

Saving lives through voluntary blood donation: learning from medical students in ruvuma, southern Tanzania

Abstract

Background: Medical students present a high merit and potential source of blood in hospitals due to their medical knowledge, physiological potential by age however their use has been rarely described in southern Tanzania.

Objectives: The main objective of the study was to assess the knowledge, attitude, willingness for the future blood donation among medical students of southern, Tanzania.

Methods: A cross-sectional study to assess awareness, knowledge, attitudes, willingness and factors associated blood donation among medical students in Ruvuma, Southern Tanzania was conducted from March to June 2018. A self-administered questionnaire was used and data was analyzed by IBM Corp, SPSS Version 24.0.

Results: A total of 176 students were assessed at an average age of 25.8 ± 3.6 years. Eighty medical students (45.5%) ever donated blood while among them 66 (82.5%) of those being out of volunteering. About 46 (57.5%) students had a repeated experience for blood donation. Majority of students had positive attitude toward blood donation 159 (90.3%), often 135 (77%) identified voluntary blood donation to be useful and 133 (75.6%) were willing to donate in the future. Factors that were significantly associated with blood donation were age above 30 (OR=0.18, $p<0.001$), male sex (OR=3.69, $p=0.001$), past HIV screening (OR=2.59, $p=0.029$), knowledge of one's own blood group (OR=4.86, $p<0.001$), and knowledge of the safe duration to donate a unit of blood (OR=2.42, $p=0.024$).

Conclusion: Medical students present a high awareness, positive attitude, and high intention to donate blood to achieve the WHO goal for non-remunerated blood donation.

Keywords: saving lives, voluntary blood donations, medical students, Africa. Tanzania

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Abbreviations: AJUCO, archbishop james university college; MOHCDGEC, ministry of health community development gender elderly and children; NBTS, national blood transfusion services; SPSS, statistical package for social sciences; UDSM-MCHAS, university of dar es salaam - mbeya college of health and allied sciences; VNRBD, voluntary non-remunerated; WHO, world health organization

Background

Blood donation is a vital health care practice needed for blood transfusion in a broad range of clinical services like cardiovascular and transplant surgery, massive trauma therapy, hematological malignancies, pregnancy-related complications and severe childhood anemia.¹ Unfortunately, there is a challenge for country-level availability of blood in most of low and middle income countries.² The World Health Organization (WHO), estimates that about 108 million blood donations are collected globally every year. Half of the global volume of blood is collected in high-income countries and is to less than 20% of the world's population. Again, the average blood donation rate is 9 times higher in high-income countries than in low-income countries.³

It is a principle, for any country to meet the minimum demand for blood, collection should be at least from 1% of the population to meet a nation's most basic requirements for blood.⁴ This is an extremely easier goal to be archived but surprisingly it is less achieved by most of developing countries. Developing countries particularly those in

Africa require blood to effective management of pregnancy-related complications, postnatal care, trauma, severe childhood anemia and hematological conditions.⁵

For safety of donors, it is recommended that whole blood donated shall not exceed 13% of blood volume: e.g. a donor weighing 45 kg to donate 350 ml and those weighing 50 kg to donate 450 ml (age of 18 to 60 years).⁶ With a time frame of 10 to 20 minutes in one setting, repetition can be 12 weeks (3 months) for males and 16 weeks (4 months) for females.⁷ Unfortunately, there has been a diminishing external support to regional transfusion services in most of sub-Saharan African countries. As a result, the end volume of blood available and safety⁸ has remained to be of challenge⁹ in achieving the goal of universal health coverage.¹⁰

The above requirement can be met from blood donation, where donors are classified as Voluntary Non-Remunerated Blood Donors (VNRBD), Family replacement, Remunerated / Paid / Commercial / Professional donors, and Autologous Blood Donors.¹¹ However, the safest blood donors are VNRBD from low-risk populations [10]. Volunteers aged between 24 and 35 years are considered to give the most effective blood. Majority of them being in secondary school training or college.¹²

Despite the highest population and highest blood demand in East Africa, Tanzania presents a lowest blood collection units per a population of 1000 people i.e. Tanzania (3.6), Kenya (4.1) and Uganda (6.3).¹³ In 2017, Tanzanian National Blood Transfusion Services

