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Trust in vaccines and medicines in Uganda

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ABSTRACT

Trust underlies numerous decisions in health care, affecting vaccine uptake as well as care seeking rates, treatment adherence, and health outcomes. Although trust in the doctor-patient relationship has garnered much attention, trust in health care commodities such as vaccines and medicines has rarely been examined. We report findings from a cross-sectional survey to assess trust in vaccines vis-à-vis their trust in conventional medicines and traditional medicines in Uganda. Trust in vaccines, conventional and traditional medicines were assessed by adapting the vaccine hesitancy scale developed by the SAGE Working Group on Vaccine Hesitancy. Reported trust in vaccines and conventional medicines was much higher than trust in traditional medicines. Significant associations were observed between trust in vaccines and trust in conventional medicines. Of the trust components explored, respondents were most concerned about access to and safety of vaccines and medicines. Further, respondents' previous health care experiences, primary source of health information, and trust in providers' skills were significantly associated with reported trust in vaccines and medicines. Although strong levels of trust in vaccines and conventional medicines were observed overall, the findings identify areas where policies and communication efforts can focus to strengthen trust.

1. Introduction

Trust is the basis of many decisions in health care, directly affecting vaccine uptake as well as care-seeking rates, treatment adherence, and health outcomes [1–3]. Thus understanding how to build trust in vaccines and health care is essential to promoting better population health. However, developing and maintaining trust is difficult due to its complexity, which arises from many contextual influences, ranging from socio-economic determinants and past health care experiences to ease of access to health services [4–6]. Moreover, significant heterogeneity across sub-groups, populations, and locations results in considerable within-country variance in vaccination coverage and health care utilization [3,5–8] and necessitates tailored approaches to building trust across populations.

Vaccines are one of the most cost-effective public health interventions, saving millions of lives and preventing billions in treatment costs [9]. Vaccines are especially important in low- and middle-income countries where it is estimated that childhood immunizations will avert 350 million illnesses and 14 million deaths between 2011 and 2020 [10]. Despite the evidence demonstrating their value, vaccine hesitancy has become a growing concern [2,5,11,12]. The World Health Organization (WHO) defines vaccine hesitancy as "the delay in acceptance or refusal of vaccination despite availability of vaccination services" [5,13]. As countries improve vaccination coverage, vaccine-preventable diseases diminish, thus making it more difficult to appreciate the value of vaccines [14], increasing complacency about vaccination [15].

Vaccine hesitancy has been identified to be one of the barriers to vaccination in Uganda [5,6,16]. Identifying who is hesitant to vaccinate and what concerns contribute to this hesitancy are crucial to increasing vaccination coverage [5,17]. Trust in vaccination may play an important role in the demand for and utilization of vaccines [18]. Previous research seeking to determine reasons behind vaccine hesitancy in Uganda has identified a wide range of reasons including religious beliefs, safety concerns, poor health care experiences, limited knowledge, and poor access to health services [6,16,19]. This study aims to contextualize trust in vaccines vis-à-vis trust in conventional medicines and traditional medicines

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in Uganda. For this study, a vaccine is defined as "a biological preparation that improves immunity to a particular disease", conventional medicines are defined as "modern scientific preparations that use pharmacologically active ingredients to treat diseases," and traditional medicines are defined as "practices and preparations indigenous to a culture that aim to treat diseases" [20,21].

Our understanding and measurement of trust has improved in recent years through advancements in psychosocial metrics. Various trust measures have been developed to quantify levels of trust among relationships across the health system, with a large focus on measuring patient-provider trust and patient-health system trust [3]. For vaccines, measures of vaccine hesitancy have been developed by the WHO Strategic Advisory Group of Experts (SAGE) Working Group on Vaccine Hesitancy, to help diagnose and address vaccine hesitancy [5]. However, trust in vaccines has rarely been measured in low-income countries and contextualized within health care or compared against trust in other forms of medicines. We adapted the vaccine hesitancy scale to measure trust in vaccines compared to conventional and traditional medicines.

