numbers held in profiles and resource instanced MUST therefore be in one of the following forms:

MAJOR – e.g. 1

MAJOR.MINOR – e.g. 1.0

MAJOR.MINOR.PATCH – e.g. 1.0.2

Definitions:

- Minor Change
  - A minor change is defined as a backwards-compatible change, which is not expected to break existing implementations. Examples include:
    - Addition of new optional fields in a profile
    - Addition of new operations whose name does not clash with existing operations
- Major Change
  - This is a breaking change, and as such, implementers will need to understand the changes that have been made in the new version, and make changes to their implementations if required.
- Resources
  - The versioning requirements relate to all FHIR “profile” resources published nationally – including StructureDefinitions, ValueSets, OperationDefinitions, ImplementationGuides, Conformance Statements, etc.

Rule 004	Versioning of derived profiles **MUST** be independent of the CareConnect profile used for the base resource.

Comments	This allows the derived profile to have completely separate life cycle to the CareConnect profile. It is therefore important to understand that the version of the derived profile has no correlation to the version number of the CareConnect base resource. Traceability for conformance is done using the base element for example: <base value="https://fhir.hl7.org.uk/StructureDefinition/CareConnect-Practitioner-1"/>.

7. Cardinality

These rules apply equally for all elements regardless of whether they are a parent or child element. These rules apply to all element types including reference and extension unless stated otherwise.

Rule 005	The table below **MUST** be followed for changes to cardinalities. * = “n” in the derived profile **MUST** be less than or equal to “n” in the CareConnect profile ** = Min “n” in derived profile **MUST** not be less than Min “n” in CareConnect profile **AND** Max “n” in derived profile **MUST** not be greater than Max “n” in CareConnect profile
Comments	

Derived Profile	0..0 (Not used)	0..1 (optional)	0..n (optional, many)	1..1 (required)	1..n (at least 1)	n..n (where n >1)
CareConnect						
0..1	Y	Y	N	Y	N	N
0..*	Y	Y	Y	Y	Y	N
0..n	Y	Y	Y*	Y	Y*	N
1..1	N	N	N	Y	N	N

1..*	N	N	N	Y	Y	N
1..n	N	N	N	Y	Y*	N
n..n (where n >1)	N	N	N	Y	Y	Y**

8. Extensions

Care Connect profiles contain some extensions required for use with the NHS in England. The following rules apply to extensions.

Rule 006	Derived profiles **MUST NOT** contain additional extensions.
Comments	See rule below regarding constraining an existing extension

Rule 007	Existing extensions in the base CareConnect profile **MAY** be constrained using the rules within this document. This will result in the extension pointing to a constrained (local) version of the extension.
Comments	

Rule 008	Any local extensions **MUST** follow the naming convention for profiles as per the section on versioning.
Comments	

9. References

Rule 009	Derived profiles **MUST NOT** contain additional references*.
Comments	*An additional reference would be a reference to a resource or profile of a resource, of a type that is not present in the CareConnect profile. See rule below about constraining an existing reference.

Rule 010	An existing reference in the base CareConnect profile **MAY** be replaced by local reference based on the same base CareConnect profile in the derived profile.
Comments	

Rule 011	References that are based on the FHIR base resources **MAY** be replaced by references to a constrained local profile based on the same FHIR base resource in the derived profile.
Comments	

Rule 012	References to “Any” **MAY** be replaced by local references, or constrained to CareConnect references
Comments	

Rule 013	Any local reference **MUST** follow the naming convention for profiles as above.
Comments	

9.1. Aggregation

Rule 014	The aggregation properties **MUST** not be set in a derived profile.
Comments	These are the tick boxes for Contained, Referenced and Bundled in Forge.

10. Slicing

CareConnect profiles may contain slicing which can be utilised or amended in derived profiles. This section defines the rules about when slicing may be used.