(NBTS) reported an estimate of only 36% of all blood need being met.¹⁴ Main source for blood supply in the hospitals in Tanzania comes straight from donors who non - NBTS blood banks.¹⁵ About 79% of blood collected in Tanzania by NBTS (blood bank) are from VNRBD and the remaining 21% from family replacement.¹⁶ Strengthening VNRB campaigns has been continuously recommended for public institutions in Tanzania.¹⁷

One of the most important VNRBD groups are college students based on their age and knowledge.^{12,18,19} General factors influencing blood donation vary from region to region by attitudes, willing to donate, age, gender, knowing a person who has donated blood, knowledge of the amount of blood donated, willingness to donate in the future, and post-donation reward.^{20,21} Lately, medical students have presented impressive knowledge, awareness and attitude on blood donation in Africa.^{22,23} Unfortunately, blood donation is not more than 95% among medical students with questionable internal variations among medical students.²⁴

The main aim of the study was to assess the knowledge, attitude, willingness for the future blood donation among medical students of southern, Tanzania.

Methods

Study design, the aim, and setting of the study

The quantitative descriptive cross-sectional study design was conducted in Songea town, Ruvuma region of southern Tanzania. The study aimed at assessing the knowledge, attitude and practice for medical students in volunteering for blood donations that can save lives during pregnancy, birth, anemia in children and hematological conditions. The study was conducted at a Teaching Medical Hospital of Archbishop James University College, AJUCO at Peramiho Medical Campus. Today all of these students are academically registered at University of Dares Salaam, Mbeya College of Health and Allied Sciences, UDSM-MCHAS).

Setting, sampling and study duration

A frame list of all students attending medical degree training was created. Special code for each student was created. Medical students who were willing to participate in the study were invited and second list of eligible students was generated. All students willingly to participate were randomly selected by a simple random sampling technique. Those who were sampled were given written consent and interviewed using structured questionnaire. Data was collected from 10th March to 30th June 2018.

Eligibility

All medical students who were present and willing to participate in the study were included in the participant's list. All medical students who were absent during data collection, or those who were present during data collection but did not consent for the participation were excluded. Students who were present during data collection and participated in the study but did not complete filling of questionnaire were also excluded from the study.

Data collection tools, data management and analysis

Data was collected by using as self-administered structured questionnaire. Data was entered and stored in SPSS database using summary codes for all variable values. A code book was

guiding investigators to do data cleaning for reviews of errors and incompleteness. The quantitative analysis of data was done using IBM Corp. SPSS Version 24.0 of 2016 was used for data analysis. Description of the proportions for demographic summary, proportions for awareness, knowledge, attitude and willingness for blood donations were done and measures of associations (odds ratio) for ever donating blood and factors associated was analysed.

Ethics

Ethical review and permission was granted by the Institutional AJUCO - Ethical Review Committee. Information on the design of the study, benefits and chances if there are risks to participate was given in writing. The study pointed out clearly that there are no any anticipated risks and all information shared will be recorded, stored and analyzed with a strict confidentiality. The information that data will be stored using ID codes and not names was given orally and writing. Informed consent was granted by students before data collection.

Results

From a total of 662 medical students registered at AJUCO, where none of students were in first year (MD1), 84 students were in a second year (MD2), 328 from MD3, 100 from MD4 and 69 students from MD5. There were 81 MD3 students attending clinical training at another teaching hospital (>300 km away) and a total of 307 students were not willing to participate. Finally, a total of 274 medical students (54 from MD2, 120 from MD3, 50 from MD4, and 50 from MD5) given questionnaires but 98 students presented with incomplete filled questioners.

Demographic characteristics of participants.

A final sample of 176 students were available for final analysis, after reviewing the completeness of questionnaire and data cleaning. Among the 176 participants, the average age 25.8 (\pm 3.6) years, ranging from 20 to 44 years and the majority, 152 (86.4%) ranged from 20 to 29 years. Details of the demographic characteristics are shown in Table 1.

Awareness of blood donation

The information on the source of awareness of Blood donation among students is shown in the Table 2.

Knowledge on blood donation

Majority of the participants 134 (76.3%) knew their blood groups 96 (54.4%) knew the minimum frequency that a donor should donate per year, 113 (64.2%) had no knowledge on the safe amount of blood volume that not more than which should be donated also 126 (71.6%) had no knowledge of amount of time required for blood donation process at one on set. The overall knowledge of common blood groups, groups of people that can donate blood and knowledge of TTI's was generally impressive as shown in Table 3.

