



Knowledge, Attitude and Perceptions of Population about Cement
dust health effects of the Mashyuza Cement Factory

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Declaration

I, **BAYIHIKI BASILE**, HEREBY DECLARE THAT THE THESIS HAS BEEN WRITTEN BY ME WITHOUT ANY EXTERNAL UNAUTHORIZED HELP, THAT IT HAS BEEN NEITHER PRESENTED TO ANY INSTITUTION FOR EVALUATION NOR PREVIOUSLY PUBLISHED IN ITS ENTIRETY OR IN PARTS. ANY PARTS, WORDS OR IDEAS, OF THE THESIS, HOWEVER LIMITED, WHICH ARE QUOTED FROM OR BASED ON OTHER SOURCES, HAVE BEEN ACKNOWLEDGED AS SUCH WITHOUT EXCEPTION.

Executive summary

Introduction: Cement industry is one of the largest manufacturing industries and its workers are exposed to dust at various manufacturing and production processes. Cement dust causes lung function impairments chronic obstructive lung disease, restrictive lung disease, pneumoconiosis and carcinoma of the lungs, stomach and colon. Like different population worldwide, many of them even exposed to cement dust have different perceptions and attitudes on cement dust.

Method: The present research is a cross sectional descriptive research on the knowledge, attitude and perception of population about cement dust health effects of the Mashyuza cement factory (CIMERWA). The study was conducted on 607 population. The recruitment of the population to participate to survey has been done among the population of 3 sectors surrounding Mashyuza cement factory. Data collection was done through administration of questionnaire. Data entry was done with Microsoft excel 2010. After cleaning, data were exported into SPSS 16.0 for analysis. Chi-square test was used to test the statistical significance of the association.

Results: All study participants know the existence of CIMERWA, 98.5% are exposed to cement dust from CIMERWA 75.3% , 72.8% and 88.7% affirm that cement dust reaches respectively their water, food and respiratory air; 92.1% knows that cement dust has effect on person life; 74.9% of study population listed pneumopathy as one side effect from cement dust; 92.7% did not know how can be prevented side effects from cement dust; move out of exposed zone as mode of prevention was cited by 93.5% of study population who knows how can be prevented side effects from cement dust. There were significant association of measures taken for preventing food and sex of participants, sector of origin, marital status and religion

Conclusion: Cement dust was shown as public health problem in this study as most of participants know that it has effect on their life. What is positive point is that most of them knows how to prevent side effects from cement dust unfortunately measures or strategies taken by health care services and CIMERWA authorities on this problem are still few.

Resumé

Introduction: La poussière de ciment est l'un des dangers que les plus grandes industries de fabrication du ciment et de ses travailleurs sont exposées à divers procédés de fabrication et de production. La poussière de ciment provoque une déficience de la fonction pulmonaire, la maladie pulmonaire obstructive chronique, la maladie pulmonaire restrictive, la pneumoconiose et le carcinome du poumon, du côlon, et de l'estomac. Comme différente population dans le monde entier, beaucoup d'entre eux, même exposés à la poussière de ciment ont différentes perceptions et les attitudes sur la poussière de ciment.

Méthode: La présente recherche est descriptive transversale sur la connaissance, l'attitude et la perception de la population des effets de la poussière de ciment de l'usine de ciment de Mashyuza sur la santé. Le recrutement des participants à cette étude a été fait parmi toute la population des 3 secteurs, les deux sexes considérés, et qui ont accepté de faire partie de l'étude. La saisie des données a été faite avec Microsoft Excel 2010. Après le nettoyage, les données ont été exportées dans SPSS 16.0 pour l'analyse.

Résultats: 98,5% des participants savent qu'ils sont exposés à la poussière de ciment de l'usine; 92,1% savent qu'elle a un effet sur la vie de la personne; 74,9% de la population d'étude listait pneumopathie parmi ses effets secondaires et 92,7% ne savent pas comment l'on peut les prévenir; le déménagement hors de la zone exposée, l'un des modes de prévention a été cite par 93,5% de la population de l'étude qui savent comment se prévenir de ces poussières. Secteur d'origine, la religion des participants et le statut matrimonial des participants étaient associés à la connaissance sur les effets de la poussière de ciment sur la santé.