2. Methods

We conducted a cross-sectional survey in Mukono district in Central Uganda in December 2017. Mukono district (population of 596,000) is located 21 km east of Kampala, Uganda's capital city [22]. On average, the residents of the district are young (52.1% under age 18) and literate (82.3% literacy rate) [22]. Regional vaccination rates are high with 98.4% of children aged 12–23 months having received at least one vaccine, but full coverage of recommended vaccines according to the Uganda national immunization schedule remains low, with only 46.7% of these children having received all of the basic vaccines [8]. Using simple random sampling (SRS), one division was selected out of the 2 divisions in the Mukono municipality and one sub-county was selected out of the 15 sub-counties to examine differences across rural and urban areas. The two areas selected for the study were Seeta Namuganga sub-county (rural) and Mukono Central division (urban). In the rural area, two parishes (Namuganga and Namanoga) were randomly selected out of the five parishes in the sub-county. One village was then selected from each of the two rural parishes using SRS: Nsagi village was selected from Namuganga parish out of 16 villages, and Mawotto village was selected out of 13 villages from Namanoga parish. In the urban area, one zone was selected from each of the two wards in the municipality using SRS: Agip zone from Gulu ward and Upper Kauga zone from Nsubbe Kauga ward.

Comprehensive listings of all the households in each village or zone were obtained with the help of Village Health Team members (VHT) and community leaders in the urban zones. Study sample sizes were allocated across the four selected areas using probability proportional to size (PPS). The number of households selected in each area were: Agip – 109; Upper Kauga – 108; Mawotto – 99; and Nsagi 118. Respondents were either the household head or spouse and had to be at least 18 years of age. Trained research assistants approached respondents, acquired consent, and conducted the survey. All study materials were translated into Luganda (the local language spoken in Mukono district) and back-translated into English to check for accuracy. Study data were collected and managed using REDCap (Research Electronic Data Capture) tools hosted at the University of North Carolina at Chapel Hill [23]. REDCap is a secure, web-based application designed to support data capture for research studies [23]. Data were collected on electronic tablets using REDCap's mobile application for offline data collection and synchronized to the online REDCap server at the end of each day.

The household survey asked questions to compare respondents' levels of trust in vaccines, conventional medicines, and traditional medicines. In the survey, the operational definition of conventional medicines was "medicines obtained from health facilities, such as clinics, hospitals, pharmacy, or drug store." The operational definition of traditional medicines was "medicines given by herbalists or spiritual healers." Items to assess trust levels in vaccines were directly adopted from the 10 question Likert Scale survey on vaccine hesitancy [5]. The questions assess trust in vaccines by asking about respondents' beliefs in vaccine safety, efficacy, and importance (questions are presented in Appendix 1). To assess trust levels in conventional and traditional medicines, we modified the subject of these questions to conventional and traditional medicines.

The survey also asked additional questions to assess respondents' perceived ease of access to vaccines and medicines, trust in providers, health attitudes, prior experiences with vaccines and medicines, social capital, and sources to obtain vaccines and medicines. Items to assess trust in providers and social capital were adapted from a prior study by the authors that assessed trust in providers in Cambodia [24]. Items to assess prior experiences and identify sources to purchase medicines were developed by the authors. Respondents' demographic information was collected, including age, gender, education, marital status, employment status, religion, household size, ethnic group, and socio-economic status (SES). Respondents' SES was assessed through a standardized asset index score utilizing the Uganda Demographic and Health Survey (DHS) household wealth index questions, where respondents were assigned into wealth quintiles based on nationally representative wealth index score cutoffs from the DHS survey [25].

We conducted our analysis by developing trust scores (on a scale of 20 to 100) for vaccines, conventional medicines, and traditional medicines by collating responses to the ten standardized Likert Scale questions. These scores were compared to each other using linear regression analysis to explore associations and determine whether they were significantly different from each other using two sample t-tests. Kruskal-Wallis one-way analysis of variance was used to identify differences in trust scores across nominal demographic variables. Wilcoxon-type test for trend was used to identify differences in trust scores across ordinal variables and across questions that assessed health attitudes, prior experiences with medicines, social capital, and sources of vaccines and medicines.

In addition to developing overall trust scores, we also aggregated the Likert Scale questions into five smaller scales for vaccines and conventional medicines. These scales assessed respondents' beliefs in the importance, efficacy, safety, perceived ease of access, and trust in the provider of vaccines and conventional medicines (questions are demarcated in Appendix 2). We assessed the concurrent validity of the overall trust measures and of the smaller component scales by examining associations between their scores and additional questions on social capital related to trust. We found evidence of concurrent validity in scales for vaccines and conventional medicines. All data cleaning and analyses were conducted using Stata version 14.2 (College Station, TX).

This study was approved by the Institutional Review Boards at the University of North Carolina at Chapel Hill, Makerere University School of Public Health and the Uganda National Council for Science and Technology.