Attitude towards blood donation

The attitude of the medical students towards blood donation was quite good 159 (90.3%) also 135 (77%) perceived voluntarily donated blood to be the best blood source, furthermore most of the participants believed temporary weakness as the common post donation effect as shown in Table 4.

Table 1 Demographic Characteristics of the Participants

Characteristics		Frequency	Proportion (%)
Age group	20-24	83	47.2
	25-29	69	39.2
	30-34	20	11.4
	35-39	2	1.1
	40-44	2	1.1
	Second	40	22.7
	Third	81	46
	Fourth	24	13.6
	Fifth	31	17.6
Sex	Male	137	77.8
	Female	39	22.2
Marital status	Single	141	80.1
	Married	35	19.9
	Roman Catholic	82	46.6
	Muslim	32	18.2
	Protestant	31	17.6
	Others*	21	11.7

*Jehovah witness, seventh day Adventist church, Anglican, EAGT, Lutheran, TAG

Table 2 Awareness of blood donation

		Frequency	Proportion (%)
Heard about Blood Donation on Mass Media	Had Prior Exposure	148	84.1
Never had Prior Exposure		28	15.9
Blood Donation Motivation	Motivated for Donation	147	83.5
Not Motivated		29	16.5
Past HIV Screening History	Screened Before	146	83
Never Screened Before		30	17

Practice of Blood Donation

Concerning the practice of blood donation among students, 80 (45.5%) of the respondents they at least donated blood once in their life time. Among those who donated 66 (82.5%) of those being out of volunteering. Regular blood donors were 46 (57.5%) out of those who ever donated blood as shown in Table 5.

Willingness of participation in next blood donation event

Majority of respondents 133 (75.6%) were willing participate in next blood donation events or whenever they are called. The major reasons of not donating blood were; unfit to donate, fear of needle and

the need to donate for a friend/relative in future 34.9%, 27.9%, 18.6% respectively Figure 1.

Table 3 Participant's knowledge on blood donation

Characteristics		Frequency	Proportion (%)
	A+	4	2.3
	B+	7	4.0
	AB+	12	6.8
Knowledge on Common blood groups	O+	50	28.4
	O-	5	2.8
	Positives [#]	46	26.1
	All	52	29.5
	A+	26	14.8
	A-	1	0.6
	B+	26	14.8
	B-	1	0.6
Knowledge on Participant's blood group	AB+	13	7.4
	AB-	2	1.1
	O+	55	31.3
	O-	10	5.7
	Don't know	39	22.2
	Forgotten	3	1.7
Knowledge on if blood transfusion can cause infection	knew	170	96.6
	Didn't know	6	3.4
	HIV Can be transmitted	175	99.4
	HIV Can't be transmitted	1	0.6
	HCV Can be transmitted	155	88.1
	HCV Can't be transmitted	2	1.1
	HBV Can be transmitted	170	96.6
	HBV Can't be transmitted	6	3.4
	Syphilis Can be transmitted	123	69.9
	Syphilis Can't be transmitted	53	30.1
	Malaria Can be transmitted	99	56.3
	Malaria Can't be transmitted	77	43.8

Table Continued

Characteristics	Frequency	Proportion (%)
Knowledge on Frequency of blood donation per year	Weekly	2
	Monthly	7
	Three monthlies	96
	Six monthlies	30
	Annually	6
	Others	1
Knowledge on safe amount of blood volume donation at one on set	Don't know	34
	<500ml	63
	500-1000ml	60
Amount of time required for blood donation process	Don't know	53
	20-60minutes	50
	<20minutes	32
	Don't know	94
Knowledge on groups of people that can donate blood	Men can donate	176
	Men can't donate	0
	Women can donate	171
	Women can't donate	5
	Healthy can donate	176
	Healthy can't donate	0
	Young<18 years can donate	16
	Young<18 years can't donate	160
	Old>60 years can donate	8
	Old>60 years can't donate	168
	Diseased can donate	2
	Diseased can't donate	174

#Respondents who selected all A+, B+, AB+, O+ as the common blood groups which they knew

