Factors associated with willingness to receive the COVID-19 vaccine among residents of Hoima District, Mid-Western Uganda

KEYWORDS: COVID-19, Willingness, Vaccination, Rural settings, Uganda

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ABSTRACT

Introduction: For the effective control of the COVID-19 pandemic, the development and use of vaccines was a global target. Since March 2021, Uganda publicized and implemented COVID-19 vaccination activities. Reports from other parts of the world indicate mixed results in relation to willingness to receive the vaccine and little information is available from rural settings. We assessed the willingness to receive the COVID-19 vaccine and associated factors among adult residents in Hoima District, Western Uganda. **Methods:** A cross-sectional study that employed concurrent mixed methods comprising a survey and key informant interviews. The study was conducted between January and April 2022, among residents of Hoima District, Uganda. We used multi-stage sampling to randomly select 379 adult participants from 13 systematically sampled villages in two rural sub-counties in Hoima District. We also interviewed 8 purposively selected key informants who were health workers at Hoima Regional Referral Hospital (HRRH), where vaccination was being conducted. We used descriptive statistics and then conducted multivariable-modified Poisson regression to generate adjusted prevalence ratios (adj.PRs) and confidence intervals (CIs) for the quantitative data, while a thematic approach was used for qualitative data analysis. **Results:** More than three-quarters 79 % (301/379) of the participants were willing to receive the COVID-19 vaccination. Willingness to receive COVID-19 vaccination was significantly higher among participants with tertiary level of education (adj.PR=1.26, 95% CI: 1.12-1.47); those who received information about COVID-19 vaccination from healthcare workers (adj.PR=1.37, 95% CI: 1.21-1.64); and those who resided within five Kilometers from a vaccination site (adj.PR=1.22, 95% CI: 1.18-1.37). Perceived fear of losing libido among men and infertility among women was a major concern across the interviews. **Conclusion**. Willingness to receive COVID-19 vaccination was high in rural settings but safety concerns were the main barrier. Strategies to improve COVID-19 vaccination programs, in such settings, may focus on health education messages through local radio stations to counter fears of reproduction and misconceptions about the vaccine.

Introduction

Coronavirus disease of 2019 (COVID-19) is caused by the severe acute respiratory syndrome coronavirus 2 (SARS-COV-2) [1]. On 30 January 2020, following the recommendations of the emergency Committee, the WHO Director-General declared that the outbreak constituted a Public Health Emergency of International Concern (PHEIC) [2]. The SARS-COV-2 is a β-coronavirus , which is non-segmented positive-sense RNA virus [3]. Vaccination was deemed a key strategy to limit the severity of the COVID-19 pandemic [4]. According to the WHO, countries need to vaccinate at least 70% of their populations to be able to achieve herd immunity. However, the COVID-19 vaccination program met a lot of resistance from communities, and there was limited data on willingness to receive the COVID-19 vaccine in Uganda.

The infodemic about COVID-19 contributed to varying perceptions in the community which yielded both positive and negative effects on the willingness to uptake the COVID-19 vaccine [5]. By September 2021, there were very few studies that assessed the willingness to receive the COVID-19 vaccine in Uganda [6–8]. These studies were conducted through online surveys, hence leaving behind the population that does not have access to the Internet. Therefore, we assessed the level and factors associated with willingness to receive a COVID-19 vaccine among the adult residents of Hoima district in Western Uganda.

Methods

Study design and setting A cross-sectional study that employed mixed methods approach was used; with quantitative and qualitative data collected concurrently. Between January and April 2022, a household survey among adults aged 18 years and above in addition to key informant interviews were conducted to corroborate findings among residents of Hoima District, Uganda. Hoima district is one of the eight districts that make up the Bunyoro health region. At the onset of the pandemic, the regional referral hospitals hosted COVID-19 treatment units (CTU) for the health regions under their jurisdiction, and Hoima Regional Referral Hospital was no exception as it served as the regional COVID-19 treatment unit (CTU) for the region. Local data from the surveillance registers revealed that the Bunyoro Health Region had a cumulative 4499 cases, and the Hoima District alone had 1448 cases by September 2021. Up until that time, the CTU had admitted a cumulative of 405 cases of which 114 died due to COVID -19 and its complications (case fatality rate of 28%) [9] , meaning Hoima was hit hardest by the pandemic in the region. The COVID-19 vaccine was provided free of charge to the public to mitigate the severity of the disease by the Ministry of Health Uganda National Expanded Program on Immunization (UNEPI).