3. Results

We surveyed 434 participants comprising 217 respondents each from rural and urban areas (Table 1). Participants were

Table 1
Respondent Demographics.

Demographics	Total (n = 434)	Rural (n = 217)	Urban (n = 217)	p Value
Age, mean (SD)	38.9 (14.6)	41.9 (16.2)	35.9 (12.1)	p < 0.001*
Gender (%)				
Male	144 (33.2%)	85 (39.2%)	59 (27.2%)	p = 0.008*
Female	290 (66.8%)	132 (60.8%)	158 (72.8%)	
Education (%)				
None	50 (11.5%)	41 (18.9%)	9 (4.1%)	p < 0.001*
Some Primary	120 (27.7%)	89 (41.0%)	31 (14.3%)	
Completed Primary	61 (14.1%)	36 (16.6%)	25 (11.5%)	
Some Secondary	58 (13.4%)	26 (12.0%)	32 (14.7%)	
Completed Secondary	78 (18.0%)	17 (7.8%)	61 (28.1%)	
Tertiary	45 (10.4%)	8 (3.7%)	37 (17.1%)	
University	22 (5.1%)	0 (0%)	22 (10.1%)	
Religion (%)				
Protestant	220 (50.7%)	105 (48.4%)	115 (53.0%)	p = 0.009*
Catholic	131 (30.2%)	79 (36.4%)	52 (24.0%)	
Muslim	83 (19.1%)	33 (15.2%)	50 (23.0%)	
Marital Status (%)				
Married or Living Together	287 (66.1%)	158 (72.8%)	129 (59.4%)	p < 0.001*
Divorced/Separated	65 (15.0%)	33 (15.2%)	32 (14.7%)	
Widowed	43 (9.9%)	21 (9.7%)	22 (10.1%)	
Never Married/Never Lived Together	39 (9.0%)	5 (2.3%)	34 (15.7%)	
Employment status (%)				
Employed	318 (73.3%)	165 (76%)	153 (70.5%)	p = 0.066
Casual	6 (1.4%)	5 (2.3%)	1 (0.5%)	
Unemployed	110 (25.3%)	47 (21.7%)	63 (29.0%)	
Household size, mean (SD)				
Overall household	5.5 (3.5)	5.6 (3.7)	5.5 (3.3)	p = 0.623
Children aged 5 years and under	1.3 (1.1)	1.3 (1.0)	1.3 (1.1)	p = 0.683
Wealth Quintile (%)				
Lowest	14 (3.2%)	14 (6.5%)	0 (0.0%)	p < 0.001*
Low	28 (6.5%)	28 (12.9%)	0 (0.0%)	
Middle	50 (11.5%)	50 (23.0%)	0 (0.0%)	
High	64 (14.8%)	60 (27.6%)	4 (1.8%)	
Highest	278 (64.1%)	65 (30.0%)	213(98.2%)	
Ethnic Group (%)				
Muganda	228 (52.5%)	90 (41.5%)	138 (63.6%)	p < 0.001*
Other ethnic groups	206 (47.5%)	127 (58.5%)	79 (36.4%)	
Received a vaccine before (%)				
No	13 (3.0%)	13 (6.0%)	0 (0%)	p < 0.001*
Yes	419 (96.5%)	202 (93.1%)	217 (100%)	
Don't Know	2 (0.5%)	2 (0.9%)	0 (0%)	

SD: Standard deviation.
* Significant at p < 0.05.

predominantly female (66.8%) with an average age of 38.9 years. Almost all respondent adults (96.5%) had received at least one vaccination in their lifetime; those who had not (3.0%) or did not remember (0.5%) being vaccinated were all located in the rural area. Amongst the 317 participants from households with children aged 5 and under, all respondents reported their children having received at least one vaccine. On average, urban respondents were younger, more likely to be single, had more education, and were wealthier.

3.1. Trust in vaccines, conventional medicines and traditional medicines

Respondents demonstrated high overall levels of trust in vaccines (mean trust score 82.6; 95% Confidence Interval 81.9–83.2) and conventional medicines (mean trust score 80.9; 95% CI 80.2–81.7) compared to traditional medicines (mean trust score 57.8; 95% CI 56.4–59.2). Respondents' trust in vaccines was higher than trust in either conventional or traditional medicines ($p < 0.01$). A significant positive association (0.51, $p < 0.01$) and moderate positive correlation ($r = 0.56$) was found between trust levels for vaccines and conventional medicines. Trust levels for conventional and traditional medicines were negatively associated ($p < 0.01$). No significant association was found between trust in vaccines and traditional medicines.