Conclusion: la poussière du ciment produite par la CIMIRWA est un problème de santé publique comme l'a montrée la population d'étude. La plupart d'entre eux savent déjà les effets secondaires associés à cette poussière et comment prévenir ces effets. Malheureusement pas assez de mesures préventives ou stratégies de la part des services de santé ou de la CIMERWA à ce problème ont été prises.

Dedication

For my Beloved wife and children.

Acknowledgment

I would like to express my deep appreciation and gratitude to the Government of Rwanda, through the Ministry of Health and UR/College of Medicine and Health Science/ School of Public Health, for providing me the opportunity to continue my studies.

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Acronyms and Abbreviations

CIMERWA: Cimenterie du Rwanda

Cr: Chrome

HSE: Health and Safety Executive

FEV1: Forced Expiratory Volume in 1 second

FVC: Forced Vital Capacity

FEF: Forced expiratory Flow

IRB: Institute of Review Board

NIOH: National Institute of Occupational Health

SCTEE: Scientific Committee on Toxicology, Ecotoxicology and the Environment

SSA: Sub-Saharan Africa

SPH: School of Public Health

UR: University of Rwanda

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1. Introduction

1.1. Definitions of key concepts

Dust: consists of particles in the atmosphere that come from various sources such as soil, dust lifted by weather, volcanic eruptions, and pollution. Dust in homes, offices, and other human environments contains minerals from outdoor soil, human skin cells, burnt meteorite particles, and many other materials which may be found in the local environment(1).

Cement: is a binder, a substance that sets and hardens and can bind other materials together. The word "cement" traces to the Romans, who used the term *opus caementicium* to describe masonry resembling modern concrete that was made from crushed rock with burnt lime as binder. Cement is widely used in construction and can cause ill health mainly by: skin contact; inhalation of dust; and manual handling(2).

Health effect: the causation, promotion, facilitation and/or exacerbation of a structural and/or functional abnormality, with the implication that the abnormality produced has the potential of lowering the Quality of life, contributing to a disabling illness, or leading to a premature death(3)

1.2. Background and problem statement

The worldwide community especially the people in developing countries is facing increasing risks of respiratory disease due to production of smoke and dust in different occupational and industrial sectors. The health risks posed by inhaled dust particles are influenced by the duration of exposure and the biological responses exerted by the particles(4).

Cement industry is one of the largest manufacturing industries and its workers are exposed to dust at various manufacturing and production processes, Portland cement dust is a mixture of calcium oxide, silicon oxide, aluminum trioxide, ferric oxide sand and other impurities. The aerodynamic diameter of cement dust particles is within the respirable extent, consequently occupational exposure to cement dust can cause numerous health hazards including the onset of acute or chronic respiratory disease and respiratory function deficits(5).

Cement industry is involved in the development of structure of this advanced and modern world but generates dust during its production. Cement dust causes lung function impairments chronic obstructive lung disease, restrictive lung disease, pneumoconiosis and carcinoma of the lungs, stomach colon(6) .

Studies have shown that cement dust may enter into the systemic circulation and thereby reach the essentially all the organs of body and affects the different tissues including heart, liver spleen, bone muscles, and hairs and ultimately affecting their micro structure and physiological performance(7).

Most of the studies have been previously attempted to evaluate the effects of cements dust exposure on the basis of spirometry or radiology, or both. However collective effort describing the general effects of cement dust on different organ and systemic in humans or animals, or both has not been published(8).

There are few studies done in this area in developed countries and developing countries and even done it was not related to general population but to cement factories , among them a study done in Egypt among 350 workers in cement factory showed that most of them were exposed to different health effects like pneumopathy(42.8%), skin disorders and sinusitis (65.7% & 62.8%), hearing disorders (50.5%), and nearly two thirds of the studied workers were had poor knowledge about different types of personal protective equipment and occupational diseases in cement factory(9). In other study done in United Emirates Arabia on 153 cement factory workers, 114 (74.5 %) of the workers knew that exposure to the dust was a serious hazard to their health, but the workers mentioned that they had been provided with masks to protect them from dust, however, only 28.8 % of them claimed that they used the masks all the time during working hours(10).

