

Impact evaluation of a youth led intervention to increase COVID-19 vaccine uptake in Kwazulu-Natal, South Africa

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ABSTRACT

Background: COVID-19 vaccination rates in South Africa remain low at 51% of the adult population being fully vaccinated, defined as having two shots of the COVID-19 vaccine with or without a booster. To improve vaccine uptake, a community-based intervention was tested in a high vaccine hesitancy community in South Africa. Trained community youths used social media, face to face interactions, door to door and neighbourhood outreach activities to deliver the intervention.

Methods: To assess if the intervention had an impact, data was collected before the intervention and after the intervention in two districts, Wentworth an intervention site and Newlands East a control site. Both districts are in KwaZulu Natal Province, South Africa. The following outcomes, changes on perceptions and knowledge about COVID-19, intention to get vaccinated for those who were not fully vaccinated and vaccination uptake were assessed using difference-in-difference methods applied through Augmented Inverse-Probability Weighting and contrasts of Potential Outcome Means (POM).

Results: One thousand, one hundred and fifty (1 150) participants agreed to take part in the study at baseline, and 916 (80%) were followed up after the 9-week intervention period. Intention to get vaccinated for COVID-19 was higher (difference-in-difference, DID 20%, 95% CI 6% – 35% higher), more people were fully vaccinated (DID 10%, 95% CI 0% – 20%) or partially vaccinated (DID 16%, 95% CI 6% – 26%) in Wentworth the intervention site compared to Newlands East, the control site. There were noticeable increases on the percentage of study participants indicating trust on the Government's COVID 19 programme, from 24% at baseline to 48% after the intervention in the intervention group than in the control group, 26% baseline and 29% at follow-up. There was a 10% (absolute) increase on the percentage of participants' saying they believed health care workers provided reliable information, 58% at baseline and 68% at follow-up in the intervention group, but there was little change in the control group 56% and 57% for baseline and follow-up respectively.

Conclusion: The youth-led intervention implemented in Wentworth, a community with a high rate of vaccine hesitancy, was effective in increasing vaccination uptake. Given the low COVID-19 vaccine coverage in South Africa and across the African region, as well as the new emerging variant of concern (XBB 1.5), there is an urgent need to scale up such intervention at the community level to address persistent misinformation and promote vaccine equality.

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1. Introduction

Vaccines have been shown to be one of the most effective ways of slowing down and containing epidemics and pandemics [1]. However, for vaccines to be effective, there is need for sufficient coverage across the whole susceptible population.

SARS-CoV-2 or COVID-19 vaccination rates in South Africa remain low despite the availability of vaccines in the country. As of the 11th of January 2023, ~ 51 % of all adults aged 18 years or older in South Africa had received at least a single COVID-19 dose [2]. This compared to 83 % in upper middle-income countries, 80 % in higher-income countries, 65 % in lower-middle income countries and 26 % in low-income countries. Relative to other countries, Chile at 92 %, had the highest single dose vaccination rate in the world, while the United States of America had 81 %, and some African countries like Botswana 64 %, Mozambique 56 %, Egypt 48 %, Eswatini 42 %, and Nigeria 33 % had varying rates of vaccination [3].

Several studies have been conducted to assess the acceptability and the uptake of COVID-19 vaccines. There are many reasons cited for low COVID-19 vaccination uptake [4–7]. The World Health Organisation, (WHO) lists vaccine hesitancy as one of the ten threats to global health [4]. The WHO behaviour and social drivers of vaccination framework (BeSD) defines vaccine hesitancy as a “motivational state of being conflicted about, or opposed to getting vaccinated and this includes intentions and willingness”. Vaccine hesitancy according to this framework may be driven by individual thinking and feeling, and/or social processes factors [5]. The current evidence supports the fact that vaccine hesitancy is associated with low COVID-19 vaccine uptake as observed worldwide including in South Africa. Based on the BeSD framework, some of the individual “thinking and feeling” factors that are cited as contributing to vaccine hesitancy include, concerns about the efficacy and effectiveness of the vaccines, misinformation and lack of trust of the vaccines, belief on natural immunity, belief that the COVID-19 virus does not cause serious illness or death, and that it affects only old people or people with other health conditions and personal freedoms. Factors that form the “social processes” domain that are cited in the literature include anti-vaccination drives, lack of trust of leaders and influencers, and religious beliefs. [6–18].

The VAXScene study that informed the intervention reported in this paper, reported the following factors as being associated with vaccine hesitancy, socio-demographic factors, age with higher vaccine hesitancy among younger age groups, and income, with higher hesitancy among low-income groups. The study also reported the following factors as “thinking and feeling factors” that were associated with vaccine hesitancy, self-perceived risk of infection and associated benefits of being vaccinated, concerns with vaccine safety, concerns about the side effects of the vaccine. The study also reported the “social processes” factors, beliefs in conspiracy theories regarding the origin of the SARS-CoV-2 and distrust in the government COVID-19 programme as contributing to vaccine hesitancy. Among the practical access factors contributing to low vaccine uptake, the study reported lack of access to the government online registration platform for vaccination, and its perceived low capacity to deliver the vaccination programme as barriers to vaccine uptake [19].

Several studies in South Africa have shown that young South Africans who felt they had a lower risk of being seriously sick from COVID-19 disease were more hesitant to take-up COVID-19 vaccination compared to older adults. These studies also reported that men were more hesitant compared to women to take the vaccine. In addition distrust in government’s ability to manage the vaccination programme due to perceived poor delivery of basic services have been reported as being one of the reasons for low COVID-19 vaccine uptake [20–26]. Reported mistrust of international and national institutions especially Western sources of information have also contributed to low intentions to get vaccinated [23–25,27,28].

2. The need for interventions to increase vaccination uptake

Because of the low uptake of COVID-19 vaccination in the country, there is need for innovative interventions to increase the willingness of individuals to get vaccinated [29]. These interventions should aim to address COVID-19 vaccine hesitancy, ensuring consistent demand and vaccination uptake [21]. The interventions ought to be context specific and be tailor-made to speak to key concerns of the target populations [21].