Factors associated with blood donation

The factors that associated with blood donation were age above 30 years (OR=0.18, $p<0.001$) where the respondents aged between 20 - 29 years of age were 82% had less chance to donate blood than those 30 and above. Another factor is the male sex (OR=3.69, $p=0.001$) where males were almost four times more associated to donate blood than females. The past HIV screening had two and half chance for blood donation (OR=2.59, $p=0.029$). The knowledge of one's own blood group had five times more chance to donate blood than medical students who do not know their blood group (OR=4.86, $P<0.001$). The knowledge of the safe duration of time of blood donation in one setting had two and half more chance to donate blood than medical students who do not know the safe duration for blood donation (OR=2.42, $P=0.024$). Details of other factors and their measures of association are shown in Table 6.

Table 4 The Attitude towards Blood Donation

Attitude for blood donation	Frequency	Proportion (%)
General feeling towards blood donation	Good practice	159
	Bad practice	3
	It is a neutral practice	14
	Voluntarily blood donation	135
Best blood source	Family replacement donation	18
	Self-donation	10
	Remunerated / paid donor	3
	Don't know	10
Adverse effects for blood donor during/ after donation	There are adverse effects	125
	There is no adverse effects	36
	Don't know	15
	Temporary weakness	134
Post blood donation effects	Contract infection	13
	Fall sick	3
	All of the above	17
	No effect	1
	Don't know	8

Table 5 Practice of Blood Donation

Practice	Frequency	Proportion (%)
Previous experience of blood donation (N=176)	Ever donated blood	80
	Never donated blood	96
Reason for donating blood for those who ever donated (N=80)	Voluntary	66
	A friend /relative needed blood	13
	To know my blood status	1
Regular donation	Yes	46
	No	33
	<1 time a year	42
Regular donor's frequency	1-3 times a year	17
	>3 times a year	7
	inapplicable**	110

Table Continued

Practice		Frequency	Proportion (%)
Willingness to donate blood in future (N=176)	Yes	133	75.6
	No	43	24.4
Reasons for not donating (N=43)	My religion forbids it	3	7
	Need to donate to friend or relative in future	8	18.6
	Unfit to donate	15	34.9
	Fear of needle	12	27.9
	Donated blood may be donated to others	5	11.6

*Ever donated blood N=176, includes those who never donated and those who donated only once in their life time.

Discussion

Our study has presented findings that medical students in Songea, Ruvuma region of Southern Tanzania to have high awareness blood

donation and high knowledge of the procedures and benefits blood donation.

Medical students in Southern Tanzania presented a proportion of 86.4% medical students aged 20 - 29 years. The majority of students were third years, mainly males (77.8%). About (84.1) had previous exposure, 83.5% motivated and about 83% were previously screened for HIV and though their can give blood to save lives in the hospitals.

We learned that 76.3% of medical students from Southern Tanzania were aware of the importance of knowing blood groups. They think this important information is a key life-saving knowledge when there is an emergence. This proportion was relatively higher compared that of 64% from Kilimanjaro, Northern Tanzania that included both medical and non-medical students of Kilimanjaro with odds ratio of 11.5, $p<0.0001$).¹² This level of knowledge is however of lower proportion when compared to knowledge of blood groups among medical students from Adama University in Ethiopia (91.4%),²² and Khartoum, 98.2%.²⁴ About 54.4% knew the minimum frequency that a donor should donate per year this is lower compared to that reported from Gondar, Ethiopia in which 67.8% had a correct knowledge on this aspect.²³ The knowledge of the blood donation duration and past HIV screening were also significant factors associated with student blood donations.