Study population
Study participants were eligible for study inclusion if they were residents of Hoima District, aged 18 years and above. We excluded individuals from the study if they were too sick to participate or had communication disabilities. Qualitative findings were obtained from health workers at Hoima Regional Referral Hospital.

Sample size and sampling procedure. A sample of 422 respondents was computed for the household survey using Kish Leslie (1965) [10] formula with the following assumptions; a precision of 0.05, 95% confidence level, and a non-response rate of 10% as shown below

$$n = \frac{Z^2 \cdot P \cdot Q}{d^2}$$

Where;
n- Sample size.
Z- The standard normal value corresponding to the 95% confidence level; z = 1.96.
P- The proportion of the population that would accept the COVID vaccine is not known and it was therefore assumed to be 50%; P= 50%, Q= 100% – P
d- The precision (acceptable degree of error for cross-sectional studies) is 5%

Therefore, $n = \frac{1.96^2 * 0.5 * (0.5)}{0.05 * 0.05}$

= 384 respondents

Catering for a non-response rate of 10%, the sample size was calculated as follows;
= (10/100)*384 =38.4 =38
Therefore, the study recruited 422 respondents to participate in the study.

For the qualitative component, the sample size was determined based on the recommendation by Creswell[11] where an adequate sample size is between 5 to 25 for key informant interviews or until redundancy or saturation is attained. Therefore, we

interviewed 8 health workers who were participating in treating COVID-19 patients and in the vaccination of residents in Hoima.

Sampling for quantitative data

A four-stage multi stage sampling strategy was done for the household survey; that is at the sub county level, parish level, village level and finally household level. At stage one, two sub-counties that had bigger populations were purposively selected. At stage two, 2 parishes from each sub-county were randomly selected using computer-generated random numbers giving us 4 parishes out of total 9 parishes. At stage three, a list of villages in each selected parish was obtained at the district health office and participating villages were selected using computer generated random numbers. Kahoora Division central ward (parish) had 10 villages; 1. Isaka Upper, 2. Isaka Lower, 3. Kijungu Cell, 4. Police Cell, 5. Hospital Cell, 6. Bank Cell, 7. Market Cell, 8. Public Cell, 9. Mosque Cell, 10. Park Cell and the desired number of villages was 6. Therefore using the random numbers generated to select the 6 desired villages, we arrived at; 06, 07, 05, 01, 10, 08 [12] as the 6 villages that were included in the study. Therefore, 6-Bank Cell, 7-market cell, 5-Hospital cell, 1- Isaka Upper, 10-Park cell, and 8-Public cell were considered as the 6 villages included in the study. Kahoora Division South ward (parish) had 9 villages;

1. Kibati I,
2. Kibati II,
3. Katuugo,
4. Kalyabuhire,
5. Kigaragara,
6. Busiisi East,
7. Kiryatete Upper,
8. Kiryatete Lower,
9. Kiryatete East.

Using also the random number generator the results showed; 1, 4, 8, 7, 3 and the desired number of villages was 5. Therefore, the villages that were involved from Kahoora Division south were; 1. Kibati, 4. Kalyabuhire, 8.Kiryatete Lower, 7.Kiryatete upper and 3.Katuugo.

In Kigorobya's South Eastern ward (parish), they were 2 villages; 1. Kigorobya 1 cell and 2. Kigorobya II cell. Using the random number generator, the value of 1 was arrived at which meant that Kigorobya 1 Cell.

Kigorobya South Western ward also has 2 villages; 1. Kikwanana and 2. Kikonkona. Using the random number generator, the value of 2 was arrived at which meant that Kikonkona was used for the study.

To calculate the number of villages to be selected per parish, the formula below was used.

$$np = \left(\frac{\text{Total Number of villages per parish}}{\text{Total number of all villages for the study}} \right) \times \text{Desired villages for the study}$$

Where *np* is the number of villages per parish. The total number of villages that were selected for this study was 13.