This paper reports the evaluation of an innovative intervention of a youth-led community-based programme implemented in Wentworth, KwaZulu-Natal in South Africa. The intervention was motivated by results of the VaxScenes Study which was conducted in four communities that included Wentworth as one of the communities. [19]. The VaxScenes study’s main objective was to assess factors associated with vaccine hesitancy. The study areas covered three provinces, Gauteng, KwaZulu Natal and the Western Cape, and it included formal and informal urban areas, *peri*-urban and rural areas. The cross-sectional study randomly sampled 300 individuals aged 18 years and older from each of four study sites. The study which used mixed methods was implemented between June and July of 2021. Vaccine hesitancy in Wentworth in that study was reported to be 55 %.

3. Methodology

3.1. The intervention

The content of the Covid-19 vaccination training was informed by the findings of the VaxScenes research in Wentworth and was designed to address four information gaps, i) Why is COVID-19 vaccination important and what does it do to the body?, ii) Who needs a COVID-19 vaccine and what are the vaccination schedules for different vaccines including booster shots?, iii) COVID-19 vaccine safety and side effects, and iv) Sources of COVID-19 vaccine information and common misinformation about COVID-19 vaccination.

3.2. Theoretical framework

The World Health Organisation Behavioural and Social Drivers (BeSD) of COVID-19 vaccination acceptance model was used as the framework for the intervention [5]. The model has four domains; i) What people think and feel, which captures concerns about the COVID-19 vaccine safety, fear of side effects and vaccine effectiveness, ii) social processes, which captures social norms about COVID-19 vaccination and vaccine behaviour of influencers and trust in government, iii) Motivation which captures individuals’ motivation and intention to get a vaccine, of which vaccine hesitancy is a factor and iv) access which captures easiness, affordability and access to vaccination, all of which are supposed to impact on vaccination uptake, Fig. 1 below.

Based on this BeSD framework [5] and the VaxScene study, the youth-based intervention focused on the “what people think and feel” and “Social processes” modifiable factors that can increase motivation and reduce vaccine hesitancy and thus increases the uptake of COVID-19 vaccination [19]. These included concerns about COVID-19 infection, risks over benefits of taking the vaccine, vaccine safety. The intervention was also designed to influence social processes that included trust in government, support from family, friends, the community, and religious leaders. In term of the intervention worked, it would reduce vaccine hesitancy. To support access challenges, information and how to register on the Electronic Vaccination Database System (EVDS), a government platform used to register and roll-out the COVID-19 vaccination programme in the country was also provided as part of the intervention.

Table 1 below summarises the main components of the programme implementation. The programme aimed to promote vaccine uptake in multi-generational households in Wentworth, thus providing protection to the most at-risk population from serious disease and reduce the

number of hospitalisations and deaths in this community. All young people recruited to deliver the intervention had matriculated from school, (completed five years of high school), but were unemployed at the time of their recruitment into the COVID-19 vaccination literacy intervention. The objectives of the interventions were:

1. To provide youths aged 18–24 years, drawn from the community of Wentworth with basic skills that would enable them to engage and communicate important and accurate information about COVID-19 within their community.
2. Conduct door to door and neighbourhood outreach activities targeting multi-generational households.
3. To improve vaccine literacy through the promotion of locally appropriate vaccine messages using mediums that included social media, face to face interactions and other appropriate engagement methods targeted at multi-generational household members in Wentworth.

3.3. Training programme and implementation of the intervention

The intervention ran for nine weeks between June–August 2022. After a four-day training received in week one (Table 1), the young people worked together as a team in the intervention site with weekly supervision visits by a regional field officer. In the first instance teams focused on producing social media postings. They generated weekly content, which was posted on the campaign's official Facebook page (now Meta): Wentworth Youth Community Project <https://www.facebook.com/WentworthAgainstCovid>; Twitter (now X): Wentworth Youth Community Project YHA <https://twitter.com/YouthWentworth>; and, personal WhatsApp groups used by the young people themselves, Fig. 2.

At the onset the community engagements were supported by the distribution of an A5 information sheet, which resulted in a total of 1 500 pamphlets being distributed. Among some of the information highlighted on the pamphlets were, reasons why one should consider being vaccinated against COVID-19 infection and possible side effects of the vaccine, Fig. 2. From weeks 7–9 the door-to-door work was supported by a verbal script of open-ended questions which the young people used to invite residents to share their concerns and which in turn facilitated the young people reinforcing the main education messages. The team practiced using this approach during an additional two days of training offered in week six of the intervention. Thereafter the team worked in pairs and visited all the households that had participated in the baseline data collection to implement the intervention programme.

Local community contacts known to the research team helped facilitate access to local educational institutions/schools ($n = 4$) and faith-based organisations/churches ($n = 5$). These meetings were used to disseminate the same messages described above. As shown by these small numbers, the young people struggled to organise a programme of

Table 1

Outline of a youth-based intervention programme to promote vaccine uptake in multi-generational households in Wentworth, South Africa.

Preparation	Week 1 Training	Weeks 2–5	Week 6 Review & training	Weeks 7–9
Briefing meeting with local stakeholder groups to secure buy- in. Recruitment & contracting of 14 youth (men & women) aged 18–25 living in Wentworth through online application & face-to-face workshop process	2 days of work readiness training 2 days of COVID-19 vaccination training	Face-to-face outreach into the community including household visits Dissemination of print flyers Local social media postings on Meta/ Facebook and WhatsApp	2 days of training to strengthen educational messages	Face-to-face outreach into the community including household visits Local social media postings on Meta/ Facebook and WhatsApp

talks in local institutions. It was unclear if the organisations that participated disseminate the information further within their own networks.

The most productive component of the campaign was the face-to-face community engagement with local residents. This was achieved through household visits and speaking with residents in well used public locations, resulting in a total of 1 723 visits over the intervention period.