Table 6 Factors associated with blood donations

Experience for blood donation					
Factors for blood donation		Ever donated Freq (%)	Never donated Freq (%)	(100% for each row)	P-value ($\alpha=0.05$) Odds Ratio (95% Confidence interval)
Age	20-29	62 (40.8)	90 (59.2)	152	0.18
	≥30	19 (79.2)	5 (20.8)	24	<0.001 (0.06-0.51)
Sex	Male	72 (52.6)	65 (47.4)	137	3.69
	Female	9 (23.1)	30 (76.9)	39	0.001 (1.63 - 8.35)
Past HIV screening	Ever screened	73 (49.7)	74 (50.3)	147	2.59
	Never screened	8 (27.6)	21 (72.4)	29	0.029 (1.08 - 6.22)
Knowing own blood group	Knew	73 (54.1)	62 (45.9)	135	<0.001 4.86
	Didn't know	8 (19.5)	33 (80.5)	41	(2.09 - 11.28)
Knowing safe duration	Knew	21 (63.6)	12 (36.4)	33	2.42
	Didn't know	60 (42.0)	83 (58.0)	143	0.024 (1.10 - 5.29)
Academic Level**	Non-clinical	58 (47.9%)	63 (52.1%)	121	0.451 1.281
	Clinical	23 (48.1%)	32 (58.2%)	55	(0.67-2.43)
Exposure of blood donation programs	Exposed	72 (48.6%)	76 (51.4%)	148	0.18 2
	Not exposed	9 (32.1%)	19 (67.9%)	28	(0.85-4.70)
Blood donation motivation	Motivated	72 (49%)	75 (51%)	147	0.076 2.11
	Not motivated	9 (31%)	20 (69%)	29	(0.91-4.99)

Table Continued

		Experience for blood donation				
Factors for blood donation		Ever donated Freq (%)	Never donated Freq (%)	(100% for each row)	P-value ($\alpha=0.05$)	Odds Ratio (95% Confidence interval)
Knowing Safe frequency of donation	know	45 (46.4%)	52 (53.6%)	97	0.913	1.034
	Didn't know	36 (45.6%)	43 (54.4)	79		(0.57-1.87)
Knowledge on safe blood volume	Know	37 (57.8%)	27 (42.2%)	64		2.11
	Didn't know	44 (39.3%)	68 (60.7%)	112	0.018	(1.13-3.95)
Attitude toward blood donation	satisfactory	77 (48.4%)	82 (51.6%)	159	0.05	3.05
	unsatisfactory	4 (23.5%)	13 (51.6%)	17		(0.95-9.76)
Knowing best source of blood	Knew	68 (50.4%)	67 (49.6%)	135	0.036	2.1
	Didn't know	13 (31.7%)	28 (68.3%)	41		(1.04-4.58)

** All students studied hematology in year 2 (MD2) but levels of knowledge for blood donations increases with clinical exposure from year 3 to year 5

When considering amount of blood to be drawn, we found 35.8% of students in Songea knew the safe amount of blood volume to be donated which was somewhat similar to what is reported from Kilimanjaro, North-West Tanzania (36.5%),¹² higher than experience in Khartoum, Sudan (31%)²⁴ but lower than medical students from Gondar, North-West Ethiopia where 44.7% of student had sufficient knowledge.²³

The attitude of the medical students towards blood donation was fairly impressive at 90.3% this was consistent with findings in Kilimanjaro Tanzania (93.0%) [12], this is due to the fact that medical students witness the needs of blood in their practices in hospital in saving the life of needy groups such as maternal hemorrhage.

Voluntarily donated blood was mentioned by medical students as the best source of blood at 77% slight lower compared to report from Rajkot University, India of 80%²⁵ and Gondar University, Ethiopia (91.8%).²³ Additionally, we learned that 71% of medical students in Southern Tanzania presented worries that after a moment of blood donation there could be some circulatory system side effects that were explained by Hinrichs in 2017²⁶ This was unexpectedly higher compared to what was reported in India (33.3%)²⁷ and Ethiopia (14.5%)²³ [23]. Students also mentioned temporary weakness (76.1%) reported as dizziness among medical student in Northern Tanzania, (94.9%).

We found about half of student (45.5%) had an experience of blood donation in primary or secondary school training. This was higher than experience reported in Sudan,²⁴ Ethiopia,^{22,23,28} Kilimanjaro,¹² Pakistan²⁹ and Northern India^{30,31} and Sothern India³² which ranged from 12.5% to 30%. However, this proportion was lower than medical students at Nnamdi Azikiwe University 78.2%.³³ Those who donated out of voluntarism were 82.5% which is higher than those reported in Solan, Northern India (38.4%)³¹ but lower than that reported in Northern Tanzania 90.5%.¹²