Rule 015	An element in the base CareConnect profile which is sliced and has been defined as “closed” **MUST NOT** have further slices added in the derived profile.
Comments	

Rule 016	An element in the base CareConnect profile which is sliced and has been defined as “unordered” **MAY** be changed to “ordered” in the derived profile.
Comments	

Rule 017	An element in the base CareConnect profile which is sliced and has been defined as “ordered” **MUST NOT** be changed to “unordered” in the derived profile.
Comments	

Rule 018	An element, which is sliced in the derived profile, **MUST** have a valid “Discriminator” set*.
Comments	* valid as per the FHIR rules on profiling When a discriminator is provided, the composite of the values of the elements designated in the discriminator is unique and distinct for each possible slice and applications can easily determine which slice an item in a list is. The intention is that this can be done in generated code, e.g. using a switch/case statement. When a constraining structure designates one or more discriminators, it SHALL ensure that the possible values for each slice are different and non-overlapping, so that the slices can easily be distinguished. See this link for further information: https://www.hl7.org/fhir/profiling.html#discriminator

Rule 019	An element, which is sliced in the derived profile **MUST NOT** change the “Discriminator”, set in the CareConnect base profile.

Comments	

Rule 020	An element, which is sliced in the derived profile, **MUST** have a unique slice name.
Comments	

Rule 021	An element, which is sliced in the base CareConnect profile, **MUST NOT** have the sliced element re-sliced.
Comments	

11. Value Set and CodeSystem Binding

Rule 022	Value sets defined as “Required” in the base CareConnect profile **MUST NOT** be changed to another value set in the derived profile. The codes contained in the value set **MAY** be constrained to a subset of the CareConnect value set. The codes contained in the value set **MAY** be mapped to a subset of the CareConnect value set.
Comments	

Rule 023	Value sets defined as “Extensible” in the base CareConnect profile **MAY** be extended by allowing additional codes from another value set to be used within the derived profile. Constraints on the value set **MUST** follow the FHIR rules for “Extensible” value sets.
Comments	When an element is extensibly bound to value set, derived profiles may state rules on which codes can be used, but cannot select new or additional codes for these elements unless no codes with appropriate meanings are found in the base value set. When this occurs, the missing values should be fed back to allow the value set in the CareConnect base profile to be updated if deemed appropriate.

Rule 024	Value sets defined, as “Preferred” in the base CareConnect profile **SHOULD** be used in the derived profile whenever possible.

Comments	Value sets defined as “Preferred” in the base CareConnect profile may be changed to another value set in the derived profile if the preferred value set does not meet the local requirements.

Rule 025	Value sets defined as “Example” in the base CareConnect profile **MAY** be changed to another value set in the derived profile.
Comments	To aid interoperability the use of “Example” binding should be avoided.

Rule 026	A Value set in a CareConnect profile **MAY** be fixed to a single code contained in the value set in the derived profile.
Comments	

12. Is-modifier

Rule 027	Where a CareConnect profile assigns the “Is-modifier” Boolean property to an element the derived profile **MUST NOT** change the value of the Boolean.
Comments	

13. Data Types

The FHIR specification defines a set of data types that are used for the resource elements. There are four categories of data types:

- Simple / primitive types, which are single elements with a primitive value (below)
- General purpose complex types, which are re-usable clusters of elements (below)
- Complex data types for metadata
- Special purpose data types: Reference, Narrative, Extension, Meta, and Dosage

For the purpose of this document, the rules are divided up into two basic types Primitive and Complex.

Rule 028	Where a CareConnect profile allows a choice of data types for an element the choice **MAY** be reduced in number in the derived profile.
Comments	Applies to Primitive and Complex.

Rule 029	Where a CareConnect profile does not mandate all the elements of a data type the non-mandatory elements **MAY** be removed in the derived profile.
Comments	Applies to Complex.

Rule 030	Where a CareConnect profile mandates elements of a data type the elements **MUST NOT** be constrained out in the derived profile.
Comments	Applies to Complex.