To estimate the number of respondents for each parish, the formula for sampling proportionate to size was applied. The number of respondents selected in each village was obtained by equally distributing the total number at the parish level by the number of villages selected in that Parish. At stage four, random sampling was used. A list of households was obtained from the Local Council leader. The households were allocated numbers. Using computer-generated random numbers, households were selected for inclusion in the study. At stage five, one adult individual was selected from each household and if there were more than one eligible participant, the household head was chosen for the study.

Measurements

The dependent variable was willingness to receive the COVID-19 vaccine which was a dichotomous indicator derived from the answer given to the following question: "Are you willing to receive COVID-19 vaccination?" This variable was coded yes=1 or no=0 and used as a proxy for willingness to get vaccinated.

The independent variables were individual factors such as age, gender level of education, occupation marital status, religion, and household income; health system variables which included: distance to the nearby health facility, source of information about COVID-19 vaccination information, availability of COVID-19 vaccines, perception of attitude of health workers, involvement of local leaders and management of vaccine related health information /vaccination certification; and health workers perceptions and experiences with the community regarding willingness to get vaccinated.

Data collection and analysis

Quantitative data were collected using a structured interviewer-administered questionnaire. Completed questionnaires were checked daily for completeness. Data were entered into EPI DATA version 3.02 (*EpiData,* Odense, Denmark) and exported to STATA version 14.0 (*Stata Corp*, College Station, Texas, USA) for analysis. Descriptive statistics were presented as means (standard deviation) for continuous variables and frequencies and proportions for categorical variables.

To identify the factors associated with willingness to get COVID-19 vaccination, we used modified Poisson regression [13]. Variables that were significant with a p-value <0.05 at bivariable analysis were checked for collinearity and included in the multivariable model to estimate independent effects. Variables in the final model were considered statistically significant at a p-value <0.05. Hoima Regional Referral Hospital was purposively selected for recruitment of key informant study participants because it hosted the regional COVID-19 treatment Unit and led COVID-19 response activities. We interviewed eight health workers who participated in COVID-19 vaccination activities.

The key informant interviews focused on perceptions of health workers and experiences from the community regarding the factors associated with willingness to get vaccinated. The interviews were audio recoded and transcribed verbatim by Principal Investigator (JT). Data were analyzed using the thematic approach adapted from Braun and Clerk [14]. Themes were identified concerning level of willingness, individual factors such as fear of disease, cultural and religious influence and health system related factors associated with willingness to receive the vaccine. The Principal Investigator read the manuscripts several times to familiarize with the content, identified quotes that were relevant to the themes, and these were tallied to determine the frequency of the appearance of a given theme and meaningful narratives and quotes were identified. Qualitative data were presented in the form of statements and quotes. Quantitative and qualitative analysis was done sequentially such that the qualitative findings enrich the findings from the quantitative component by adding contextual understanding.

Ethical considerations

Approval to conduct the research was obtained from the Makerere University School of Public Health Higher Degrees Research and Ethics Committee (Letter dated 1 February 2022). Permission to conduct the research was obtained from District Health Officer. All participants consented to the study protocol before being involved.

Results

Overall, 379/ 422(90%) respondents completed the interviews. We found that most participants were willing to receive the COVID-19 vaccine 79% (301/379). The mean age of the respondents was 39.1 years (SD=13.5) and 80.2% (304/379) were below 50 years of age. Majority of the respondents were males 52.8% (200/379); Anglicans 46.7% (177/379); married, 66.2% (251/379); educated up to secondary school level, 46.2% (175/379); and low-income earners getting below Uganda Shs.300,000 (80 USD) per month 72.0% (273/379) **(Table 1).** Our findings from key informants revealed that the level of willingness was also high in the community, two thirds of the key informants perceived that at least seven of ten residents were willing to receive the COVID-19 vaccine. However, there is a proportion of about one third of the people who were not willing to receive the vaccine.

"*Of the people I have interacted with, I would say seven of ten are willing to take the vaccine."* –KI, assistant nursing officer.

Factors associated with willingness to receive COVID-19 vaccination.