Regular blood donors nearly similar to those in northern Tanzania 57.5% by 55% respectively¹² but higher than Solan, Northern India (43.4%).³¹ In this case we learnt that regular blood donation has remained to be of challenge. Thus, this finding reflect that a strong blood donation systems guided by determinants of blood donations

is needed.³⁴

With regards to willingness, the majority of students in Southern Tanzania (75.6%) were willing participate in next blood donation events or whenever invited. This was a relative higher proportions compared to students of Khartoum Sudan 53.8%²⁴ but lower than students at Gondar University in Ethiopia (85.5%)²⁸ and Northern Tanzania (96%).¹²

We noticed a major reason of not donating blood was respondents feeling medically unfit (34.9%) as similarly described in southern India (47.8%).³² This was a shocking paradox age as students aged 20-29 years were less likely to donate blood than those at 30 years and above. In contrast, literature from Ethiopia by Mulugeta showed age of 25 -30 years has four times will to donate blood than those at age 20-24 years significantly at 99% confident interval.²³

In southern Tanzania, medical students with male sex had higher wills to donate blood than female sex in consistent with Karachi, Pakistan. However, we found 4 times (male; female wills) to donate blood in southern Tanzania compared to 1.5 times (male; female wills) in Karachi, Pakistan.²⁹ Surprisingly, Northern Tanzania literature showed males to have 48% lower odds of donating blood than girls at 95% confidence level.¹² Other remaining literature has shown that male sex has a higher volunteering chances.¹⁶

We found that age of more than 30 years, male sex, knowing owns blood group, past HIV screening and knowledge safe duration of donating blood to be positively associated with blood donation willingness.

It is therefore anticipated that NBTS and MOHCDGEC can use this opportunity of blood donations from medical students. With a total of 8 medical university colleges in Tanzania training about 13,000 medical students a year.³⁵ Tanzania can easily reach the WHO goal of 100% voluntary non-remunerated blood donation by scaling up medical students' awareness. In this perspective we also urge other African countries with high rates of maternal mortalities, blood disorders or high proportion of accidents to scale up blood donation through the use of medical students.

Study limitations

This study design was a university campus based descriptive cross-section study that was not funded but motivated by Medical Students Association. It was part of the academic requirement for a degree of course of medicine Arch Bishop James University College, Peramiho Medical Campus in Songea town, Ruwuma region of Southern Tanzania. Data were collected in a short duration and had sample size limitation to recruit additional medical schools due to lack of enough funding.

Conclusion

Medical student offers an impressive attitude towards the practice of voluntary blood donation accompanied with a testified willing to participate once called to it. They present a high awareness, positive attitude, and high intention to donate blood. Medical students offer the low hanging fruits for high volume of safe blood collection. This is an opportunity to save more lives to meet the WHO goals for non-remunerated blood donations.

Recommendations

The NBTS and MOHCDGEC are urged to organize University Medical College events that will collect blood from medical students. To meet the WHO goal of 100% voluntary non-remunerated blood donation, other African countries have to scale up the use of medical students for blood donation.

Declaration

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Availability of data and materials

All relevant data are included in the manuscript. Data collection tool attached as a supplementary material. Availability of additional data and materials Data sets are available by a friendly request to the corresponding author.

Authors' contributions

MMS: Developed the concept note and design, acquisition of data, analysis, and interpretation of data as well as initial development of the manuscript. KBZ: Made substantial contributions to design, acquisition of data, analysis, and interpretation of data. BM: Has made substantial contributions to the analysis, interpretation of data and initial draft the manuscript and led the final write up of the manuscript. All the authors have been involved in drafting the manuscript and revising it critically for important intellectual content, and; have given final approval of the version to be published.

Ethics

Ethics approval and consent to participate Ethical clearance was granted by the Archbishop James University College - Ethical Review Committee as established by National Health Research Ethics Sub-Committee (NatHREC) of Tanzanian National Institute for Medical Research. Written consents were obtained from all study subjects with ethical review committee approval due to the fact that the data collected were not invasive with minimal health impact; hence, ascertained that the participation was voluntarily. The study participants' code numbers were used rather than personal identifiers. Finally, all questionnaires were kept for an intended purpose only.

Consent for publication

All participants have consented for publication of the result of this study (medical information, case description if needed and demographic summary without sharing names).

Competing interests and Conflicts of Interests

The authors declare that they have no competing neither the conflicts of interests.

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