Twitter seemed to have had the lowest reach registering four followers only. As a result of low numbers of followers on both Facebook and Twitter, the study could not implement standard social media analytics. The young people however reported better response to their postings on WhatsApp groups, but the study was unable to formally track this.

3.4. Evaluation design

To evaluate the impact of the intervention programme, two communities, Newlands, a control site and Wentworth, an intervention site were used. Wentworth, Ward 68 in eThekweni district in KwaZulu-Natal Province of South Africa was selected as the intervention site based on results of the VaxScene study as described above. The control site, Newlands East, Ward 11 which is in the same district as Wentworth was selected based on it having similar socio-demographic characteristics as

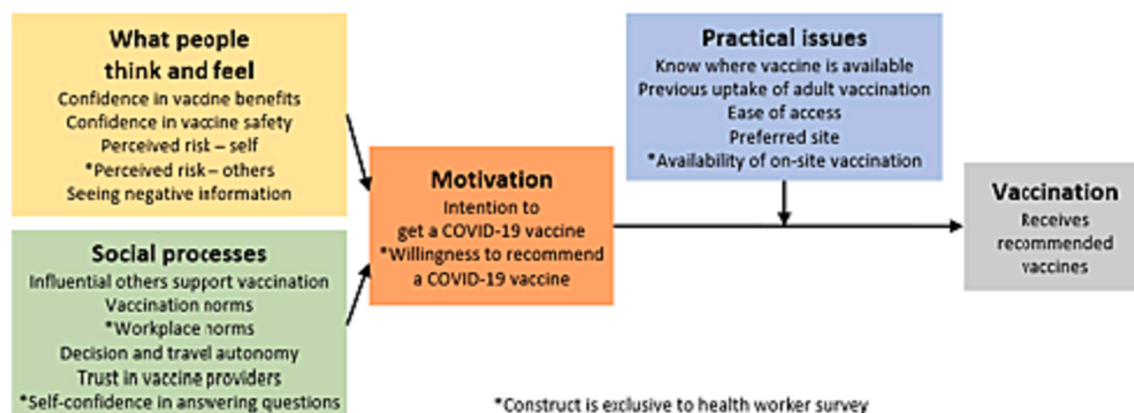


Fig. 1. The Behaviour and social Drivers of vaccination for COVID-19.

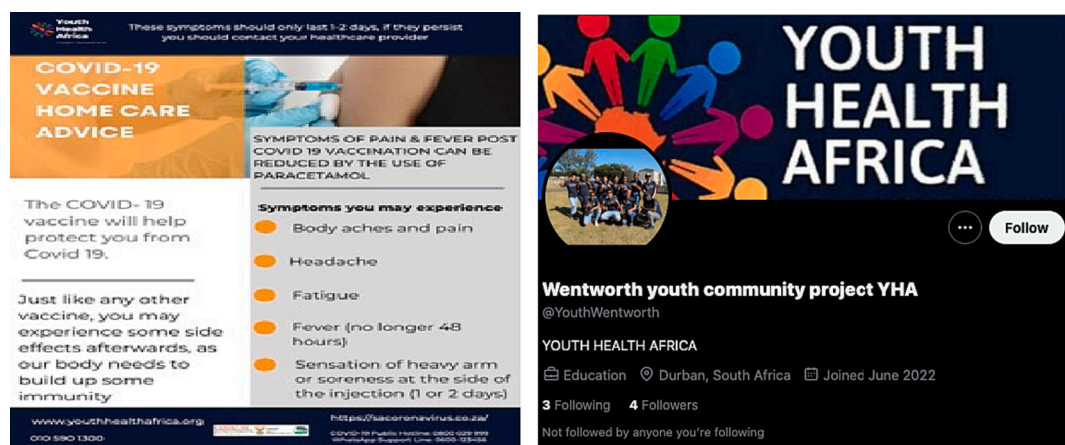


Fig. 2. Print media pamphlets hand-out and media posted on YouTube and Twitter.

Wentworth.

Data was collected in both sites before the intervention was implemented and again after implementation of the 9-week intervention, but the intervention was only implemented in Wentworth. Baseline data was collected in May 2022, programme implementation took place between June and August 2022, while follow-up data collection took place in September 2022. Contact details of participants (cell phone numbers) of those who consent to participate at baseline were collected, and participants were asked to consent to be followed-up after the intervention period. At baseline, data collection and capturing were face to face using electronic tablets, while telephonic interviews using electronic forms were conducted at the follow-up interviews.

3.5. Questionnaire and variables

The survey tool was administered in English. Socio-demographic data that included, age, gender, education, employment status, income and whether participant's household received a Government COVID-19 relief grant in the past were collected. Data on knowledge, perceptions and attitudes on COVID-19 including trust on the information and programmes on COVID-19 by government, misconceptions about the disease, self-reported past COVID-19 infection status, intention to get vaccinated against COVID-19 among those not vaccinated nor fully vaccinated, and self-reported vaccination status (fully vaccinated or partially vaccinated) were collected.

3.6. Inclusion criteria

Study participants had to be 18 years or older at the time of the interview, and they had to be a member of the sampled household selected to be part of the study. Selected participants were excluded if they were unable to complete the questionnaire because of physical, cognitive disability or if they were drunk.

3.7. Sampling and sample size

A sample size of 567 from each of the two study sites (giving an estimated total study sample of 1 314 individuals) was determined to be sufficient to detect a difference of 25 % between control and intervention on the main outcomes (intention to vaccinate or vaccination status) assuming i) alpha 5 % (i.e. $Z_{\alpha} = 1.96$), ii) statistical power of 80 %, (i.e. $Z_{\beta} = 1.64$), and iii) design effect of 2, and an attrition rate of 25 % between baseline and follow-up. Effective sample sizes of 557 and 583 from the control and intervention sites respectively were realised at baseline, and 433 (78 %) and 483 (83 %) participants were followed up after the intervention period from the control and the intervention sites respectively.