Rule 031	If the data type of the element in the CareConnect profile is a Primitive data type, that data type **MUST NOT** be changed in the derived profile.
Comments	Applies to Primitive only.

Rule 032	If the data type of the element in the CareConnect profile is a Complex data type, that data type **MAY** be changed to a valid constraint of the data type in the derived profile
Comments	Applies to Complex only.

14. Must-Support

Rule 033	Where a CareConnect profile labels an element as “Must-Support” (true or false), the derived profile **MUST NOT** change the value of the MUST-Support flag.
Comments	

Rule 034	Where a CareConnect profile does not label an element as “Must-Support” the derived profile **MAY** label the element as “Must-Support”. *

Comments	* Providing doing so does not contradict the conformance stated in the CareConnect profile. For example a mandated element cannot be marked as Must-Support=”false”.

15. Constraints

Rule 035	Where the CareConnect profile contains a constraint the constraint **MUST NOT** be removed or altered in the derived profile.
Comments	

Rule 036	A derived profile **MAY** contain additional constraints providing the constraints do not contradict any constraint stated or implied with what is contained in the CareConnect base profile.
Comments	

16. Properties

Certain properties of the CareConnect profile as shown in the Properties Tab in Forge may be amended or added to within the derived profile. In some cases, the properties must be updated see following rules. Note: the element names are the Structured Definition element names, which may not be the same as the labels in Forge. The current Forge labels are shown in brackets.

Rule 037	The value attribute of the element “url” (URL) in the base CareConnect profile **MUST** be updated to the correct value in the derived profile.
Comments	The “url” cannot be the same as the CareConnect profile.

Rule 038	The value attribute of the element “version”(Version) in the base CareConnect profile **MUST** be changed to the correct value in the derived profile.
Comments	The version may or may not be the same as the CareConnect profile.

Rule 039	The value attribute of the element “name”(Name) in the base CareConnect profile **MUST** be changed to the correct value in the derived profile.
Comments	The “name” cannot be the same as the CareConnect profile.

Rule 040	The value attribute of the element “description” (Description) in the base CareConnect profile **MUST** be updated to the correct value in the derived profile.
Comments	

Rule 041	The value attribute of the element “status” (Lifecycle status) in the base CareConnect profile **MUST** be updated to the correct value in the derived profile.
Comments	

Rule 042	The value attribute of the element “copyright” (Copyright) in the base CareConnect profile **SHOULD** be updated to the copyright value applicable to the authoring organisation in the derived profile.
Comments	

Rule 043	The value attribute of the element “publisher” (Publisher) in the base CareConnect profile **MUST** be updated to the correct value in the derived profile.
Comments	The “publisher” cannot be the same as the CareConnect profile.

17. Fixed Values

Rule 044	Any value fixed in a CareConnect profile **MUST** also be fixed in any derived profile.
Comments	

18. Descriptions

Rule 045	Definitions, comments/usage notes and examples for the elements in a CareConnect profile **MAY** be updated to reflect the usage of the element within the context of the derived profile providing the context or meaning is not changed.*
Comments	* Updated annotations should clarify not extend the use of the element for local use.

19. Feedback

Rule 046	Issues found when profiling CareConnect profiles **SHOULD** be fed back to the INTEROPen forum.
Comments	

Rule 047	If a CareConnect profile cannot be used as the base for a local profile and a un-derived local profile is created, the issues or reasons for doing so **SHOULD** be still be fed back to the INTEROPen forum.
Comments	If for example, the timescales of the local project were too tight for the feedback to be addressed within a CareConnect profile in time. The approach would be to create a local profile with a view to update to the CareConnect derived profile when possible

20. Useful Links and References

For more information on derived profiles, these links may be useful.
https://thefhirplace.com/2016/12/05/forging-profiles-on-profiles/
http://docs.simplifier.net/forge/forgeDerivedProfiles.html