Fig. 1 summarizes associations found between overall trust in vaccines and medicines, and various demographic characteristics, socio-economic factors, and health attitudes. Among demographic variables, household size was the only variable significantly associated with trust in vaccines ($p < 0.01$), conventional medicines ($p = 0.04$), and traditional medicines ($p = 0.04$) in a multivariate analysis controlling for all other reported demographic variables. The Wilcoxon-type test for trend indicated that trust levels for vaccines increased with household size ($p = 0.01$), with larger households having higher levels of trust. Rural participants ($p = 0.04$) demonstrated higher trust in conventional medicines compared to urban respondents. Conventional medicine trust levels were significantly different across wealth quintiles ($p = 0.02$), with wealthier respondents displaying lower trust in conventional medicines compared to poorer respondents. Gender was significantly associated with differences in trust levels for traditional medicines, with female respondents ($p = 0.03$) displaying higher levels of trust in traditional medicines. No significant associations were found between trust levels and educational attainment or religion. Fig. 1 also summarizes other identified associations discussed below, beyond demographic variables.

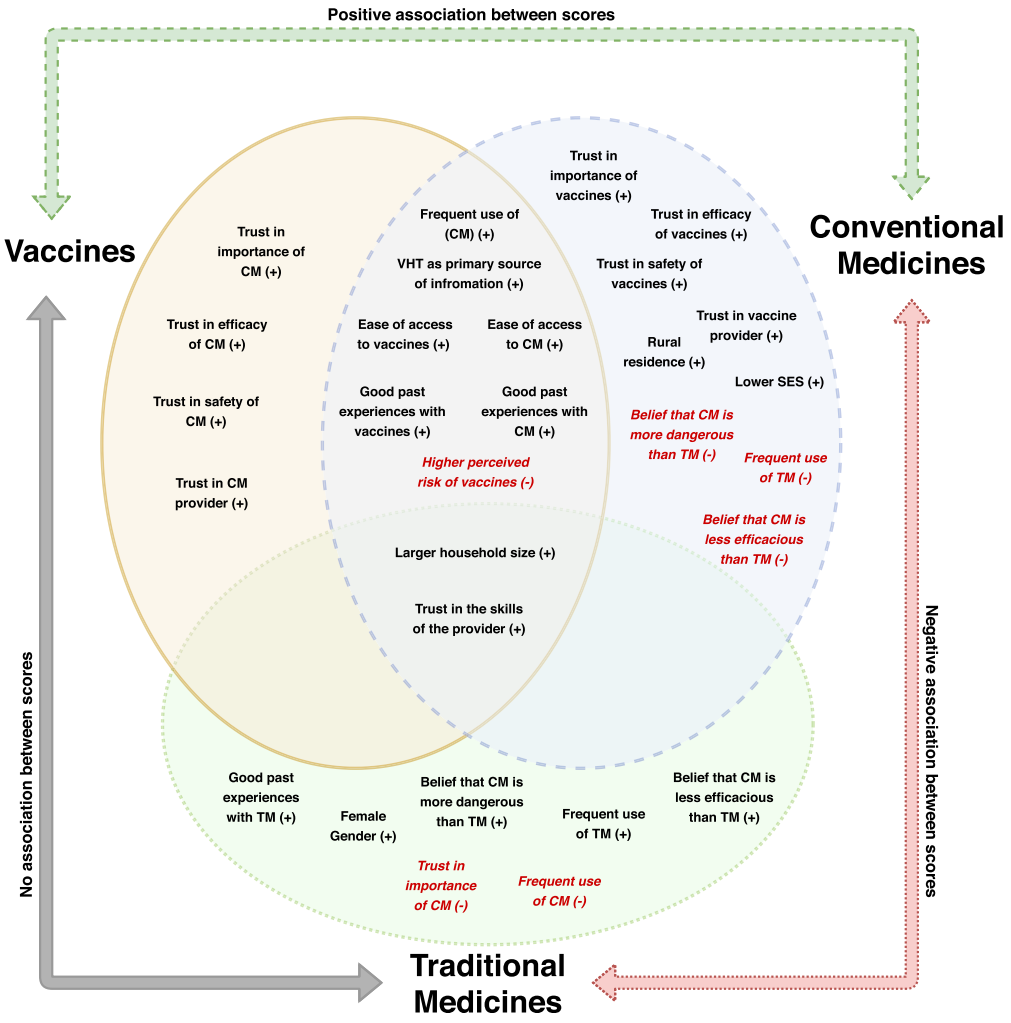

Fig. 1. Associations between trust scores for vaccines, conventional medicines, and traditional medicines, and various demographic characteristics, socio-economic factors, and health attitudes. CM – Conventional Medicine; TM – Traditional Medicine; VHT – Village Health Team; SES – Socio-economic Status. Dashed blue circle – Conventional Medicines; Solid orange circle – Vaccines; Dotted green circle – Traditional Medicines. Factors in black and denoted by (+) are significantly associated with higher trust levels. Factors in red, Italicized and denoted by (−) are associated with lower trust levels. Factors are presented twice if they are significantly associated with higher trust in one category and lower trust in another, i.e. Frequent use of CM. (For interpretation of the references to colour in this figure legend, the reader is referred to the web version of this article.)

Table 2 shows how respondents' mean trust scores for vaccines, conventional medicines, and traditional medicines varied by frequency of use of conventional and traditional medicines. Table 2 also shows how respondents' overall ratings of prior experiences varied across vaccines and medicines. More frequent use of conventional medicines was associated with increased trust in vaccines ($p < 0.01$) and conventional medicines ($p < 0.01$), and with a decrease in trust in traditional medicines ($p < 0.01$). Good past experiences with vaccines, conventional and traditional medicines were associated with higher trust scores ($p < 0.01$). Respondents with good previous experiences with vaccines had significantly higher trust in conventional medicines ($p < 0.01$) and vice versa. Past experiences with traditional medicines did not significantly affect trust in vaccines or conventional medicines.