Because there was no readily available sampling frame, a multi-stage sampling method was implemented using systematic sampling to select participating households. Firstly, crude estimates of the number of households in the two study areas were made using google maps (~3500 – 4000 households), and a sampling interval of 5 was then determined. A random number between 1 and 5 was then selected to determine the first house to start sampling from, and thereafter every 5th household was invited to take part in the study. From each selected household one individual was then selected using an online random generator application [30]. If the selected person was not at home at the time of the selection, an appointment was made, and the interview conducted when she/he became available. The study allowed for three revisits, and if the selected individual was still unavailable, then the team would move to the next selected household. Sampling was done without replacement because there was oversampling to account for non-response.

3.8. Data management and data analysis

The study questionnaire was programmed using Survey Monkey to enable electronic data collection using Android tablets. Data was collected in real time where completed questionnaires were uploaded to a server as soon as the interview was completed. After some initial data cleaning, data was downloaded to STATA (version 17, STATA Corp) for analysis.

Categorical variables were reported as frequencies and percentages, while continuous variables were reported as means and standard deviations. Results were reported stratified by treatment group (control and intervention) and time at data collection (baseline and follow-up). To test the association between factors of interest and, treatment by time group, Chi-squared tests or Fishers Exact tests in instances where cell frequencies were small were used.

3.9. Evaluation model

Since we did not randomise treatment to groups, the Difference-in-Difference (DID) method applied using Augmented Inverse-Probability Weighting (ATET) was used. The variables used to create propensity weights in all models included gender, ethnic group, education level and age, using “teffects aipw” in STATA. To estimate the effect sizes, Potential Outcome Means (POM) for the four groups, baseline control, follow-up control, baseline intervention and follow-up intervention were obtained using the “pom” option. To obtain the impact of the intervention, i.e. $E[(\bar{y}_{11} - \bar{y}_{10}) - (\bar{y}_{01} - \bar{y}_{00})]$, where the first sub-script represent group, 1 = intervention and 0 = control, and the second sub-script represent time, 0 = baseline and 1 follow-up, i.e. $E(\bar{y}_{11} - \bar{y}_{10})$ is the expected mean difference for the intervention group between follow-up and baseline, and $E(\bar{y}_{01} - \bar{y}_{00})$ estimates the expected difference between follow-up

and baseline for the control group. The difference of these two, thus gives an estimate, difference-in-difference (DID), which compares intervention and control accounting for potential baseline differences. The “contrast” command was used to estimate standard errors used to calculate 95 % confidence intervals for the difference-in-difference estimates.

Using the health belief model[31,32], the following outcomes were assessed, i) knowledge and perception score, ii) intention to get vaccinated for those not vaccinated or partially vaccinated, iii) vaccination status, both iii-a) fully vaccinated and iii-b) partially vaccinated/those with at least one dose of the COVID-19 vaccine.

The knowledge and perception scores were generated using Principal Component Analysis (PCA). First, to check for interval consistency of individuals questions, Cronbach Alpha was used, and then PCA fitted, and scores predicted. The individual questions used to create the PCA covered knowledge of available vaccines, issues on perceptions about safety of COVID-19 vaccines, misconceptions about the vaccines and effectiveness of the vaccines. The vaccination status variable was generated based on the question “Have you been vaccinated for COVID-19?”. Participants were classified as being “fully vaccinated” if they reported having had two shots of the vaccine or if they had two shots plus a booster. Partial vaccination was defined as having at least one shot of a COVID-19 vaccine. To create the “intention to vaccinate variable”, participants who had never taken a vaccine were asked “If you are not vaccinated, are you considering being vaccinated in the next few months (1 or 2 months)?”, and those who had only one dose were asked “If you have had only one dose of the vaccine and you required two, are you considering getting another vaccine shot in the next few months?”. Those who said “yes” were classified as intending to vaccinate, while those who said “no” were classified as not intending to, while those who said “don’t know” were excluded from this analysis.

Crude unadjusted estimates (% and 95 % CI), and difference-in-difference estimates for all outcome variables are reported, but interpretation of the impact of the intervention are only based on adjusted weighted models. Significance levels are reported at 5 %, and all statistical tests were two-sided.

3.10. COVID-19 precautions

The research team implemented COVID-19 protocols to minimise the risk of COVID-19 transmission for study participants and fieldworkers during data collection. The measures included wearing face masks, conducting interviews outdoors, and use of hand sanitizer in all interactions with respondents. The second-round/follow-up interviews were conducted telephonically.

3.11. Ethics

Ethics approval was obtained from the Human Sciences Research Council (HSRC) Research Ethics Committee Protocol No REC 5/24/11/21: Effects of youth-led education to promote COVID-19 vaccine uptake at community-level, The Wentworth Youth Health Africa-68 (WYHA-68) Impact Evaluation Study. At the selected household, informed consent was sort from the head of the household or any designated adult person after the objectives of the study were explained and any clarifying questions answered. Once an individual was selected to participate in the study, the study objectives were again explained, an information sheet provided, and the participant was then invited to take part in the study. The informed consent processes included asking the selected participants to consenting to being followed-up at the end of the intervention period for a second round of data collection. Participation in the study was voluntary and participants could withdraw from the study at any time. All participants, regardless of being in the intervention site or control site, were given ZAR 50 equivalent to ~ US\$2.50 to compensate for their time. The amount was considered not too high to induce individuals to participant in the study.

4. Results

4.1. Baseline characteristics

A total of 1 150 study participants agreed to take part in the study at baseline. Nine hundred and sixteen (916 or 80 %) of whom were followed up after the intervention, Fig. 3. The following socio-demographic factors were comparable across the study sites, gender, education and family size. The intervention site participants reported relatively higher incomes, 42 % had an average monthly household incomes of R9 000 (~US\$530) or more, compared to 36 % in the control site who had a similar income level. Thirty percent (30 %) of study participants in Newlands reported receiving a Government COVID-19 relief grant, compared to 19 % in Wentworth Table 2.

