In the context of the current COVID-19 pandemic, congested public health facilities pose a health risk to patients with chronic conditions such as non-communicable diseases (NCDs), HIV/AIDS and tuberculosis (TB). Recent medical research articles and reports indicate that patients with chronic conditions have relatively high mortality when infected by the severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2).1-3 During the various alert levels of the COVID-19 lockdown, some chronic patients did not risk going to clinics for collection of their usual medications, and adherence levels dropped substantially.4 In addition, transport options were limited, and up to 11% of patients on chronic medication in cities, and 25% from informal settlements, struggled to access care.5
Methods
The project used action research methodology to address a service delivery problem, using a collaborative approach among the partners mentioned above. Chronic patients who attended Skinner Street Clinic were included in the study. Excluded were patients due for special investigations (e.g. follow-up blood tests) or who needed to be physically examined in a face-to-face consultation. In addition, patients residing outside the delivery area, and those who declined home delivery of medication, were also excluded.

Prior to the rollout of the project, the team worked on setting up the necessary systems to allow medications to be transported and delivered to patients’ homes. These included creating standard operating procedures (SOPs) for telephone calls to patients to assess clinical appropriateness and willingness, packaging of medication and use of Uber transport to collect medication from the clinic pharmacy and take it to community health workers (CHWs) within communities. The SOPs also included measures to safeguard medication from being lost or stolen, and ways to protect drivers and CHWs from COVID-19. Fig. 1 shows the steps undertaken from enrolment through to final delivery.

Fig. 2 shows the overarching steps described in Fig. 1 in graphic format, including the potential reach of the project (1 800 CHWs in the district).

The files of those patients who could not be contacted initially were marked as such, and when they attended a neighbouring clinic, their phone numbers were verified and they were offered the option to leave the queue, return home and have their medication delivered to them the next day.

Ethical approval
The study was granted ethical clearance from the Research Ethics Committee of the Faculty of Health Sciences, University of Pretoria (ref. no. 102/2011).

Results
The project is in its pilot phase, and below we outline the results descriptively to showcase its reach and the potential impact if it went to scale.

Table 1 describes the 1 727 files that were evaluated for inclusion in the project. Within the files evaluated, 357 patients had more than 1 diagnosis, 302 had 2 diagnoses, 48 had 3 and 7 had 4 diagnoses. Therefore, there were 2 146 instances of medical conditions identified within the 1 727 files.

Of the 1 727 patients:
• almost one-third (547 patients, 32%) were immediately suitable for home delivery
• 757 (44%) required further investigation or in-person check-up and were not suitable for home delivery
• 379 (22%) could not be reached via telephone (voicemail or no answer)
• 44 (3%) did not have a correct contact number.

| Conditions                          | Patients, n (%) |
|-------------------------------------|-----------------|
| HIV                                 | 1 284 (74)      |
| Hypertension                        | 418 (24)        |
| Mental health-associated conditions | 105 (6)         |
| Diabetes mellitus                   | 98 (6)          |
| Dyslipidaemia                       | 61 (4)          |
| Pregnancy-related conditions        | 56 (3)          |
| Osteoarthritis                      | 30 (2)          |
| Asthma                              | 26 (2)          |
| Epilepsy                            | 17 (1)          |
| Other                               | 51 (3)          |

*Total >100% because 357 patients had >1 condition.
Of the 547 who qualified for home deliveries, 432 (79%) accepted home deliveries, and 115 (21%) of the patients did not (Fig. 3).

Four patients included in the project also needed to be referred for further management at a health facility, and 54 (13%) enrolled

**Fig. 1. Project steps. (CCMDD = Centralised Chronic Medicine Dispensing and Distribution system; WBOT = ward-based outreach team; CHW = community health worker).**

**Fig. 2. Home delivery project. (MSD = medicines supply depot; NGO = non-governmental organisation, GG = government garage vehicle; PMP = patient medicine parcel; WBOT = ward-based outreach team; CHW = community health worker.)**

Of the 547 who qualified for home deliveries, 432 (79%) accepted home deliveries, and 115 (21%) of the patients did not (Fig. 3).

The 432 (25% of the total 1 727) patients who qualified for and agreed to receive home deliveries had the conditions listed in Table 2. Of these 432 patients, 102 had more than 1 diagnosis, 84 had 2 diagnoses, 14 had 3 diagnoses and 4 had 4 diagnoses.

