Professional Record Standards Body

Better records for better care

DIGITAL MEDICATION DOSE AND TIMING INFORMATION

NON-TECHNICAL GUIDANCE V1.3

APRIL 2019

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1 Purpose of this document

This guidance document has been produced as part of an NHS England and NHS Digital project to support the digital sharing of medication information, for example between GPs, hospitals and their departments, pharmacy, and care homes. The aim is to improve patient safety by having up to date and accurate medication information available whenever and wherever it is needed. The project has developed a way of sharing medicines information and dosage instructions in a safe and reliable way which can be understood by different healthcare IT systems.

The main audience for this document is front line healthcare professionals, who will be implementing and using prescribing and pharmacy systems which will incorporate a new standard way of expressing medicines information and dosage instructions. This guidance explains, in a non-technical way, the purpose and benefits of sharing medications information through system interoperability[1], the need for standards, what these standards will cover and what they won't, as well as answers to frequently asked questions and an outline of the next steps.

The technical guidance[2] and full project report[3] are published separately.

2 Context

Relevant information about patient medications, including detailed dosage instructions, needs to be shared in computable form when a patient moves from one care setting to another. This includes, but is not limited to, moving from primary care into secondary care and secondary care into primary care. In addition, within a hospital setting, medicines information must be shared between electronic prescribing and administration systems (ePMAs) and pharmacy stock control systems where these systems are not integrated.

Outpatient / primary care and inpatient (secondary care) use different methods of prescribing. Outpatient / primary care prescribing is focused on patient self-administration and is product based e.g. Paracetamol 500 mg tablets, two tablets to be taken every six hours. Inpatient prescribing is typically dose-based for example the same prescription would be expressed as Paracetamol 1 gram orally every six hours. When a patient transfers between these settings, a process of translation is required to ensure the correct medicines and dosages are identified, prescribed and administered in the new care setting. This process is currently largely paper based, requires considerable manual intervention and is prone to errors.

Previous attempts to identify information requirements, mapping and rules to enable automation of the translation process have been unsuccessful due to over-complexity and trying to address every eventuality at the first attempt, rather than allowing a more evolutionary approach. Learning from this, we are now using a more iterative approach at finding these solutions.

[1] https://www.england.nhs.uk/digitaltechnology/connecteddigitalsystems/interoperability/
[2] https://developer.nhs.uk/apis/dose-syntax-implementation-1-3-1-alpha/
[3] https://theprsb.org/

For healthcare systems to communicate this information reliably and accurately there is a need for a standard for medication, its dosage, timings and directions information.

The overall purpose of the standard is to provide a way in which medication information can be shared between health and care systems in a standard machine-readable format with translation rules so that medication information can be machine transferred and translated to the appropriate prescribing syntax for professionals to review and action appropriately in the receiving system. The aim is to reduce manual translation and re-entering of medications information, areas prone to errors. This should provide safer care for patients, and more efficient and reliable and unambiguous information for professionals.

What is the interoperable medication dose and timing project about?

This specific project is part of a wider UK effort to create definitions of patient medication and clinical information so that this can be easily exchanged between different health IT systems/apps and different care-settings, for example, when a patient is admitted to, or discharged from hospital.

This project is focussed very specifically on how to record the complexities of medication doses and timings in a standardised way that can be understood by different systems in the same way and builds on wider work.

This is an example of a medication instruction (prescription) which needs to be converted to a computable form, the part highlighted is the dose-timing instruction.

"Flucloxacillin 250mg capsules, one capsule four times a day for 7 days"

A more complex example might be:

"Enalapril -oral- 2.5mg once daily for 1 day, then 5mg once daily for 7 days, then 10mg indefinitely"

What this project is <u>not</u> about how the interoperable messages might be utilised – for example:

- medicines reconciliation; though it is an indirect benefit of this work;
- user interface design e.g. how the system looks;
- medication information beyond dosage instructions e.g. name, route, indication, etc. as this is defined in existing standards[4] that have been subject to wide consultation.

Why is this so hard?