4.2. Knowledge, perceptions, and attitude about COVID-19

Table 3 show study participants’ knowledge, perceptions and attitudes towards COVID-19 including views on vaccination at baseline and after the intervention. Among participants of Newlands, the control site, 19 % reported past/current history of COVID-19 infection at baseline, and this figure had increased to 35 % at the follow-up visit. In Wentworth, the intervention site, 23 % and 30 % at baseline and follow-up visits reported that they had been infected with COVID-19 in the past.

When asked “How concerned are you about getting COVID-19?”, there were noticeable differences between the two sites over time. There was a decrease in the proportion of people saying they were somewhat concerned/very concerned from 67 % at baseline to 28 % at follow-up among Newlands participants, while there was a slight increase in Wentworth from 42 % at baseline to 46 % at follow-up on the same sentiment. There was a similar trend on the questions “How concerned are you with new variants of the COVID-19”; a decrease from 70 % to 28 % in Newlands, and an increase from 42 % to 50 % in Wentworth at baseline and follow-up respectively.

When asked about what their views were on how important it was for them to get a COVID-19 vaccine, in Newlands 80 % at baseline and 57 % at follow-up indicated that it was important for their health, and this compared to 61 % at baseline and 71 % at follow-up in Wentworth. Response to a question on the importance of getting a COVID-19 booster shot had similar trends, i.e. a decrease in Newlands (70 % vs 47 % for baseline and follow-up respectively) and an increase in Wentworth (49 % vs 61 %) of participants indicating that a booster shot was important. Interestingly similar responses were observed for the two sites when participants were asked about “How important it was to get vaccinated to protect other people”, 76 % and 58 % for Newlands and 57 % and 71 % for Wentworth at baseline and follow-up respectively thought that vaccination against COVID-19 was important to protect other vulnerable people in their community.

Study participants were asked about their perception and attitude about the science behind COVID-19 vaccines as well as their trust on Government’s COVID-19 vaccination programme, Table 4. Before the intervention, 46 % and 48 % of participants in Newlands and Wentworth respectively said they trusted the science used to make the COVID-19 vaccine, and these percentages increased slightly in both sites to 50 % and 54 % respectively at follow-up.

Trust in the Government’s COVID-19 vaccination programme was low in Newlands, 26 % and 29 % at baseline and follow-up respectively. There was a marked increase in trust in Government’s handling of the COVID-19 vaccination programme in Wentworth, from 24 % at baseline to 48 % at follow-up of participants saying they had moderate to high trust of the COVID-19 vaccination programme. Whilst Newlands study participants’ perceptions about health care workers providing reliable information on COVID-19 remained roughly the same across the two time periods (56 % vs 57 %), proportionately more people in Wentworth at follow-up (68 %) compared to baseline (58 %) trusted health care workers to provide reliable information about COVID-19.

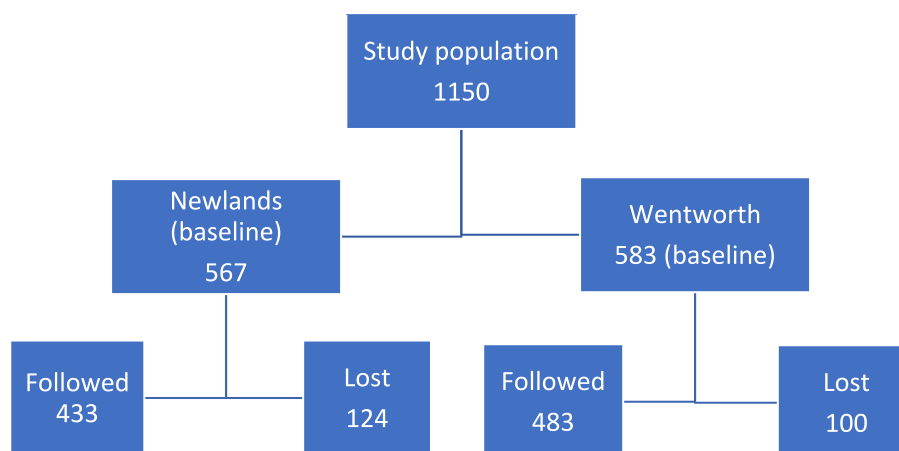


Fig. 3. Flow chart of study participants recruited in a young led intervention in South Africa.

In Newlands, 44 % and 32 % of participants at baseline and follow-up indicated that they were worried about the safety of COVID-19 vaccines, while in Wentworth 36 % and 25 % for baseline and follow-up respectively said they were worried about the safety of the COVID-19 vaccines.

Whilst there was an increase in the percentage of Newlands residents from baseline to follow-up (18 % to 24 %) believing that “COVID-19 brings other illnesses”, there was a decrease in Wentworth from 27 % to 13 % for baseline and follow-up respectively holding the same views. At baseline 6 % in Newlands and 14 % in Wentworth of participants believed that COVID-19 brought in a new disease, and the percentage with the same view was 3 % and 1 % for the two sites respectively at follow-up. Four percent (4 %) and 14 % for Newlands and Wentworth participants believe the misconception that COVID-19 vaccines were used as a tracking tool, while at follow-up the figures were 3 % and 1 % for Newlands and Wentworth, respectively.

To assess the impact of the intervention, comparisons between intervention and control accounting for possible baseline differences in perceptions, intention to get vaccinated for those who were not vaccinated or were partially vaccinated, vaccination status (fully vaccinated or at least one single dose) are reported, Table 5. Unadjusted and adjusted model results are presented.

There was no evidence of a statistical difference between Newlands and Wentworth on perception scores (Difference-in-Difference adjusted estimated mean difference score 0.04, 95 % CI –0.10 to 0.19). However, the proportion intending to get a COVID-19 vaccine decreased from 37 % at baseline to 11 % at follow-up for participants in Newlands, while it decreased much less from 27 % to 21 % in Wentworth. Therefore, there was a significant difference on the percentage among not vaccinated or partially vaccinated participants who intended to get vaccinated between Newlands and Wentworth, adjusted DID effect size 20 % (95 % CI 6 % – 35 %), i.e., proportionately intention to get vaccinated was 20 % higher (difference of difference) in Wentworth (intervention site) compared to Newlands. There was a proportionately higher increase in partial vaccination in the Wentworth than in Newlands, adjusted DID effect size 16 % (95 % CI; 6 % – 26 %). At baseline, 49 % of participants in Wentworth had received at least one dose of the vaccine, and this increased to 71 %, while in Newlands, the figures were 57 % at baseline increasing to 63 % at follow-up. Strikingly, before the intervention, 49 % of Newlands participants and 44 % of participants in Wentworth reported that they were fully vaccinated (had at least two doses of a COVID-19 vaccine). At follow-up 54 % and 59 % in Newlands and Wentworth participants reported being fully vaccinated, an adjusted DID effect size of 10 % (95 % CI; 0 % – 20 %).