In Sub-Saharan Africa(SSA), in a cross-sectional study done in Nigeria on occupational hazard awareness and safety practices among 293 cement factory workers, two hundred and sixty two (96.7%) of the respondents accepted that their occupation was hazardous. The most commonly

known hazard by the respondents was dust, 206(77.4%). 265(97.8%) used protective equipment and nearly all the respondents 268(98.9%) were interested in updating their knowledge about hazards prevention(11).

In Rwanda there are currently 3 cement factories: Mashyuza, Musanze and in Kigali and in these area population residents around them are exposed to dust effect and many of them are suffering from this effect.

This study concerned population around MASHYUZA cement factory. Since it has been installed in this region, there is no preventive measure that protects the population taken by CIMERWA authorities or government of Rwanda because perhaps no studies on cement dust side effect on population health in this region.

Many of this population have different knowledge, attitudes vis a vis on cement dust and sometimes they don't know what are preventive measures against cement dust. Up to now very little is known in this area in Rwanda to show the magnitude of this problem.

Therefore it is in this context this research with a scientific interest will provide new and necessary knowledge on the cement dust health effects in the population and then inform the cement factory administration and the population what are their attitude and knowledge about the cement dust effect and then take protect measures.

1.3. Research question

What are the awareness and behavior of the population resident around Mashyuza cement factory vis a vis health effects of cement dust?

1.4. Justification and the interest of the topic

Studies have shown that cement dust exposure can cause numerous health hazards on different organ and systemic in both humans and animals. It has been noticed that in Rwanda very few is known on cement dust health effects in terms of knowledge, attitude, perception and behavior among exposed population.

Like different population worldwide, many of Rwandan population even exposed to cement dust may have different perceptions and attitudes on cement dust. Knowing the effect of cement on the health help in taking measures to protect himself or protect others. It is not known if population near the MASHYUZA cement factory knows the effect of cement dust to which they are exposed and how they can protect themselves.

This study will show the current status of knowledge, attitude, perception and behavior of the exposed population vis a vis health effects of cement dust.

1.5. Study area

The Mashyuza cement factory (CIMERWA) is located in a challenging but very strategic region in East Africa. CIMERWA, situated in southwestern Rwanda, in Rusizi district, Muganza sector. This factory has been installed here in 1985. It is surrounded by many houses where live different families. Dust cement produced from CIMERWA reaches three sectors: MUGANZA, GITAMBI and NYAKABUYE with a population of 83,845.

The motivation to conduct this study in the three administrative sectors listed above results from the fact that people resident of those sectors are the ones who are exposed to cement dust since 1985.

1.5. Literature review

Exposure to cement dust should cause changes in pulmonary function (5). Not only that but also it was concluded that due to its alkalinity, moistened cement would also produce eye irritation(12). Many cases of cement dermatitis appearing to arise as a result of skin sensitization to hexavalent chromium(13).

Different studies related to effect of dust on person's health were done in different regions and all of them showed that cement dust from cement factory has bad effect on health.

In developed countries, recently the European commission's Scientific Committee on Toxicology, Ecotoxicology and the Environment (SCTEE) expressed an opinion of the risks to

health from Cr(VI) in cement(14). SCTEE also concluded that, based on studies in Denmark, a reduction of Cr(VI) compounds in cement to less than 2 ppm will reduce the prevalence of allergic cement eczema in workers, and will reduce the risk of becoming sensitized to chromate (15). They also emphasized that education and the use of personal protective measures would also contribute to a lower frequency of skin sensitization.

In developing countries, a recent study, pulmonary function was investigated in male workers at Tanzanian Portland cement factory and this did not show any pulmonary effect in exposed population(16). According to those different studies, the impact of cement dust on exposed population health and suggest protective measures to exposed population was shown.

Considering the area of knowledge, attitude and perception of population on effect of dust cement on exposed population health, few studies were done both in developed and developing countries. One study done in United states of Arabia to assess the knowledge and practice of workers on related hazard showed that the majority (74.5 %) of the workers knew that exposure to the dust was a serious hazard to their health, but only 52.9 % of the workers knew the hazards other than the dust that were associated with their work(17).