Table 3 shows how respondents' mean trust scores for vaccines, conventional medicines, and traditional medicines varied by 1) source where they received them, 2) reported trust in the skills of health care providers, and 3) source of information about vaccines and medicines other than from their health care providers. Significant differences in trust levels were observed across health sectors that respondents visited to receive vaccines, conventional medicines, and traditional medicines. Most respondents (90.3%) received vaccines at public facilities and demonstrated higher trust levels than those who received vaccines at private facilities ($p < 0.01$). The majority of respondents (60.1%) obtained conventional medicines from commercial sources (pharmacy or drug shops) and reported higher trust scores than those who obtained conventional medicines from either public or private health facilities ($p < 0.01$). Higher trust in the skills of the health care provider was significantly associated with higher overall trust levels for vaccines, conventional medicines, and traditional medicines (all $p < 0.01$). Respondents whose primary source of information, other than the provider, for both vaccines and conventional medicines was Village Health Teams or the media displayed higher levels of trust ($p < 0.01$).

3.2. Components of trust for vaccines and conventional medicines

Table 4 summarizes mean trust scores for vaccines and conventional medicines by five components, including their perceived safety, efficacy, importance, ease of access, and provider trust. Levels of trust in providers, and trust in the efficacy and importance of vaccines and conventional medicines were all high (mean trust scores 86.1–92.6). Respondents displayed the lowest level of

Table 2
Effect of frequency of use and past experiences on trust scores for vaccines and medicines.

	Vaccines			Conventional Medicines			Traditional Medicines		
	N (%)	Trust Score (mean)	p-value	N (%)	Trust Score (mean)	p-value	N (%)	Trust Score (mean)	p-value
	Frequency of use of conventional medicines[†]								
Always	338 (77.9%)	83.1	0.002*	338 (77.9%)	82.10	<0.001*	338 (77.9%)	56.57	0.001*
Often	68 (15.7%)	81.3		68 (15.7%)	77.21		68 (15.7%)	61.47	
Sometimes	22 (5.1%)	79.7		22 (5.1%)	76.09		22 (5.1%)	62.64	
Rarely	6 (1.4%)	74.3		6 (1.4%)	74.67		6 (1.4%)	69.00	
Never	0 (0%)	0.00		0 (0%)	0.00		0 (0%)	0.00	
	Frequency of use of traditional medicines[†]								
Always	12 (2.8%)	82.83	0.679	12 (2.8%)	80.5	0.020*	12 (2.8%)	67.83	<0.001*
Often	52 (12.0%)	81.08		52 (12.0%)	78.6		52 (12.0%)	65.15	
Sometimes	176 (40.6%)	83.27		176 (40.6%)	81.1		176 (40.6%)	63.85	
Rarely	87 (20.0%)	81.20		87 (20.0%)	79.6		87 (20.0%)	57.01	
Never	107 (24.7%)	83.14		107 (24.7%)	83.0		107 (24.7%)	43.85	
	Overall rating of past experiences[‡]								
Very Good	95 (38.8%)	85.05	<0.001*	209 (48.2%)	83.76	<0.001*	29 (8.9%)	68.90	<0.001*
Good	122 (49.8%)	81.66		187 (43.1%)	79.54		195 (59.6%)	62.95	
Fair	19 (7.8%)	82.84		27 (6.2%)	73.11		85 (26.0%)	61.65	
Poor	7 (2.9%)	79.43		7 (1.6%)	70.00		16 (4.9%)	50.63	
Very Poor	2 (0.8%)	71.00		4 (0.9%)	69.50		2 (0.6%)	38.00	