5. Discussions

The intervention reported in this study was a simple but innovative community-based intervention that was implemented by youth recruited from the same community. At the end of the intervention period, full vaccination rates in Wentworth were higher (59 %) than in those observed in the control site (54 %), higher than the national average (51 %) and also higher than those observed in Kwazulu-Natal province (45 %) [2]. Similarly, while 71 % of study participants in Wentworth reported being partially or fully vaccinated, the national average stood at 59 %, while the provincial figure stood at 62 % [2]. Note that the figures reported in Wentworth were as of September 2022, while the reported national and provincial estimates were as of January 2023, i.e. four months later, thus the differences are likely to be even larger.

There are other interventions that have been implemented to try to increase COVID-19 vaccination uptake. Diaz et al. (2022) implemented an intervention in a New York Non-Hispanic Black community in the United State of America to increase first dose vaccination rates. The intervention which had two components, a digital online self-scheduling for vaccination based on zip codes and direct outreach to educate and schedule patients through community-based organisations, resulted on substantial and sustained increases of first-dose COVID-19 vaccination uptake in the targeted population[33].

Our results indicate that the intervention increased more awareness about the impact of the disease among people in Wentworth, the intervention site, with more people indicating that they were more concerned about contracting COVID-19 as well as being more concerned about new variants of the disease at follow-up. There was a positive increase on the proportion of people in the intervention group indicating the importance of being vaccinated and getting boosters for themselves as well as being vaccinated to protect other people. The control groups in Newlands showed the opposite of these sentiments; participants in this control site underplayed the need for vaccination and the seriousness of the disease and its impact as shown by decreasing proportions of people with positive views on vaccination and their perceptions of low impact of the disease.

A study conducted in Uganda of community leaders who were invited to a dialogue meeting about the disease was able to increase “COVID-19 risk perception, reduced concerns of COVID-19 vaccine safety and side effects, and improve perceptions on COVID-19 vaccine benefits, improve perception on vaccine access, and willingness to receive the COVID-19 vaccine” amongst the invitees. The study believed communication to address misconceptions may influence vaccine uptake in communities[34]. Although in our study community leaders from churches and education institutions were included, the evaluation

Table 2
Socio-demographic factors for study participants in youth led intervention.

Variable/Factor	Control (Newlands)		Intervention (Wentworth)	
	Baseline N = 557 n (%)	Follow-up N = 433 n (%)	Baseline N = 583 n (%)	Follow-up N = 483 n (%)
Gender				
Female	361 (65)	231 (68)	374 (65)	210 (66)
Male	196 (35)	109 (32)	199 (34)	106 (33)
Other	0 (0)	0 (0)	3 (1)	1 (0)
Race				
Black African	86 (15)	47 (14)	23 (4)	11 (4)
White	3 (1)	0 (0)	1 (0)	2 (1)
Coloured	452 (81)	283 (83)	546 (95)	296 (94)
Indian/Asian	15 (3)	10 (3)	5 (1)	6 (2)
Other	1 (0)	0 (0)	1 (0)	1 (0)
Age (Mean, SD)	39 (15)	38 (15)	44 (16)	43 (15)
Education				
None	0 (0)	0 (0)	2 (0)	0 (0)
Primary	4 (1)	4 (1)	25 (4)	2 (1)
Some secondary	144 (26)	97 (29)	190 (33)	87 (27)
Metric	315 (57)	181 (53)	274 (48)	182 (57)
Certificate/Diploma	19 (3)	16 (5)	29 (5)	7 (2)
Graduate/post-graduate	72 (13)	41 (12)	56 (10)	39 (12)
Prefer not to say	2 (0)	1 (0)	0 (0)	0 (0)
Employment status				
Employed – full time	156 (28)	104 (31)	159 (28)	89 (28)
Employed – informal sector/part time	37 (7)	26 (8)	64 (11)	18 (6)
Unemployed	204 (37)	123 (36)	181 (31)	118 (37)
Home Duties (not looking for work)	24 (4)	14 (4)	15 (3)	9 (3)
Full-time/part time Student	32 (6)	14 (4)	14 (2)	11 (4)
Retired	34 (6)	32 (9)	64 (11)	25 (8)
Self Employed	28 (5)	18 (5)	56 (10)	27 (9)
Other, specify	38 (7)	6 (1)	23 (4)	18 (6)
Prefer not to say	1 (0)	2 (1)	0 (0)	1 (0)
Family Size				
1	24 (4)	19 (6)	46 (8)	11 (4)
2 – 4	273 (51)	202 (61)	378 (66)	157 (51)
5 plus	242 (45)	112 (33)	147 (26)	141 (46)
Family Income				
None	6 (1)	1 (0)	24 (4)	1 (0)
0 – 2 999	64 (12)	14 (4)	69 (12)	26 (9)
3 000 – 5 999	68 (12)	53 (16)	134 (23)	52 (18)
6 000 – 8 999	120 (22)	69 (21)	107 (19)	83 (29)
9 000 – 14 999	164 (30)	85 (26)	90 (16)	95 (33)
15 000 – 19 000	108 (3)	69 (21)	70 (12)	26 (9)
20 000 plus	17 (3)	40 (12)	79 (14)	7 (2)
Family received COVID-19 grant				
Yes	162 (30)	123 (37)	111 (19)	58 (20)
No	383 (70)	183 (56)	450 (79)	222 (76)
Not sure	4 (1)	24 (7)	12 (2)	11 (4)
Prefer not to say	0 (0)	0 (0)	0 (0)	2 (1)

did not include a component to quantify the contribution and impact of this aspect of the intervention.