From the multivariate analysis, the prevalence of willingness to get vaccinated was 1.26 times higher among residents with tertiary level of education compared to those who had no formal education (aPR=1.2, 95% CI: 1.12-1.47). The prevalence for willingness to get vaccinated was 1.22 times higher among residents whose health facilities were within 5 kilometers from their residences compared to those who health facilities are beyond 5 kilometers (aPR=1.2, 95% CI: 1.18-1.37). The prevalence of willingness to get vaccinated was 1.37 times higher among residents who were receiving COVID-19 vaccination information from health workers compared to those who heard information from friends (aPR =1.37, 95% CI: 1.21-1.64). In addition, all the respondents had heard about COVID-19

vaccination and majority (214/379) mentioned the source of information to be from local radio stations. This was corroborated by the findings from the key informants who mentioned that radio stations were a key source of information for COVID-19 vaccination awareness.

"They can do health education and sensitise communities, but if you are reaching individuals, one per one, it is very difficult, but if radio talk shows are used for purposes of community sensitisation, they will reach more people COVID-19 vaccination willingness would improve." – KI, midwife vaccinator.

Individual factors from qualitative study

Fear of the pandemic and vaccine side effects

Across the interviews, we found that people were more willing to take the vaccine when COVID-19 was causing more hospitalization and deaths. Fear of the disease was a main motivator for willingness to get COVID-19 vaccination, but then the trends changed, and people stopped perceiving the disease as a major threat.

"During the time when COVID-19 was seriously killing people, about eight of ten people would willingly take the vaccine but I think that has changed recently since the pandemic is going away" KI- medical officer.

However, fear of the side effects that could possibly come from the vaccine were a main barrier to people's willingness to get vaccinated, as different genders in the community were found to have differing perceptions about the vaccine and its side effects. For instance, most of the key informants said men were concerned that the vaccine would cause loss of libido and affect fertility or would take away their "manhood"-as they call it.

"When COVID-19 vaccination came, people were saying that actually if they vaccinate you, in the long ran you may fail to produce or it may burn sperms in men, they are worried that they will not function in bed after the vaccination" –KI, assistant nursing officer and COVID-19 vaccinator.

"People have fears I tell you; the males say that this vaccine will reduce their libido or even cause outright impotence, many females say that their menstruation was affected, and they may fail to produce in future" – KI, working at COVID-19 treatment unit.

Some key informants said women had reported that they are having longer menstrual periods after taking the COVID-19 vaccine which in the long term could affect their fertility and stop them from producing children.

"Women are concerned that if they get vaccinated, they will not produce. Some women reported that after taking the vaccine their menstrual periods have become prolonged and that they will fail to produce." –KI, theatre staff.

Qualitative findings on other health system related factors

The qualitative data from key informants showed that there were other commonly cited health system related issues affecting the willingness of individuals to get COVID-19 vaccination such as vaccine availability, management of health information, and human resources for health. These were mainly cited as barriers to willingness. While more than two thirds of the key informants said that the vaccines are always available in the hospital, some had concerns that specific types such as AstraZeneca vaccine was not available for people who wanted to take their second doses or booster. Also, there was an issue of unreliable data management system the which in turn was affecting how and when people would get their vaccination certificate. The data entrants were few and the vaccinators were also few.

"The issues that have affected people's willingness to receive the vaccine in our health system are many. Several people have got AstraZeneca, but we don't have it in stock to give them the second dose, others want specific types like Johnson and Johnson, and when they come twice or so without finding the vaccine, they lose interest. The other one is on the vaccination certificates; it takes forever for a person to get their vaccination certificate because there are very few data entrants to enter their details into the epivac system. "KI working in COVID treatment centre.

One participant said she works in many places in the hospital and it's hard for her to concentrate on vaccination, as a result people come and go back without being vaccinated, and they are not willing to come back.

"There are not enough human resources especially nurses to vaccinate the people, we are engaged in very many activities and can't be in two different places at the same time, we get overwhelmed sometimes and of course patients give up, I could go on and on" –KI, nurse COVID-19 vaccinator.

Culture and religion

Our study found that culture motivated people's willingness to get vaccinated in Hoima District. For example, cultural leaders such as the officials of Bunyoro Kingdom came out to encourage people to

get vaccinated. However, the findings from the quantitative data did not show any statistical significance to do with cultural influence at multivariable analysis.

"Owekitinisa Omuhikirwa of Bunyoro came out and supported the vaccination program, he told people the importance of immunization and encouraged people to go for COVID-19 vaccination. I felt very comfortable with getting vaccinated, and I am sure this convinced may people of Bunyoro that the vaccine was good." _KI, support staff at Hoima regional referral Hospital.

