**Vaximap impact analysis**

This document sets out an estimate of the time savings accrued so far by use of the Vaximap tool.

As of 13 Feb 2021, 201k patient visits have been planned.

1. **Dataset**

These calculations are performed on the dataset of generated routes that are stored by the website. This dataset does not contain patient locations; only the distances in between them.

To complement this dataset, we have surveyed a number of users for feedback; their responses are used in the following calculations.

1. **Nature of time savings**

The Vaximap tool saves time in two ways: 1) a saving for practice managers when planning of routes, and 2) a saving for practitioners following the optimal route in between patients. We can estimate the former using feedback from users and the latter from the dataset of generated routes.

1. **Time saved in planning routes**

Feedback from users indicates that to manually plan routes for a group of 50 patients would take 2-4 hours. Particularly with the added constraint of fixed group size (which is crucial to minimising vaccine wastage), this is a complex optimisation problem that would be extremely difficult to perform manually. The problem also scales non-linearly: to optimise for 20 patients takes more than twice the effort than planning for 10. We use the lower bound of feedback from users and assume that for every 50 patients processed, 2 hours of planning time are saved.

1. **Time saved in following optimal routes**

We estimate this time saving relative to the worst-case scenario, which we generate by performing a completely random clustering. This would be equivalent to visiting patients in the order they are stored in an EMIS database, for example, and it is reasonable to assume that this would be the fall-back option for some surgeries in the absence of any other tools. We then calculate the total distance covered in visiting all patients in random order. Because the dataset only consists of straight-line distances, we also multiply distances by a factor of 1.2 to account for the fact that roads are not straight. We now have an estimate of the total distance covered in the worst-case scenario.

We calculate the corresponding total distance covered in the optimal routes that were generated by Vaximap, which is the best-case scenario. With these two extreme estimates, we now assume that a manual approach could achieve 75% optimality, which is represented graphically below:

Vaximap (best) --------- 25% ---------- manual -------------------------- 75% ---------------------- random (worst)

Hence the total distance penalty associated with a manual approach can be calculated as:

Distance penalty = 0.25 \* (random distance – Vaximap distance)

Finally, we convert this distance penalty into a time penalty by assuming an average moving speed of 25mph. This reflects use in both urban and rural areas.

1. **Summary of assumptions made**

Time saved when planning routes for 50 patients: 2 hrs

Correction for real-world distances not following straight lines: 1.2

Extra distance when following a manual route, as a proportion of the difference between the best- and worst-cases: 25%

Average moving speed when following routes: 25 mph.

1. **Total time savings**

The approach and assumptions made above yield the following results:

Time saved in planning: 7,450 hrs

Time saved in travelling: 8,950 hrs

Total savings: 16,400 hrs

The time savings split roughly 45 % : 55 % between PMs and practitioners

The typical user uploads 39.4 patients and requests a cluster size of 11.4 per request.