In Sub-Saharan Africa (SSA), in a study done in Nigeria on occupational hazard awareness and safety practices among cement factory workers, the majority of the study respondents accepted that their occupation was hazardous. The most commonly known hazard by the respondents was dust and few of them used protective equipment (11).

In East-African countries including Rwanda, there are several cement factories which produce dust to which population are exposed unfortunately there was no published studies done about knowledge, attitude and perception of population on effect of cement dust on exposed population.

In conclusion, the health effects of cement dust that were confirmed by different studies are many like allergy to eyes, dermatitis, cancers, Pneumopathy, death due to different reasons...

The level of knowledge of the exposed population Vis a Vis these cement dust effects is not very known as limited studies were done in this area, their attitude and perception also were not yet assessed, the preventive measures commonly used by the population were not described in studies above. There is a need of other studies on this area and in different countries as it has been shown that cement dust has negative effect on population health.

This study should provide some information needed which can help in prevention of life effects caused by cement dust in population living near the factory.

1.6. Objectives

1.6.1. General objectives

The aim of this study research is to assess the awareness and behavior of the population vis a vis health effects of cement dust

1.6.2. Specific objectives

1. To evaluate the knowledge of the population about health effects of cement dust.
2. To determine the attitude and perception of the population vis a vis health effects of cement dust
3. To identify the preventive measures used by exposed population against cement dust

2. Materials and methods

2.1 Study design

The present research is a cross sectional descriptive research on the knowledge, attitude, perception and behavior of population about cement dust health effects of the Mashyuza cement factory.

2.2. Methods

2.2.1. Variables

Dependent variables:

- Knowledge of cement dust side effect on health of the population.
- Attitude and perception vis à vis cement dust.
- Behaviour of exposed population vis-à-vis cement dust

Independent variables:

Socio-demographic parameters (Age, sex, marital status, provenance, religion, education level and occupation, etc.),

2.2.2. Data analysis plan

Univariate analysis

For descriptive and data summary purposes, univariate techniques was applied to single sets of data. These are: tabular techniques by use of frequencies. Regarding continuous variables, summary statistics such as mean and standard deviation were calculated.

Bivariate analysis

To show the relationship between variables, bivariate methods were used and in this case contingency tables to describe relationship between nominal variables were employed to

describe the relationship. Tabular methods of describing the relationship between two nominal variables by finding proportions were also employed. Chi-square was used to test the statistical significance of the association. The level of significance was less or equal than 0.05.

2.3. Study population

The population targets of this study is population resident of three sectors, Muganza, Gitambi, and NYAKABUYE where the factor is located; and the staffs of health facilities which are located in those sectors.

2.3.1. Sampling and Sample size calculation

➤ Sample size calculation

The following formula has been used to calculate the sample size:

$$n = \frac{d(z^2 \times p \times q)}{\alpha^2}$$

With

n: minimum sample size

d: cluster effect= 1,5

z: confidence interval at 95%= 1,96

p: current prevalence of the problem = 0,50 because on our knowledge, any similar study has been conducted on this population. Thus, we consider that the current prevalence of the problem is unknown.

q: 1- p= 1- 0.50= 0.50

α : precision=5%

Using this above information, the calculated sample size is n= 577 subjects.

n= $\frac{1.5 \times (1.96 \times 1.96 \times 0.50 \times 0.50)}{0.05 \times 0.05} = 577$ subjects.

0.05 x 0.05

When adding 5% (29 subjects) of potential non-respondents, then the final sample size becomes $577 + 29 = 607$.

➤ **Sampling techniques**

Data were collected from the three Sectors, Muganza, Gitambi and Nyakabuye. We used the proportional method to get the number of respondents to be interviewed in each Sector. In fact, based on the location of CIMERWA, we estimated that the proportion of the population exposed to cement dust from this factory could be distributed across three Sectors as follows: Muganza 60%, Nyakabuye 30% and Gitambi 10%. Therefore, the sample size was proportionally distributed in these three Sectors as follows:

Table 1: Sampling in exposed Sectors

No	Sector	Proportion of subjects to be interviewed	Number of subjects to be interviewed
1	Muganza	60%	364
2	Nyakabuye	30%	182
3	Gitambi	10%	61
Total		100%	607

To complete the selection of these respondents, we went in the middle of each Sector. Using a bottle, we determined the direction to take. Then, from the nearest household, we started interviewing household members until we reached the number of respondents allocated to the Sector. In each household, only one household member, aged 18 years or above, voluntarily accepting to participate in this study was interviewed.