Some religious beliefs were a barrier to willingness to get COVID-19 vaccinated. Some participants believed that COVID-19 vaccination is evil and should be avoided such as some faithful believers of Bisaka. However, religion was not statistically significant factor from the quantitative findings of this study.

"Religious beliefs are hindering people's willingness to get vaccinated. The people from Bisaka faith have expressed concerns that their religion is against vaccination and that it's evil to get involved. Some believers in Jehovah's witness also said their religion does not allow them to get vaccinated." _KI, midwife COVID-19 vaccinator.

Discussion

We found that over three-quarters of the residents were willing to get vaccinated while only 21% were not willing. The study findings are consistent with others where the level of willingness has been found to be high, that is above 70% on the global scene [15], in the United States of America [16] , in China [17],in Asia [19] and in Kampala Uganda [20]. These findings are also in agreement with key informant reports where health workers perceived the willingness to be high in the communities where they stay. Across the interviews, it was found that people were more willing to take the vaccine when COVID-19 was causing more hospitalizations and deaths. Moreover, fear of the disease was a main motivator for willingness to get COVID-19 vaccination, but then the trends changed when the number of deaths reduced, and people stopped seeing the disease as a major threat.

In contrast, studies in Russia showed the level of willingness to take the COVID-19 vaccine was low (at 47%) among the Russian adult general population [24] and health care workers in Congo where the prevalence of willingness was very low at 28% [25] and among Ugandan students the prevalence was found at 20% [26].

We found that fear of side effects was a barrier to willingness. For example, most of the key informants reported men were concerned that the vaccine would affect their virility or would take away their "manhood"-as they call it locally. Some key informants said women had reported that they were having longer menstrual periods after taking the COVID-19 which caused them to worry about infertility in a long term. These findings resonate with a Ugandan study on childhood immunization where parents concern about vaccine side effects was a main barrier to immunization [21]. It has also been identified by other scholars that fear works for a short time, and that means the emphasis should be put on information, education and persuasion as the key intervention for encouraging vaccination in communities other than using images of the pandemic to instill fear in the public [22]. Similarly, a study on acceptance of influenza vaccine had previously reported self-protection and fear of the influenza virus as the main reason for accepting the vaccine among healthcare workers in Greece [23].

We also found that all the participants had heard about COVID-19 vaccination and communities had been sensitized using the local radio stations. This could be because radios are cheap and accessible to majority of the people in the communities, moreover they are available in phones, cars and can be listened to in passing compared to other mechanisms that require a little bit more effort to get the information. To consolidate this high prevalence of willingness to receive the COVID-19 vaccine, and indeed other vaccines targeting deadly outbreaks such as Ebola virus disease (EVD), cholera among others, health education should be strengthened and sustained by use of the same media. These findings are in line with those from other scholars who recommended use of local radio stations to increase awareness for example in HPV (Human papilloma virus) vaccination campaigns[27] .

Moreover, there was higher willingness where participants received information about COVID-19 vaccination from health workers and where health workers were friendly to the clients. This is not surprising because friendly health services have been seen to improve health services accessibility as it is noted by Leask in their study about a communication framework between health workers

and parents willingness to vaccinate their children [28] . Also, the health workers are best suited to guide the public on health related matters in terms of prevention, diagnostic and treatment since they are able to look at scientific evidence and answer any queries and concerns about health interventions including COVID-19 vaccination as has been cited by other scholars [29].

In this study, willingness was higher among residents who had higher levels of education compared to those who had low education levels or no formal education at all, the reason could be because the highly educated could easily discern right versus wrong information regarding COVID-19 vaccination as was cited in other studies [30]. Also, it could be because of the fact that the more educated people value their life for example in terms of life years lost or the quality-adjusted life years more than the less or not educated people and the educated have been observed to take up health services such as childhood vaccination[31]. However, some scholars have found that individuals with a high education level expressed low willingness to participate in vaccination trials owing to the same reason of having more vaccine information [32,33].
In addition, willingness was higher for individuals who resided near the health facility at less than five kilometers. Previous scholars have also identified distance to closest health center as an incentive to improving uptake of the COVID-19 vaccine which can be proxied for willingness [34]
The high level of willingness to receive the COVID-19 vaccination observed in this study has significant public health implications because it highlights how improved population health outcomes can be achieved by the demonstrated potential success of vaccination campaigns. Addressing the highlighted concerns of the unwilling minority and leveraging the willingness of the majority can be handy for public health stakeholders in designing targeted strategies to achieve higher vaccination coverage and protect the public from the devastating effects from epidemics.