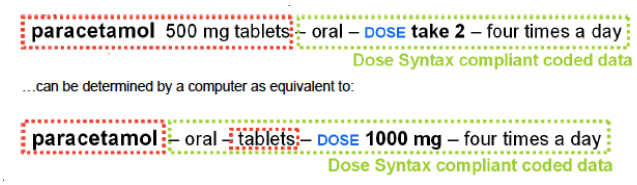
Representing dose-timing instructions in a computable way is a complex problem, in part because of the huge varieties of dosage and timing across clinical practice from simple once a day tablets to multi-drug infusions with variable administrations, to intermittent medications given in the community, to dose titrations up or down, as in the *Enalapril* example above.

[4] PRSB Transfers of Care Medication information models, e.g. https://theprsb.org/standards/edischargesummary/

In addition, outpatient and primary care “product-based” prescriptions are quite different from inpatient “dose-based” prescriptions.

As an example (Figure 1), although the following two prescriptions are identical in intent, the first would be a typical primary care prescription and the second a typical hospital inpatient prescription. When a patient is admitted, we ideally want to be able to translate the first to the second, and the reverse at discharge.

Figure 1.



The good news is that after a huge amount of effort, significantly led from the UK, we have some good international standards on which to move forward and finally resolve this challenge.

Will this project enable all dose-timing instructions to be communicated?

In due course we hope that the vast majority of inpatient and outpatient / primary care medication instructions will be covered. However, this first phase will aim to cover only 80-90% of outpatient / primary care prescriptions by volume. We have specifically excluded specialist areas such as complex infusions and chemotherapy from this initial phase of the work.

What happens if medication information cannot be communicated in a structured computable form?

The excluded dose-timing instructions will still be communicated digitally as human-readable text. Note that just because some more complex dose-timing instructions are excluded, does not mean that the rest of the medication information cannot be exchanged in a computable fashion, it is only the dosage-timing instruction that will not be computable and will require manual interpretation. The current documentation includes information on how to use structured dose-timing. However, vendors will need to identify whether their system can communicate a particular instruction as structured dose-timing. First of Type sites will also provide feedback on this. Further iterative work will be required to publish business rules on where unstructured text will be required, based on real-world experience, that will have to be implemented by system vendors to do the interpretation and communication in a safe way.

The following types of prescribing are currently supported:

- Standard directions e.g. twice a day, four times a day
- Alternate day dosing (e.g. 1 taken every 2 days)
- Very small doses e.g. 0.3mg

- Prescribing of ‘as required’ doses (PRN)
- Increasing or decreasing dosage regimens including those that are for multiple times of day. Including an infusion that begins at a slower rate for an initial period of time and then the rate is increased
- Maximum and minimum course duration to be specified in a machine readable format or a specific time for the dose
- Different doses at different times of day
- Prescribing using evening, at night, before sleep or a specific time of day
- Specifying a time for doses to be given
- Weekly prescribing with an identified day(s) of the week
- Specifying doses once a month or on an identified date
- Prescribing of the relevant dosage (drug, dose, route) including half or quarter of a tablet.
- Prescribing using drug and dose without specifying an actual medicinal product
- Brand name prescribing
- Identify the symptom the medication is intended to treat e.g. "when required for pain".
- Loading doses where patients don’t remain on initial high doses long-term
- A deferred start time for a treatment course or dose
- Identifying a dose duration for a single patch or infusion
- Identifying a treatment course of 12 months

However, at present the following prescribing approaches are not supported or have been declared out of scope (in this setting the information will be communicated as text rather than structured computable form):