Criteria of inclusion and exclusion

Inclusion: was included in this study one household member, aged 18 years or above, living in selected household at least since six months, and who voluntarily accept to participate in the study. In case within the same household more than one person meets the criteria, the oldest one able to answer to our questions was chosen.

Exclusion: was excluded from these study participants who did not meet above-mentioned criteria.

2.4. Materials

Questionnaire: A data collection tool was elaborated and explained to data collectors before data collection and helped in collecting information needed for our study (see appendix 1).

2.5. Utilization of findings

Results from this study will be presented to the population in order to increase their awareness and sensitize them to take preventive measures. The results will be also presented to CIMERWA authorities for seeing how they can minimize side effects of cement dust on the population from this factory. Finally they will be presented to health facilities located in the exposed region for appropriate measures.

2.6. Ethical considerations

IRB review

As this study involved human subjects, the protocol was presented to the Institution Review Board of the School of Public Health (SPH) to seek for the approval prior to the beginning of the study.

Informed consent

The informed consent form in English was translated and given to the patients and was always signed before any study procedures take place.

Confidentiality

We will protect the confidentiality and privacy of the individual study participants by limiting access to unique identifying participant information. Data access was limited to persons directly involved in the study, data collection and entry was done with confidentiality and privacy.

Documents containing the names and/or signatures of participants, such as consent forms were kept separately from all other study documents and were kept in designated locked place. The interviews were conducted in privacy and information was not shared with anyone without seeking for the authorization of the respondent. Study results were presented as aggregated data; no personal information was shown.

3. Results

3.1. Socio-demographic characteristics of participants

According to socio-demographic characteristics, age of the study population are between 18 and 90, the mean of age is 39, 54 ± 0.14 , clients above 35 years old are more represented with 52.3% of the whole study population. Muganza sector is more represented with 68.6%; males are 66.1%, Protestants are more represented with 45.0%; participants who did primary school as education level are more represented with 55.9%; 76.2% of study population are farmers; 55% of study population are married as marital status. See detail on table 1 below

Table 1: Socio-demographic characteristics of participants

Characteristics	Frequency	Percent
Group of age		
< or=35 years old	290	47.7
>35 years old	317	52.3
Total	607	100
Sector of origin		
Muganza	416	68.6
Gitambi	121	19.9
Nyakabuye	70	11.5
Total	607	100
Sex		
Male	401	66.1
female	206	33.9
Total	607	100
Religion of participant		
Catholic	250	41.2
Protestant	273	45
Adventist	18	2.9
Muslim	1	0.2
others	65	10.7
Total	607	100

Education level of participant		
No education	129	21.3
Primary	339	55.9
secondary	127	20.9
university	12	1.9
Total	607	100
Profession of participant		
Farmer	463	76.2
employed	53	8.8
small business	35	5.7
No job	55	9
student	1	0.2
Total	607	100
Marital status of participants		
married	334	55
Cohabitant	66	10.9
single	128	21.1
Widowed	65	10.7
Divorced	1	0.2
Separated	13	2.1
Total	607	100

3.2. Exposure to cement dust

The results show that 98.5% are exposed to cement dust from CIMERWA; 97.3% of study population affirm that cement dust reaches their home or their workplace, 75.3%, 72.8% and 88.7% affirm that cement dust reaches respectively their water, food and respiratory air; 92.1% knows that cement dust has effect on person life. See detail on table 2 below

Table 2: Exposure to cement dust

Characteristics	Frequency	Percent
exposed to cement dust		
yes	598	98.5
No	9	1.5
Total	607	100
Cement dust reaches home or workplace		
Yes	591	97.3
No	16	2.7
Total	607	100
Cement Dust reaches their water		
Yes	457	75.3
No	150	24.7
Total	607	100
Cement Dust reaches their food		
Yes	442	72.8
No	165	27.2
Total	607	100
Cement Dust reaches their respiratory air		
Yes	538	88.7
No	69	11.3
Total	607	100