Some of the innovations that have been suggested in literature to increase vaccination uptake includes providing cash incentives, the use of community pharmacists to roll out the vaccination programme, community-based interventions, family and peer-based initiatives, involvement of traditional healers, civil society, religious and traditional leaders[21,35–37]. Similar to some of the findings in these studies, the current study used a community-based, peer-based programme to reduce vaccine hesitancy and increase vaccine uptake.

Whilst the views about the science associated with the development of COVID-19 vaccines slightly increased across the two sites, there was a noticeable increase on the percentage of people saying they had trust in the Government's vaccination programme in Wentworth than in Newlands. Participants in the intervention site were also more likely to show more trust with healthcare workers providing reliable and accurate information on COVID-19 after the intervention compared to the control

Table 3
COVID-19 Attitudes and Perceptions.

Variable/Factor	Control (Newlands)		Intervention (Wentworth)		Chi-2/ Fishers Exact p- value ^{&}
	Baseline N = 557 n (%)	Follow-up N = 433 n (%)	Baseline N = 583 n (%)	Follow-up N = 483 n (%)	
To your knowledge, have you been infected with COVID-19	106 (19)	129 (35)	131 (23)	97 (30)	< 0.01
If yes, were you hospitalised if you had COVID-19	11 (10)	8 (6)	9 (7)	12 (13)	0.28
How concerned about getting COVID-19?	170 (31)	255 (69)	321 (57)	173 (53)	< 0.01
Not at all/little concerned	369 (67)	103 (28)	240 (42)	151 (46)	
Somewhat/very concerned	9 (2)	10 (3)	6 (1)	4 (1)	
Don't know/Not sure/Prefer not to say					
How Concerned about new variates?	153 (28)	256 (70)	322 (57)	159 (48)	< 0.01
Not at all/little concerned	384 (70)	104 (28)	238 (42)	163 (50)	
Somewhat/very concerned	12 (2)	9 (2)	7 (1)	6 (2)	
Don't know/Not sure/Prefer not to say					
How important getting a vaccine for your health?	98 (18)	149 (40)	222 (39)	84 (26)	< 0.01
Not at all/little important	438 (80)	209 (57)	329 (58)	233 (71)	
Somewhat/very important	13 (2)	11 (3)	16 (3)	11 (3)	
Don't know/Not sure/Prefer not to say					
How important to get a booster?	150 (27)	186 (50)	275 (49)	106 (32)	< 0.01
Not at all/little important	373 (70)	174 (47)	275 (49)	199 (61)	
Somewhat/very important	26 (5)	10 (3)	17 (3)	23 (7)	
Don't know/Not sure/Prefer not to say					
How important to get vaccinated to protect other people?	111 (20)	121 (33)	191 (34)	76 (23)	< 0.01
Not at all/little important	414 (76)	215 (58)	323 (57)	232 (71)	
Somewhat/very important	24 (4)	33 (9)	50 (9)	20 (6)	
Don't know/Not sure/Prefer not to say					

& p-value is for a chi-squared test (row by column) or Fishers Exact test assessing the association between knowledge, perception, attitudes and intervention/time variables.

group. The VAXScene study noted that for interventions to be effective to improve vaccine uptake, they should include messaging to improve trust in Government and health systems including providers of health services by community members [19]. Peer-to-peer and credible messengers targeting different segments of the populations with nuanced vaccination messaging tailored to different communities were some of

Table 4

Trust in vaccines, the science behind it and government.

Variable/Factor	Control (Newlands)		Intervention (Wentworth)		Chi-2/ Fishers Exact p- value
	Baseline N = 557 n (%)	Follow- up N = 433 n (%)	Baseline N = 583 n (%)	Follow- up N = 483 n (%)	
Trust in the science used to make vaccines.	290	185	295	149	0.17
Not at all/little trust	(53)	(50)	(52)	(46)	
Moderate/High trust	258	184	271	178	
	(46)	(50)	(48)	(54)	
Trust in the Government's COVID-19 vaccine programme	407	261	427	169	< 0.01
Not at all/little trust	(74)	(71)	(76)	(52)	
Moderate/High trust	142	109	138	156	
	(26)	(29)	(24)	(48)	
Trust in health care workers to provide reliable information on COVID-19	241	160	240	104	< 0.01
Not at all/little trust	(44)	(43)	(42)	(32)	
Moderate/High trust	308	209	326	223	
	(56)	(57)	(58)	(68)	
Worry about safety of vaccines	239	120	203	81 (25)	< 0.01
Yes	(44)	(32)	(36)	222	
No	272	229	336	(68)	
Not sure	(50)	(62)	(59)	14 (4)	
Prefer not to say	31 (6)	17 (5)	25 (4)	10 (3)	
	6 (1)	4 (1)	2 (0)		
Perceptions about COVID-19 and vaccines					
COVID-19 brings other illnesses	100	105	155	63 (13)	< 0.01
	(18)	(24)	(27)		
COVID –19 brings in a new disease	33 (6)	13 (3)	80 (14)	6 (1)	< 0.01
Vaccines are used as a tracking tool	25 (4)	13 (3)	82 (14)	5 (1)	< 0.01
COVID-19 vaccine has not been tested	117	159	196	103	< 0.01
	(21)	(37)	(34)	(21)	
COVID-19 vaccine affects/changes fertility	4 (1)	28 (6)	54 (9)	10 (2)	<0.01

the suggestions to improve vaccine uptake. Wubishet et al., 2021 discussed public hesitancy towards the COVID-19 vaccine and emphasized the potential role of pharmacists as social process influencers on addressing this issue and increasing vaccine uptake. The paper suggests that pharmacists who administer vaccine can be effective advocates and educators through dispelling myths about vaccines, providing reliable evidence-based information[38].