* Significant at $p < 0.05$.
† Based on the question: "How frequently do you and your household members take [conventional/traditional] medicines when sick?"
‡ Based on the question: "How was your household's overall experience taking [vaccines/conventional medicines/traditional medicines]?"

Table 3
Trust scores for vaccines and medicines by provider, provider trust, and information source.

	Vaccine			Conventional Medicine			Traditional Medicine		
	N (%)	Trust Score (mean)	p-value	N (%)	Trust Score (mean)	p-value	N (%)	Trust Score (mean)	p-value
	Provider of vaccines and medicines[†]								
Public Health Facilities	392 (90.3%)	82.84	0.003*	96 (22.1%)	80.15	0.001*	–	–	
Private Health Facilities	42 (9.7%)	79.81		77 (17.7%)	78.86		–	–	
Pharmacy/Drug shops	0 (0.0%)	0.00		261 (60.1%)	81.82		12 (2.8%)	58.67	<0.001*
Herbalist	–	–		–	–		83 (19.1%)	62.51	
Self	–	–		–	–		227 (52.3%)	62.76	
Relative/Elders	–	–		–	–		5 (1.2%)	52.40	
Does not use	–	–		–	–		107 (24.7%)	43.85	
	Trust in the skills of the vaccine and medicine providers[‡]								
Strongly agree	269 (62.1%)	83.84	<0.001*	206 (47.5%)	82.35	<0.001*	81 (24.8%)	61.95	0.002*
Agree	130 (30.0%)	80.98		175 (40.3%)	80.25		144 (44.0%)	65.49	
Neutral	26 (6.0%)	78.08		39 (9.0%)	78.67		83 (25.4%)	59.04	
Disagree	4 (0.9%)	81.00		9 (2.1%)	76.89		16 (4.9%)	56.50	
Strongly Disagree	4 (0.9%)	78.50		5 (1.2%)	70.80		3 (0.9%)	49.33	
	Sources of information about vaccines and medicines[§]								
VHT	233 (53.7%)	84.39	<0.001*	100 (23.0%)	83.10	<0.001*	25 (5.8%)	63.84	<0.001*
Media	49 (11.3%)	81.39		147 (33.9%)	82.38		124 (28.6%)	63.39	
Friends/Neighbors	15 (3.5%)	80.00		78 (18.0%)	79.95		146 (33.7%)	58.68	
Community Leaders	99 (22.8%)	79.78		40 (9.2%)	80.45		8 (1.8%)	64.75	
Religious Leaders	12 (2.8%)	79.00		6 (1.4%)	78.67		0 (0%)	0.00	
Other	8 (1.8%)	80.00		8 (1.8%)	72.50		17 (3.9%)	64.00	
None	18 (4.1%)	82.78		55 (12.7%)	76.29		113 (26.1%)	47.91	

VHT: Village Health Teams.
* Significant at $p < 0.05$.
† Based on the question: "Where do you and members of your household usually go (or might go) to get [vaccines/conventional medicines/traditional medicines]?"
‡ Based on the question: "Do you trust the skills and abilities of these providers to give you [vaccines/conventional medicines/traditional medicines]?"
§ Based on the question: "Besides this provider, from whom do you hear information about [vaccines/conventional medicines/traditional medicines]? (Select all that apply)."

trust in perceived ease of access (mean trust score 67.6 for vaccines, 74.8 for conventional medicines) and safety (mean trust score 51.3 for vaccines, 51.8 for conventional medicines) of vaccines and conventional medicines. Respondents perceived vaccines to be more efficacious ($p < 0.01$) and important ($p < 0.01$) than conventional medicines, and displayed higher trust in vaccine providers than in conventional medicine providers ($p < 0.01$). Perceived ease of access to conventional medicines (mean trust score 74.8; 95% CI 72.7 – 76.9) was significantly higher than access to vaccines (mean trust score 67.6; 95% CI 50.1–52.5; $p < 0.01$).