3.3. Knowledge of participants on health effects of cement dust

According to knowledge of participants on health effects of cement dust, all study participants know the existence of CIMERWA cement factory, 74.9% of study population listed pneumopathy as on side effect from cement dust; 78.5% knows at least one person who had had one of the side effects listed; 92.7% did not know how can be prevented side effects from cement dust; 93.5% of study population who knows how can be prevented side effects from cement dust list moving out of exposed zone as one of the mode of prevention. See detail on table 3 below

Table 3: Knowledge of participants on health effects of cement dust

Characteristics	Frequency	Percent
Knowing CIMERWA		
Yes	607	100
Cement dust have effect on person life		
Yes	559	92.1
No	48	7.9
Side effects caused by cement dust		
Pneumopathy	455	74.9
gastritis	10	1.7
dermatosis	9	1.5
pneumopahty&gastritis	5	0.8
Pneumopathy &dermaosis	16	2.7
ophtalmo	24	4
pneumo-ophtalmo	33	5.4
Dermatosis \$Ophtalmo	1	0.2
Knowing someone who had had side effect because of cement dust		
Yes	131	21.5
No	476	78.5
Which side effect has he/she		
Pneumopathy	84	13.8
gastritis	2	0.4
Dermatosis	2	0.4
Pneumopathy &dermatosis	1	0.2
ophtalmo	23	3.8
pneumo-ophtalmo	4	0.6
Ophtalmo &gastritis	1	0.2
Total	117	19.3
Knowing how to prevent cement dust side effect		
Yes	44	7.3
No	563	92.7
Total	607	100

How to prevent the cement dust side effect		
Moving out of exposed zone	568	93.5
ask treatment	20	3.25
Moving out of exposed zone or ask treatment	20	3.25
Total	607	100

3.4. Prevention measures used by exposed population

The results shows that 45.8% of participants do nothing for preventing water of cement dust, about the same population (45.4%) also do not do anything to prevent food of cement dust while 99.4% also do not do anything for preventing respiratory air of cement dust. See detail in table 4 below

Table 4: Prevention measures used by exposed population

Characteristics	Frequency	Percent
What do you do for preventing water of cement dust		
cover	170	28
None	278	45.8
filtration	43	7.1
heat	85	14
cover and heat	22	3.6
Cover &filtration	2	0.4
Heat &filtration	6	1
Cover, heat \$filtration	1	0.2
Total	607	100
What do you do to prevent food of cement dust		
Cover	95	15.7
None	276	45.4
washing	213	35.1
cover or washing	23	3.8
Total	607	100
What do you do to prevent respiratory air of cement		

dust		
mask	4	0.6
None	603	99.4
Total	607	100

3.5. Preventive measures by categories of population

3.5.1. Measures taken for preventing water of dust cement by different categories of study population

When looking association of measures taken by study population by different categories of population, there was no variables associated to these measures as for all $P\text{-value} > 0.05$. See detail in table 5 below

Table 5: Measures taken for preventing water of dust cement by different categories of study population

Variables	Take measures (%)		Person Square	Chi- P-value
	Yes	No		
Age			3.246	0.072
Less or equal 35 years old	124(50)	124(50)		
More than 35 years old	158(57.9)	115(42.1)		
Sex			2.069	0.15
Male	179(51.9)	166(48.1)		
Female	103(58.5)	73(41.5)		
Sector of origin			3.246	0.17
Mugaza	203(56.9)	49(47.1)		
Gitambi	154(43.1)	55(52.9)		
Nyakabuye	30(50%)	30(50)		
Education level			0.661	0.416
More than Primary	60(50.8)	58(55.1)		
Less or equal primary	58(49.2)	181(44.9)		
Profession			0.001	0.975
Unemployed	25(54.9)	257(54.1)		
Employed	21(45.7)	218(45.9)		
Marital status			3.744	0.053
Married	165(57.5)	122(42.5)		
Non-married	109(48.9)	114(51.1)		
Religion			2.101	0.147
Christian	246(53.0)	218(47)		
others	36(63.5)	21(36.8)		