This study was not without limitations. First, we relied on self-reported willingness that could have been biased by social desirability whereby respondents could have just reported that they were willing to get vaccinated because it is the expected good behavior, yet in actual sense they do not want the vaccine. We minimized this bias by reassuring participants that their identity would remain anonymous and confidentiality was ensured. Secondary at the time of the study, there was varying risk perception from the public which could affect their levels of willingness, for example in January 2022 the risk perception was high compared to April, 2022 when the cases had reduced significantly and this could affect the study results. Lastly, this study did not distinguish people who had already vaccinated from the ones who were only willing, however, data from EPIVAC showed that only 3.4% of the general population in Hoima had fully vaccinated, therefore could not have a statistically significant difference in associations.

Conclusion

Willingness to receive COVID-19 vaccination was high in the rural settings but safety concerns were the main barrier. Strategies by vaccination stakeholders to improve COVID-19 vaccination programs in such settings, need to focus on health education messages through local radio stations to counter fears on reproduction and misconceptions about the vaccine.

What is already known about the topic

- Willingness is positively associated with the friendly attitude of health workers when offering the vaccination services and health information.

What this study adds

- This study adds to the wealth of knowledge on the willingness to receive the COVID-19 vaccine among adults in low-resource settings, especially during pandemics.
- The low willingness to receive vaccinations is mainly a result of misinformation, especially during pandemics. This underpins the need for managing the safety concerns of the communities.

Competing Interest

The authors of this work declare no competing interest

Authors´ contributions

JT: Conceptualization, methodology, writing, review & editing. WK, JNB, AB: Conceptualization, writing, ANK, WK, JNB review & editing. All authors read and approved the final manuscript.

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Table 1: Socio-demographic characteristics of participants		
Variable	**Frequency, N=379**	**Percentage (%)**
Age in completed years, Mean (S.D)	39.1 (13.5)	
Age		
18–49	304	80.2
≥50	75	19.8
Sex		
Female	179	47.2
Male	200	52.8
Religion		
Catholics	128	33.8
Anglican	177	46.7
Muslim	35	9.2
Others	39	10.3
Marital status		
Married	251	66.2
Divorced	52	13.7
Single	76	20.1
Education level		
Formal	22	5.8
Primary	123	32.5
Secondary	175	46.2
Tertiary	59	15.8
Household income		
Low	273	72.1
Middle	93	24.5
High	13	3.4

Table 2: Factors associated with willingness to receive the COVID-19 vaccination, among residents of Hoima District, Mid-Western Uganda

Variable	Yes (N=301) n (%)	No (N=78) n (%)	Crude PR (95% CI)	Adj PR (95% CI)	p-value
Age					
18–49	243 (81)	58 (74.4)	REF	REF	
≥50	58 (19)	20 (25.6)	0.97 (0.67–1.54)	0.44	
Level of education					
No Formal	10 (3.3)	12 (15.4)	REF	REF	
Primary	107 (35.5)	16 (20.5)	0.92 (0.78–1.91)	0.88 (0.65–1.64)	
Secondary	148 (49.2)	27 (34.6)	1.13 (1.11–1.98)	1.12 (0.91–1.22)	0.09
Tertiary	36 (18.6)	23 (9.52)	1.91 (1.62–22.71)	1.26 (1.12–1.47)	0.03
Distance from health facility					
> 5 km	52 (17.3)	25 (32)	REF	REF	
≤ 5 km	249 (82.7)	53 (67.9)	2.67 (2.1–3.11)	1.22 (1.18–1.37)	0.04
Source of information about COVID-19 vaccination					
Friends	76 (25.3)	30 (38.5)	REF	REF	
Radio	173 (57.5)	41 (58.6)	1.19 (1.11–2.67)	1.2 (0.9–1.4)	
Health Workers	52 (17.2)	7 (8.9)	3.12 (2.46–3.68)	1.37 (1.21–1.64)	0.02