Four patients included in the project also needed to be referred for further management at a health facility, and 54 (13%) enrolled
in the CCMDD programme. Ten (2%) of the 432 were already enrolled.

Table 3 shows the reasons that 757 patients (44%) did not qualify for home delivery.

Fig. 4 shows the medical conditions of those who chose to opt in v. those who refused the service. The figure shows that those with HIV alone were the most likely to refuse the service (n=85). This could be due to stigma associated with HIV in the community.

Qualitatively, the project received positive feedback, which was collected via the Qualtrics platform at the point of delivery:

‘Highly appreciated service, I am so happy, they look after our health.’

‘I am very happy with what health department is doing for us, they are taking care of us. I was worried how I was going to get to clinic, thanks a lot to the staff members.’

‘Patient very happy with treatment home delivery system, requests that we should also deliver medication for his wife’

‘I was very scared of going out because of COVID-19, I am very happy.’

The feedback showed not only acceptance of the new patient-centric option, but those who were enrolled were eager to get other family members enrolled too.

The project used several mechanisms to deliver medication (Fig. 2). The Uber option was mainly used for those patients who lived further away from the clinic. On 21 May the first Uber delivery was completed successfully to the homebased care office in central Tshwane. The next day, delivery expanded to Mamelodi. Five (2%) of the 432 deliveries failed initially due to the patients not being at the delivery address. These were successfully delivered on the second attempt after rearranging the time or location of delivery telephonically with the patients.

Discussion

This pilot serves as encouragement, and provides data, for decisions around whether to expand this community-oriented primary care- and telehealth-related intervention to more facilities and districts.

The Western Cape Department of Health, in partnership with Aviro, uses WhatsApp and unstructured supplementary service data (USSD) to enable patients to provide their latest, most accurate contact details. Implementing such a system in Gauteng would enhance cost-efficiency, particularly if patients also indicate, through such system, their willingness or otherwise to receive medication by home delivery. Clinicians would then waste less time evaluating files and making phone calls to patients who do not answer the call or do not agree to receive medication by home delivery.

Patients on antiretroviral (ARV) medication without an additional diagnosis were less likely to accept home delivery of medication than those on treatment for NCDs, or for a NCD as well as HIV. This may be due to concerns that their HIV diagnosis could be revealed.
to others in their household when ARVs are delivered to their homes. This unwillingness may therefore be an indirect indication of the fear of stigmatisation, and of patients’ non-disclosure of their HIV diagnosis. Other factors affecting acceptance or otherwise of the home delivery option may be the patient’s age, or the perceived risk of COVID-19.

We believe the project has the following advantages:

(i) Patients have the opportunity to continue life-saving medical treatment without risking exposure to COVID-19.
(ii) Patients have significant cost savings in terms of transport. This is even more significant for those in lockdown in places further away from the clinic than their usual work or residences.
(iii) The reduced use of public transport also lowers patients’ risk of COVID-19 infection and/or transmission.
(iv) The opportunity cost of waiting for medication at health facilities may be high in the South African (SA) context. Patients waiting at health facilities sacrifice time that could be spent on more productive activities, such as employment, education or caregiving. Home deliveries eliminate this opportunity cost.
(v) Regular contact with the same CHW will establish continuity of care for patients.
(vi) Due to the above (i - v), adherence to treatment may improve, with resultant improved health outcomes. This will be the focus of a future study.
(vii) Medication delivery may elevate the standing of CHWs in the health system, as they are seen to deliver tangible value to their clients. This is important in the context of SA’s progress towards universal health coverage and the important role of community-based PHC played by CHWs.
(viii) Health workers can manage patients without face-to-face contact if telehealth is used. This lowers their risk of infections such as COVID-19 and TB.
(ix) Implementing this approach on a large scale will mean less congestion at health facilities. This will alleviate the physical workload on scarce human resources for healthcare.
(x) Home delivery of medication can be integrated into the solution set that CCMDD offers. Currently, some CCMDD pick-up points are at the facilities themselves (Fastlane pickups). For these patients, the home delivery mechanism would be an improvement for the patient and the facility.
(xi) Home delivery can also complement CCMDD where CHWs deliver medicine to patients in areas where CCMDD has no coverage, or to patients who have opted not to use CCMDD, or who do not qualify for CCMDD for non-clinical reasons.

In Table 4, we list some of the risks and mitigation strategies for the project. Not all of the listed risks have occurred as yet, but they remain on the teams’ radar in case they do.