Moore et al, (2023) reported the influence of social processes on vaccine hesitancy. The authors highlighted the portance of addressing misinformation and providing clear and evidence-based information to address vaccine hesitancy and thus promote vaccine uptake among hesitant individuals in Arkansas United States[39]. These findings are similar to the findings of the VaxScene study, which was used to design the intervention described in this study.

Although vaccination rates were higher among the intervention group compared to the control group over the intervention period, intention to vaccinate remained higher in the intervention site compared to the control site with a net difference of 20 %. This showed the continued interest among non or partially vaccinated participants in the intervention site, despite more people taking vaccination in the intervention group over this period. One would have thought that those who remained unvaccinated in the intervention group would not likely want to get vaccinated if they hadn't done so.

Based on the BeSD framework, the results are consistent and support the higher vaccination rates reported in Wentworth, thus supporting the hypothesis that the intervention achieved its desired impact of decreasing vaccine hesitancy and thus increasing COVID-19 vaccination uptake. The success of the programme can be attributed to several factors that include the local design of the programme including messaging, medium of implementation, social media, face to face engagements, and in-field follow-up and support by field staff. There was also likely to be higher levels of trust by community members of youths drawn from their own communities who implemented the programme.

The weaning of antibodies for COVID-19, implying short-term protection, as well as the emergence of new COVID-19 variates means vaccination remains probably the most effective way of reducing serious illnesses and/or deaths due to COVID-19. This can only be effective if vaccination uptake is high enough and at optimal levels.

5.1. Study limitations

There are a few limitations about the study that are worth highlighting. Vaccination status in this study was self-reported, and not necessarily verified. It is possible that some people could have reported being vaccinated (desirability bias) when in fact they were not. It is unlikely that self-reporting on vaccination status between the two sites would be different, thus the bias is likely to be small and in the same direction, thus the observed differences are likely to have minimum bias. Since the study was a community intervention, the evaluation was done at community level, we did not assess the level of exposure to the intervention at individual level to enable us to assess any dose response with study outcomes. A manuscript based on qualitative interviews to try and understand some of the nuances is underway. It is possible that there were spill over effects in the control site. Some participants in the control site may have been exposed to some the intervention material, most likely through YouTube and/or Twitter. The likely impact of this is to have overestimated positive outcomes, and underestimate negative outcomes in the control group, thus underestimating the true adjusted DID effect sizes between the intervention and control groups. In other words, the actual observed differences would be even higher if there was no spill over effects. Assignment to the intervention was not randomised, and it is possible that there are some potential unmeasured confounders that can bias the results. We however used weighting methods to create comparable groups between the control and intervention groups based on socio-demographic factors. It was noted that a nine-week intervention might have been too short for young people to fully access community structures and civic life with vaccine messages, thus reducing the full potential effectiveness of the intervention.

6. Conclusion

Community intervention programmes to communicate important factual and scientific information using members of the community can be effective on improving COVID-19 vaccination uptake as demonstrated in this evaluation study. The group of youth that implemented the programme seemed to have communicated the message on COVID-19 vaccinations well using several communication tools. Considerations should be made to see if such impactful interventions can be scaled up and expanded, targeting those areas where vaccination uptake is low.

CRedit authorship contribution statement

Edmore Marinda: Conceptualization, Formal analysis, Investigation, Methodology, Software, Writing – original draft, Writing – review & editing. **Qaqambile Mathentamo:** Data curation, Formal analysis, Software, Writing – original draft. **Nancy Coulson:** Conceptualization, Funding acquisition, Investigation, Project administration, Resources, Supervision, Validation, Writing – review & editing. **Saahier Parker:** Conceptualization, Data curation, Investigation, Project administration,

Table 5

Impact of a youth led intervention on knowledge and perception; intention to vaccinate, being fully vaccinated and having at least one dose of vaccination.

	Group	Simple Mean / Percentage (95 % CI)	DID mean / percentage (95 % CI)	Augmented inverse-probability weighting (ATET) (95 % CI)	DID ATET (95 % CI)
Outcome				PO means	
Mean Knowledge and perception score	Baseline	0,56 (0.51 – 0.61)		0.55 (0.50 – 0.61)	
	Newlands				
Follow-up	Newlands	0,41 (0.34 – 0.48)		0.56 (0.47 – 0.62)	
	Baseline				
Wentworth	Newlands	0,49 (0.43 – 0.55)		0.48 (0.41 – 0.54)	
	Follow-up				
Wentworth	Follow-up	0,32 (0.27 – 0.37)	–0.02 (-0.14 – 0.09)	0.52 (0.44 – 0.59)	0.04 (-0.10 – 0.19)
	Baseline				
% Intention to vaccinate	Newlands	38 (31—44)		37 (31—44)	
	Follow-up				
Newlands	Follow-up	10 (5—17)		11 (4 – 19)	
	Baseline				
Wentworth	Newlands	29 (23—35)		27 (21—33)	
	Follow-up				
Wentworth	Follow-up	22 (15—32)	22 (8 –35)	21 (13—30)	20 (6—35)
	Baseline				
Fully vaccinated	Newlands	49 (45—53)		49 (45—54)	
	Follow-up				
Newlands	Follow-up	52 (47—57)		54 (49—60)	
	Baseline				
Wentworth	Newlands	45 (41—49)		44 (40 – 48)	
	Follow-up				
Wentworth	Follow-up	61 (58—66)	13 (4—23)	59 (54—65)	10 (0—20)
	Baseline				
Some vaccination	Newlands	57 (53—61)		57 (52—61)	
	Follow-up				
Newlands	Follow-up	61 (56—66)		63 (58—69)	
	Baseline				
Wentworth	Newlands	51 (46—55)		49 (45—54)	
	Follow-up				
Wentworth	Follow-up	73 (68—77)	18 (9—27)	71 (66—77)	16 (6—26)
	Baseline				

Abbreviations. DID. Difference-in-Difference; ATET. Augmented Inverse-Probability Weighting.

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Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Data availability

Data will be made available on request.

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