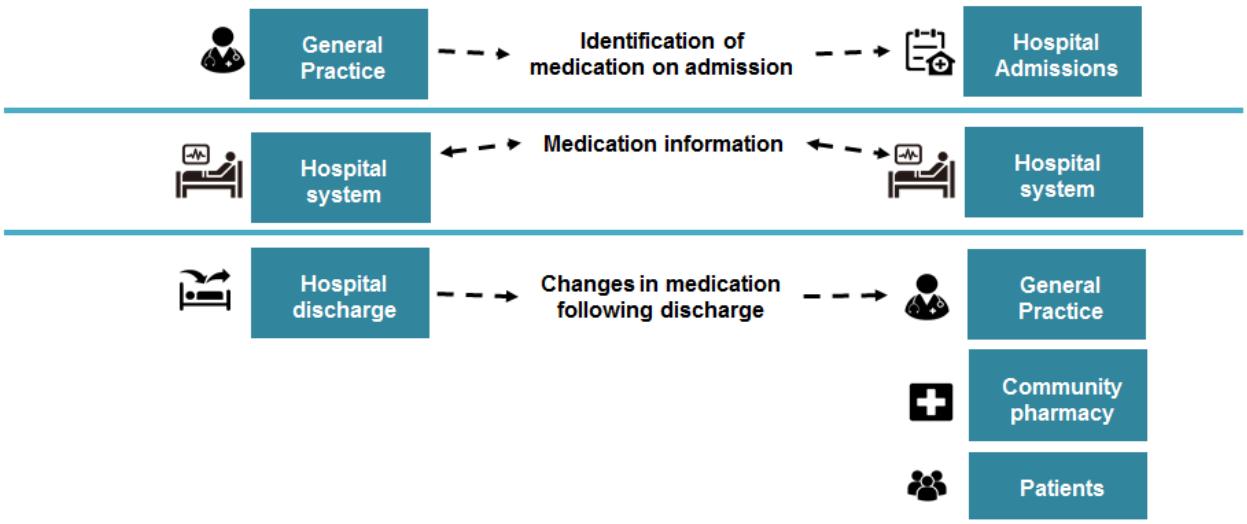
- Medication free interval during the treatment course
- Irregular frequencies (once a day for one day, gap of two days, then twice a day)
- A general instruction of before a particular time e.g. “before 10am”
- Associating the dosage of one medication with the administration of another. This is an issue with combination packs and methotrexate/folic acid regimens
- The ability to identify time critical administration e.g. Parkinson’s drugs
- Regimens where clinical evaluation or results of a test are required to decide the dosage e.g. dosing according to blood levels, Insulin doses, warfarin and pancreatic enzyme replacement therapy
- Decision support
- Chemotherapy regimens
- Complex infusions

Areas of implementation (use cases):

There are several focus areas, or use cases, for this standard. The initial ones being communication of medications information between GPs and hospitals, hospital discharge to general practice or community pharmacy, electronic transfer of medicines information between hospitals and within hospitals between electronic prescribing and medicines administration (ePMA) and pharmacy systems

without the need for manual re-transcription and re-entering of medications information (see Figure 2). In time, we expect this work to support all medications sharing scenarios.

Figure 2.



The supported areas will provide the ability to transfer all prescription details in a computable manner between different care settings. It will require a medication description from the *Dictionary of medicines and devices (dm+d)*[5], and information about the dose instructions, e.g. dose, route, site, method, frequency, timing as appropriate.

The standard will also provide the ability to integrate electronic prescribing and medicines administration (ePMA) systems and hospital pharmacy stock control systems (HPSCS) to deliver a closed-loop supply. The shared information already includes information about the patient's medicines as well as patient demographics, prescriber, quantity, date and time.

Patients will benefit from a joined-up system and improved communication between their GP and other healthcare providers, which should reduce errors, improve efficiency and safety and provide clearer instructions and up to date medicines information for themselves.

What are the potential benefits?

This work will underpin a range of benefits such as:

Supporting medicines reconciliation

- If the transfer of dose information was more accurate and persisted across care sector interfaces, this could help address workforce capacity issues as it could reduce the time taken in medicines reconciliation. For example, primary care reconciliation of medication

[5] https://www.nhsbsa.nhs.uk/pharmacies-gp-practices-and-appliance-contractors/dictionary-medicines-and-devices-dmd

data in hospital outpatient and discharge letters into the patient's record on the primary care clinical system. Likewise, pharmacy and doctor time in hospital reconciling medicines information from GP practices on admission and in outpatient clinics. Time could be saved in chasing, checking and resolving prescription queries and resulting issues.

Improving safety

- Reduced medication error e.g. reducing the requirement for manual transcription of information to be undertaken and the linked risk of errors being made during the transcription process;
- Improved ability for patients to remain on a specific strength of a liquid preparation (if multiple strengths are available) - reducing errors relating to dosing;
- If things like "Take ONE daily until 28th February 2019" was persisted as part of the transfer of care, this could offer an additional safety net for acute items being sent into the community which shouldn't be commenced as long term by the GP e.g. painkillers post-op or anti-coagulants for a specific time post procedure.
- Ensuring a patient remains on a specific branded product where they need to do so (e.g. may have been chosen for a paediatric patient as it has reduced amounts of potentially harmful excipients);
- Improved communication between hospital pharmacy stock control and EPMA systems, reducing time spent and safety risks associated with transcribing information manually;

Improving communication

- Access to full medication history for a patient;
- Potential for sharing medication information directly with community pharmacies, opticians, etc.;
- If the patient nominated a community pharmacy for their discharge record to be sent to, this could pre-populate the pharmacy dispensing system prior to checking by a pharmacist which could reduce the risk of the patient being dispensed "old prescriptions" or "old directions" whilst waiting for the transfer of information between care settings.