### Table 4. Risk and mitigation strategies

| Risk                                                      | Mitigation strategy                                      |
|-----------------------------------------------------------|----------------------------------------------------------|
| Medication lost or stolen                                 | SOPs that detail controls in place, such as signatures for parcels transported and delivered. |
| Patients or designated relatives not found, leading to failed delivery | Telephonic confirmation of pending deliveries; return of undelivered parcels and follow-up tracing. |
| Excessive cost of transporting medication where Uber is used (currently ~ZAR35 per parcel delivered) | By scaling up to include more patients, costs will fall dramatically. Transportation costs will be funded by Uber and BMGF until December 2020, after which the costs will need to be absorbed. The experience in the Cape Metro has shown that incremental costs are less than ZAR1 per patient package in the first 2 months, when the project is suitably scaled. |
| Medical errors due to the nature of remote consultations   | File audit, peer review and supervision by family physician. |
| Incorrect medication dispensed or delivered to patients    | Pharmacist supervision. Patients given a number to phone if they note any errors in the medication. |

SOP = standard operating procedure; BMGF = Bill and Melinda Gates Foundation.

is an opportunity to expand the option of home delivery of medications to all PHC clinics and CHCs in Tshwane, starting with those with the highest headcounts and the highest numbers of missed appointments. This will assist in strengthening CCMDD enrolment and delivery through telephonic consultations and registering ward-based outreach team (WBOT) health posts as pick-up points. If up to one-third of clients are eligible for home delivery, this could alleviate a very substantial burden on the health system during a time when there are new pressures. This may further improve networking between Tshwane health facilities and non-governmental organisation partners to make more resources available for decongestion of facilities and tracing patients who missed appointments. Finally, on taking a patient-centric view of healthcare delivery, the early feedback indicates that this should be a service that continues beyond the current COVID-19 crisis period.

**Acknowledgements.** We thank Nicoleen Smit (Department of Family Medicine research technician) for manuscript preparation, and Mr Ofentse Mathibe for managing the Qualtrics and Uber Technologies accounts. **Author contributions.** BR, SN and JML implemented the project. DB and JML wrote the article. CC, JW and ZB took part in analysis and writing of the article. JML analysed the data. SN designed the data collection tools. JH, ML, SS, PM and MM provided oversight, support and advice in the implementation of the project. **Funding.** Uber provided credit for the transport of medication to the WBOTs. The Department of Family Medicine of the University of Pretoria provided administrative and logistical support. **Conflicts of interest.** None.
1. Guan W-jie, Liang W-hua, Zhao Y, et al. Comorbidity and its impact on 1 590 patients with COVID-19 in China: A nationwide analysis. Eur Respir J 2020;55(5):2000547. https://doi.org/10.1183/13993003.00547-2020
2. Kluge HH, Wickramasinghe K, Rippin H, et al. Prevention and control of non-communicable diseases in the COVID-19 response. Lancet 2020;395(10238):1678-1680. https://doi.org/10.1016/s0140-6736(20)31067-9
3. Williamson EJ, Walker AJ, Bhaskaran K, et al. OpenSAFELY: Factors associated with COVID-19 death in 17 million patients. Nature 2020;epub ahead of print. https://doi.org/10.1038/s41586-020-2521-4
4. Shange N. Almost 11 000 HIV-positive patients in Gauteng have skipped ARV collection during lockdown. Times Live 19 May 2020. https://www.timeslive.co.za/news/south-africa/2020-05-19-almost-11000-hiv-positive-patients-in-gauteng-have-skipped-arv-collection-during-lockdown (accessed 29 June 2020).
5. Human Sciences Research Council. HSRC study on COVID-19 indicates overwhelming compliance with the lockdown. Cape Town: HSRC, 2020. http://www.hsrc.ac.za/en/media-briefs/general/lockdown-survey-results (accessed 29 June 2020).
6. Tshwane Health District. District Health Plan 2019 - 2020. Tshwane: Tshwane Health District, 2019.
7. District Health Information System. Pretoria: DDIS, 2020.
8. Western Cape Government. New Healthbot launched for high-risk patients during COVID-19. Cape Town: WC Government, 2020. https://www.westerncape.gov.za/news/new-healthbot-launched-high-risk-patients-during-covid-19 (accessed 29 June 2020).

Accepted 23 July 2020.