3.5.2. Measures taken for preventing food of dust cement by different categories of study population

When looking association of measures taken for preventing food of dust cement by study population by different categories of population, there is significant association between measures taken for preventing food of dust cement and sex of participants(P-value=0.013), sector of origin(P-value=0.000), marital status(P-value=0.026) and religion (P-value=0.026) . See detail in table 6 below

Table 6: Measures taken for preventing food of dust cement by different categories of study population

Variables	Take measures (%)		Person Chi-Square	P-value
	Yes	No		
Age			1.496	0.221
Less or equal 35 years old	129(51.8)	120(48.2)		
More than 35 years old	156(57.1)	117(42.9)		
Sex			6.157	0.013
Male	175(50.7)	170(49.3)		
Female	103(58.5)	73(41.5)		
Sector of origin			26.919	0.000
Muganza	222(62)	136(38)		
Gitambi	36(34.6)	68(65.4)		
Nyakabuye	27(45%)	33(55)		
Education level			2.134	0.144
More than Primary	58(48.7)	61(51.3)		
Less or equal primary	227(56.3)	176(43.7)		
Profession			0.430	0.512
Unemployed	262(55)	214(45)		
Employed	23(50)	23(50)		
Marital status			5.771	0.016
Married	169(58.9)	118(41.1)		

Non-married	108(48.2)	116(51.8)		
Religion			4.232	0.026
Christian	246(52.9)	219(47.1)		
others	39(8.4)	18(31.6)		

3.5.3. Measures taken for preventing respiratory air of dust cement by different categories of study population

When looking association of measures taken for preventing respiratory air of dust cement to study population to different categories of population, there was no variables associated to these measures as for all P-value>0.05. See detail in table 7 below

Table 7: Measures taken for preventing respiratory air of dust cement by different categories of study population

Variables	Take measures (%)		Person Chi-Square	P-value
	Yes	No		
Age			0.435	0.510
Less or equal 35 years old	2(0.8)	247(99.2)		
More than 35 years old	1(0.4)	272(99.6)		
Sex			0.000	0.983
Male	2(0.6)	343(99.4)		
Female	1(0.6)	176(99.4)		
Sector of origin			1.382	0.501
Muganza	3(0.8)	355(99.2)		
Gitambi	0(0)	104(100)		
Nyakabuye	0(0)	60(100)		
Education level			0.891	0.345
More than Primary	0(0)	119(100)		
Less or equal primary	3(0.7)	400(99.3)		
Profession			0.430	0.512
Unemployed	3(0.6)	473(99.4)		
Employed	0(0)	46(100)		
Marital status			0.639	0.424
Married	1(0.3)	286(99.7)		
Non-married	2(0.9)	222(99.1)		
Religion			0.370	0.543
Christian	3(0.6)	462(99.4)		
others	0(0)	57(100)		

4. Discussion

4.1. Knowledge of participants on health effects of cement dust

The findings show that 98.5% of respondent know that they are exposed to cement dust from CIMERWA; 97.3% of study population affirm that cement dust reaches their home or their workplace, 75.3% , 72.8% and 88.7% affirm that cement dust reaches respectively their water, food and respiratory air; 92.1% knows that cement dust has effect on person life; 74.9% of study population listed pneumopathy as on side effect from cement dust followed by eye itching and stomach ache ; 93.5% of study population who knows how can be prevented side effects from cement dust list move out of exposed zone as one of the mode of prevention. The results from this study can be compared to results from a study done in Ghana where 156 workers from cement factory were asked about their health history and behavioral habits and occupational exposure and safety(18), and all of them know that cement dust is hazard for health. The most common health problems include burning, runny and itchy eyes (41.0%), fatigue (32.7%), sneezing (32.1%) and stuffy nose (30.0%) with the least complaint being stomach ache. In United Arab Emirates, results from a cross-sectional study involving 153 cement factory workers show that the majority of the workers knew that exposure to the dust was a serious hazard to their health(17). Those results from this study and other studies compared to this one showed that population understudies are aware of dust hazardous to their health and when seeing the reported health problem by different studies even they are different by priority they are a bit the same. The knowledge of exposed population is good for the study population because when considering the findings most of them knows cement side effect and how to prevent them. Continuous sensitization on preventing of dust cement effect should be done in order to increase the awareness of population and take appropriate measures.