Improving patient experience

- Direct input into a patient held record, for example for prescription re-ordering, prompting and monitoring of adherence, etc. Possible direct link from (agreed) patient app data to provide compliance information;
- Many frail/older people and some of those living with long-term conditions rely on one or more 'family' carers' for support and it may be the carer who manages and administers their medications. This work will make it easier for carers to look after their loved ones safely and with increased confidence as they would have clear and consistent prescribing/administration instructions;

Improving dose calculation

- Automated calculation of amounts used to support stock control;
- Calculation of correct and accurate dose, based on the weight of the patient;

- Tracking overall dose changes over time, graphically displaying changes on charts to help inform clinical decision making;
- Consistent identification of the medication. i.e. not various trade names mixed with actual chemical name;
- Adding more automated and standardised dose-timing instructions will allow for more accurate durations of prescriptions to be calculated. This will allow alerts for over and under prescribing in clinical systems to become more useful (currently for things like inhalers they are largely inaccurate).

Supporting secondary uses

- Ability to analyse prescribing data with other metrics/quality indicators/outcome measures to assess impact (e.g. data analysis, machine learning);
- Support more intelligent patient outcomes analyses for drug prescriptions;
- The ability for thorough and more robust insight into medicines adherence at a population level;
- National epidemiological data;
- Reduction in variation of dosage prescribing and administration. This will occur by documentation audit and resolution of disparities arising;
- By automating/making it easier for clinicians to 'code' doses from a pre-populated transferable list, this could overcome the need for clinicians to use "as directed" as a dose-timing instruction. This would allow better visibility of how medicines are used (or intended to be used by the prescriber).

Other

- Driver for adoption of electronic prescribing and administration systems as many organisations still use paper charts;
- With the help of vendors, could enable the opportunity to display the information in the right format to the right person (patient, carer, pharmacist, healthcare professional etc.).

3 Frequently Asked Questions

This section focuses on providing answers to the frequently asked questions that we have received.

Question	Response
Wouldn't it be better to standardise the format across the systems rather than trying to 'translate' between them?	The required level of specificity for prescriptions differs between care settings and so implementing a single format in all systems for prescribing is not feasible.
Free text is hardly appropriate for interoperability. Shouldn't systems be encouraging structured medication recording?	Only the dose and timing are free text currently, other elements of medication information are highly computable

	already[6]. This standard will reduce the need to use free text markedly. However, time is required for full adoption and implementation.
Is the work restricted to GP to hospital and internal hospital information flows?	We have been careful not to identify very specific and focused use cases as this work has a broad range of applications. We have identified some important and high-volume information flows which will be the focus of initial implementations, but there are many other potential applications.
Is the process fully automatic? Will this result in medication information from elsewhere being automatically updated in my system?	There will always be a need for manual/human intervention to confirm and accept medications. Clinicians should verify information with patients rather than automatically accepting.
An important part of medicines reconciliation is allergy status. Is the allergy messaging in scope?	It is already covered as part of the PRSB and INTEROPen CareConnect information models.
Does this support the PRSB maternity and healthy child standards?	Yes, it is aligned with them and is an additional plug-in to the medication models that are common across all PRSB standards.
Is translation from machine readable to human readable supported?	Yes, systems must be able to generate a suitable, clinically safe, complete medication plus dosage string from the coded structures. To support the translation a toolkit is under development by NHS Digital. This is known as a Medicines Interoperability and Logic Toolkit[7] is in development by NHS Digital. Please also see Appendix A for functionality.
What happens to dosage instructions in existing patient records, for example GP repeat prescriptions? Will they all need to be converted to the new standard?	The challenge is GP systems using unstructured text for dose instructions, it may be unsafe to go back and structure. Going forward the target would be for GPs to increase structured content, but user interfaces may be challenging. Dose sentences have been suggested and some vendors are interested in doing natural language processing. In Scotland all suppliers on the national GP contract framework have agreed to include computable dose-timing instructions in their work – this includes 3 of the 4 major GP systems suppliers.
What will be the user experience change? Primary care systems tend to use free text fields for dose instructions so moving to a structured approach at time of data entry would be a big change, as would converting existing repeat medication – unless an accurate	This will be challenging to implement. This work is a necessary component but doesn't solve challenging issues for implementers. The focus here is on messaging and following will be how to change systems for the future. It's an iterative piece of work and part of wider interoperable and computable medications work. We are working with system suppliers and First of Type sites to support implementation of this.