Employment status and education were associated with significant differences in component trust scores for vaccines. Compared to unemployed respondents, respondents who were employed displayed higher levels of trust in the vaccine provider ($p = 0.01$), greater belief in the importance of vaccines ($p < 0.01$), and higher ease of access to vaccines ($p < 0.01$). Higher education levels were also associated with increase in ease of access to vaccines ($p = 0.01$) and trust in the vaccine provider ($p < 0.01$).

Component trust scores for conventional medicines significantly ranged by age, employment status, urban/rural location,

Table 4
Component trust scores for vaccines and conventional medicines.

Component Trust Scores	Vaccines (95% CI)	Conventional Medicines (95% CI)	Difference	P Value
Efficacy[†]	92.63 (91.8–93.5)	90.55 (89.5–91.6)	2.08	<0.001[*]
Importance[‡]	89.34 (88.3–90.4)	86.08 (85.1–87.1)	3.26	<0.001[*]
Provider Trust[§]	89.18 (88.2–90.1)	87.31 (86.4–88.3)	1.87	<0.001[*]
Ease of Access[¶]	67.60 (65.5–69.7)	74.79 (72.7–76.9)	−7.19	<0.001[*]
Safety[**]	51.29 (50.1–52.5)	51.80 (50.6–52.9)	−0.51	0.498

[*] Significant at $p < 0.05$.
[†] Efficacy was described as: effective, beneficial, and good way to prevent/treat disease.
[‡] Importance was described as: important for individual's and community's health and necessary even for uncommon diseases.
[§] Provider trust was described as: providers are skilled, reliable, trustworthy, and I follow their recommendations.
[¶] Ease of access was described as: perceived ease of access to the vaccines/medicines necessary to keep your family healthy every day and in the event of an emergency.
[**] Safety was described as: Trust in the safety, quality, and risks of vaccines/medicines.

and education. Trust in the safety of conventional medicines increased ($p = 0.02$) with age whereas ease of access decreased with age ($p < 0.01$). Compared to unemployed respondents, employed respondents displayed higher levels of ease of access to conventional medicines ($p < 0.01$) and trust in conventional medicine providers ($p = 0.01$), but lower trust in the safety of conventional medicines ($p = 0.01$). Compared to urban respondents, respondents from rural areas displayed higher levels of trust in the efficacy ($p = 0.01$) and importance ($p = 0.04$) of conventional medicines, but lower ease of access to conventional medicines ($p < 0.01$). Higher levels of education were associated with increased ease of access to conventional medicines ($p < 0.01$) and trust in conventional medicine providers ($p = 0.02$). Religion and gender were not significantly associated with differences in any of the component scores.

4. Discussion

Our study found high levels of trust in vaccines and conventional medicines compared to traditional medicines, and a significant association between trust in vaccines and conventional medicines among respondents in Mukono district in Uganda. Of the trust components explored, respondents were most concerned about ease of access and safety of vaccines and conventional medicines. Respondents had high levels of trust in the efficacy, importance, and providers of vaccines and conventional medicines. Frequent use of medicines and better prior experiences with vaccines and medicines were associated with higher trust levels. Larger households demonstrated higher levels of trust in vaccines and medicines. While other studies have documented associations between vaccination rates and demographic variables such as education [7,26–29], socio-economic status [26,28,29], maternal age [7,27,28], and religion [17], trust in vaccines was not associated with these demographic variables in our study.

Our findings that frequent use of conventional medicines, easier access, better past experiences, and higher trust in providers were significantly associated with higher trust in conventional medicines highlight the relational and experiential nature of trust, and the important role of the provider in building trust in conventional medicines (Fig. 1). These findings are consistent with literature from high-income countries documenting the association between good health care experiences and patient trust [30–33], where trust in providers was found to be an important mediator of trust in medicines and the broader health system [34–37]. This interconnectedness means that poor access, negative experiences, or lack of trust in various components of the health system can contribute to lower trust in vaccines and conventional medicines, thus stressing the importance of working to build and maintain trust in the health system.