[6] PRSB structure and content of health and care records (2018). https://theprsb.org/standards/healthandcarerecords/

[7] http://ec2-18-130-128-118.eu-west-2.compute.amazonaws.com/

parsing of the free text is introduced.	
What happens when dose instructions can't be structured?	There will be a need to fall back to communicating this information as free text. There's a need to work with vendors so that these exceptions are handled in a safe and consistent way.
If there's no product specified- do you not have to express in mg? Otherwise 1 capsule of amoxicillin could be 250mg or 500mg?	This is covered by the dictionary of medicines and devices (dm+d) standard. The proposals allow doses to be described by the amount of drug by dose form.
Is there support for multi-route prescriptions?	This is not part of the dose timing work. Expressing options on route is not considered good practice. Instead separate prescriptions should be used for each route.
Are medication labels included as part of this work?	It is up to the pharmacy system on how they translate computable info to medication labels.

4 Next steps

This project is a very focussed piece of work to define how to use technical standards to share medication and dosing information. It is part of a wider UK effort to create computable, sharable definitions of patient medication information so that this can be easily exchanged between different health IT systems/apps and different care-settings. It is anticipated that this work will result in multiple benefits and serve as a catalyst for further iterative work.

This piece of work will deliver a critical part of the infrastructure needed to allow systems to exchange computable medication records. But there is still a lot of work for system suppliers to do, particularly to design and develop user interfaces and support clinical workflows, so that we do not add to the burden of clinicians when entering or importing medication records but improve efficiency and safety as expected.

Implementing sharing of medications between IT systems and care settings will mean changes in current processes and IT systems interfaces. This work is reliant on IT system suppliers implementing the proposed solutions. Nevertheless, many of the major UK suppliers are already starting to develop interfaces to their data using the standardised medication record formats. There are clear market advantages for suppliers that are using these standards and benefits in supporting innovation. NHS England and NHS Digital are working with NHS providers and systems vendors to technically confirm that this solution will deliver. Implementation will be further encouraged by adding requirements to contracts clearly indicating that compliance is required.

An online service termed the Medicines Interoperability and Logic Toolkit[8] is in development by NHS Digital that will translate the machine-readable message and provide the text narrative. It also provides suggestions for product-based options of the dose instructions ready to be reviewed and transferred into the receiving system. It will be available for use by system suppliers during their software prototyping and design phases. It could also be suitable as an operational service in the future so that system suppliers do not have to implement this complex logic within their own solutions. However, these are only examples as there are various ways to accomplish this, and further development and implementation of the rules for dose to product translation will be vendor driven. It will also allow healthcare professionals and patients to understand the challenges faced and how the project will help. Please see Appendix F for examples of the functionality.

[8] http://ec2-18-130-128-118.eu-west-2.compute.amazonaws.com/

5 How you can help

Developing a standard is an important step in improving patient safety and reducing medication errors. This national standard is a key enabler for fully interoperable systems that allow data to be shared between different health services. However, it is important to highlight that the benefits will only be realised if the standard is used and implemented by system vendors and end users.

We need both you and your organisation's senior leaders' interest and engagement with this work and in promoting the use of the standard and its adoption.

The PRSB standards are required for all digital transfers of care (discharge summaries, outpatient letters, etc.) in the NHS Standard Contract (2017/18) in England. These standards include medication information.

We would like healthcare professionals to support adoption in their own organisation. You could help by driving this change within your organisation, for example:

- By working with the informatics department and the Chief Clinical Information Officer (CCIO) in your organisation to share this material and to put these standards on your organisation's list of digital transformation priorities;
- By asking your local clinical system suppliers to develop the messaging capability to be 'FHIR-ready' to be able to send and receive FHIR messages;
- Requesting your local clinical system suppliers to determine how they will implement the standard medication information model, including structured dosage instructions as defined in the NHS Digital technical implementation guidance on their system and the timescales for doing so;
- Get involved and provide clinical input in the development process of any system solution and user interface design;
- Taking on a quality improvement initiative in your organisation around improving recording of medication information and getting executive sponsorship for the work;
- Using a developed learning resource[9] aimed at junior doctors for improving e-discharge summaries;
- Getting in contact with PRSB to discuss how you could further support standards implementation through collaborative working: https://theprsb.org/standards/support/;

The PRSB Standards for the Structure and Content of Health and Care Records are available here: https://theprsb.org/standards/

The technical implementation guidance for structure medications dose and timing is published by NHS Digital and is available at: https://developer.nhs.uk/apis/dose-syntax-implementation-1-3-1-alpha/

[9] https://www.rcplondon.ac.uk/guidelines-policy/improving-discharge-summaries-learning-resource-materials

The Medicines Interoperability and Logic Toolkit online service is accessible through: https://developer.nhs.uk/apis/dose-syntax-implementation-1-3-1-alpha/dosage-to-narrative-overview.html

It's important to note that this is not only a technical challenge but a challenge that requires a cultural change, both for those responsible for writing prescriptions and those responsible for reading and acting on them.

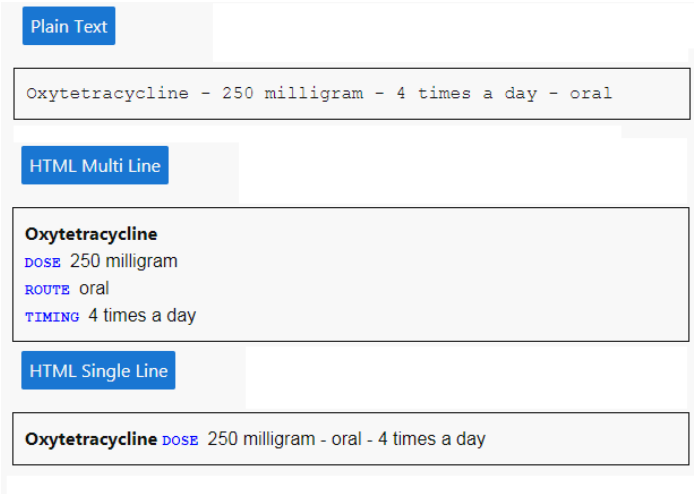
Structured data is required to allow recording, analysis and clinical use of patient data, and to enable true medicines optimisation. There is a need for healthcare professionals to shift perspective in how they view their roles. An increase in skills and understanding of clinical informatics and using data to improve patient outcomes is vital, as is championing the use of standards and influencing change by leading through example.

We need your help to influence the practice and culture at an organisational level. And this will in turn have a cumulative and wider effect, enabling different parts of the health system to work together.

6 Appendix A – Translation process

Translation to human readable dosage information

The Medicines Interoperability and Logic Toolkit[10] (currently experimental) demonstrates how to convert machine readable FHIR Dosage structure instructions into an appropriate human readable dosage string as per example below. This is provided for information purposes only and details of this will continue to be updated in the technical implementation guidance.



Dose to product translation

The Toolkit also returns a list of products that could fulfil the given dose-based instruction comprising of at least a product, plus optional route, form and dose strength. The returned list is sorted by least product divisibility, i.e. least quantity of the product to meet the ordered dose strength. Any additional filtering is subject to local requirements, e.g. stock availability, formulary, etc. It is not intended that this process auto-selects a single product. A human will ultimately decide on which product to use to fulfil the clinical need.

Shortlist of Products (suitable for further local filtering):

Product (VMP)	Quantity / Unit Dose Form
Oxytetracycline 250mg tablets [code:324095003]	1 tablet [Whole product divisable]
Oxytetracycline 250mg/5ml oral suspension [code:13003911000001104]	5 ml [Whole product divisable]
Oxytetracycline 125mg/5ml oral suspension [code:13003811000001109]	10 ml [Whole product divisable]
Oxytetracycline 500mg/5ml oral suspension [code:13004011000001101]	2.5 ml [Not whole product divisable]
Oxytetracycline 100mg/5ml oral suspension	12.5 ml

[10] http://ec2-18-130-128-118.eu-west-2.compute.amazonaws.com/