Assessing trust at the population level is complex due to heterogeneity in trust levels across sub-groups within a population [5,13]. To account for this heterogeneity, we worked to identify (1) which sub-groups have low trust, (2) what factors are lowering trust levels, and (3) where the populations with low trust are located, as recommended by the WHO SAGE Working Group on Vaccine Hesitancy [5]. Smaller household size was the only demographic variable significantly associated with lower trust across vaccines and medicines. This finding is consistent with previously reported associations between household size and completion of childhood vaccinations [26–29], where larger families have higher levels of health care utilization [38]. We also found that trust in conventional medicines was significantly lower among wealthy respondents compared to less wealthy groups, and those in urban areas compared to rural areas. These findings are consistent with higher levels of skepticism of Western health care observed among patients with higher SES levels in high-income countries [32,39].

Belief in the safety and ease of access to vaccines and conventional medicines was significantly lower across all respondents, compared to high scores for trust in providers, belief in the efficacy, and importance of vaccines and conventional medicines. Furthermore, these concerns disproportionately affected specific demographic sub-groups. Younger and employed respondents reported lower trust in the safety of conventional medicines. Rural, less educated, unemployed, and/or older respondents reported significantly lower perceived ease of access to vaccines and/or conventional medicines. These findings are important because concerns about safety and access to vaccines have been reported as one the primary reasons for vaccine hesitancy in Uganda and other African countries [6,16,17,40]. While safety concerns in other African settings have led to reduced vaccination rates and low overall trust in some vaccines [41,42], we were unable to examine full vaccination coverage or trust in specific vaccines in this study. Although Uganda is actively working to improve access to vaccines and health care [8,43], these findings highlight that much more needs to be done to ensure the public about the safety of vaccines and medicines, as well as identify and reach sub-groups that face the greatest barriers to access. High levels of trust in providers could be used to address and improve perceptions of safety in vaccines and medicines.

Trust has been shown to be difficult to improve, but educational interventions are a potential method to increase levels of trust [44–47]. A previous study on vaccine hesitancy in Western Uganda demonstrated not only that children with mothers who had a better understanding of vaccines were more likely to be fully vaccinated, but also that respondents' perceived lack of vaccine knowledge and awareness was the number one reason for vaccine hesitancy [6]. High levels of trust in health care providers, and trust placed in the Village Health Team as sources of vaccine and conventional medicine related information suggests that possible interventions to address safety concerns and strengthen trust in vaccines and medicines should leverage existing trusted relationships in communities.

We note several limitations of our analysis and study findings. First, these findings represent a regional population in Mukono district and its specific demographic composition. As a result, caution should be used in extrapolating these findings to all of Uganda or other African countries. Regional variations and geographical clustering of vaccine hesitancy and distrust have been shown to be important in other settings [47,48]. Future studies should explore trust in vaccines and medicines among nationally representative samples. Trust questions should be added in nationally-representative surveys to explore regional and subgroup variations and to better inform targeted interventions. Second, the results may have faced measurement bias due to stigma surrounding the use of traditional medicines or reluctance of respondents to reveal distrust in vaccines or conventional medicines. Stigma against traditional medicines was particularly prevalent in this region, even though people often utilize traditional medicines as part of holistic health care [49,50]. This may have led us to underestimate trust in traditional medicines. Third, interviews were conducted in person, and as a result, our results may be influenced by interviewer and response bias. We utilized standardized training and data collection procedures across interviewers to minimize this effect. Fourth, we are unable to determine causality in a cross-sectional study and thus can only report observed associations. Finally, our study results are exploratory and quantitative in nature. In depth qualitative studies could complement this work to provide explanations for key factors driving trust in vaccines and medicines.

5. Conclusions

Distrust of vaccines have contributed to under-vaccinated populations and stalled efforts to expand immunization coverage [51,52]. Similarly, distrust of medicine providers has been implicated in low medication adherence [34,53], leading to significant morbidity and mortality. To our knowledge, this is the first study of its kind to measure and compare trust in vaccines, conventional medicines and traditional medicines. This study responds to a call to explore vaccine hesitancy in Africa [54] and adds to other studies that have recently field tested the vaccine hesitancy scale [55,56]. By exploring trust in vaccines and medicines, findings of this study should help policymakers and health care stakeholders better target populations and design interventions to strengthen trust in vaccines and medicines.

Declaration of Competing Interest

None.

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Appendix A. Supplementary material

Supplementary data to this article can be found online at https://doi.org/10.1016/j.vaccine.2019.07.022.

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