4.2. Attitude of participants on cement dust

According participant's attitude on cement dust and preventive measures, 81.6% of participants affirm that cement dust kills and most of them affirm that cement dust side effect cannot be treated; the half of study participants proposed asking treatment as one of advices to give to

someone who is affected by cement dust side effects; The majority of study participants did nothing as preventive measures for their food, water and respiratory air. These study results were in accordance with the study done in United Arab Emirates in respiratory area where the use of respiratory protective equipment was poor even this was done in cement workers(17). In a study done in Egypt on workers in cement sector nearly two thirds of the studied workers were had poor knowledge about different types of personal protective equipment(19). These results from different study are a bit the same as this study done in Rwanda and show how it is necessary to continue education on prevention measures in population exposed to cement dust.

4.3. Measures taken for preventing respiratory water, food and respiratory air, according to socio-demographic characteristics

Measures taken to prevent respiratory air, water and food is still low in all study population and the worst results was in measures taken for preventing respiratory air of cement dust with only 0.6% protect themselves with mask. There were significant association of measures taken for preventing food and sex of participants, sector of origin, marital status and religion but any significant association between preventive measures for water and respiratory air and any socio-demographic characteristic of the study. This is not good and strategies and measures should be taken by health services, local administration and CIMERWA authorities in order to increase rate of population who took preventive measures for preventing respiratory air, water and food of dust cement. There are few literatures on measures taken for preventing respiratory air, food and water and their association with socio-demographic characteristics.

5. Conclusion and recommendations

Conclusion

This study showed that the majority of the study population was aware of effect of cement dust on population health. Most of them list pneumopathy, eye itching, cutaneous irritation and gastric aches or the combination of two or more than two listed above among side effects most encountered. Most of the study population also knows that drinking water, food and respiratory air should be contaminated by cement dust if they are not well protected but unfortunately the majority of them did not know what to do for those 3 health elements in order to prevent them cement dust from CIMERWA. This population also affirms that nor CIMERWA authorities, health services from this area where is located this plant did nothing to take preventive measures for this public health problem to this population.

Briefly according to results from this study, study objectives have been attained and study questions have been responded.

Recommendations

- The government of Rwanda should look how industries be installed far away from the population in order to prevent some health effects caused by those industries
- CIMERWA authorities and health services authorities in Rusizi district should organize sessions of health education concerning effect of cement dust on population in order to increase awareness of the population on problems caused by cement dust.
- Preventive measures on drinking water, food and respiratory air should be taken by population in order to prevent them to acquire side effects caused by cement dust.
- Further Studies on effect of cement dust on health of population exposed should be done using pulmonary or blood measurement tools.

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8. Appendixes

1. DATA collection tools:

**Perception of the population about Health Effects on cement dust case of
CIMERWA factory**

Individual Questionnaire

Identification		
01	Province	
02	District.....	
03	Sector	
04	Name of the health facility.....	
05	Date, month, and year of interview:	
06	Starting time :	Ending time:
07	Name of interview:	
08	Outcome of the interview	
	Completed	1
	Refused.....	2
	Incomplete.....	3
	Not available for interview	4

Section A: General /Basic Information		
No	Questions and Filters	Responses and Codes
A1	How old are you?	Years : _____
A2	What levels of education have you completed?	No education,.....1 Primary.....2 Secondary.....3 University.....4
A3	What is your profession?	Farmer.....1 Employee.....2 Small business.....3 No job.....4
A4	What is your marital status?	Currently married 1 Living with partner.....2 Single3 Widowed.....4 Divorced..... 5 Separated.....6 Specify other:.....7
Section B: KNOWLEDGE ON HEALTH EFFECTS OF CEMENT DUST		
B1	Do you know Cimerwa factory?	Yes 1 No 2 Don't know 9
B2	Are you exposed to cement dust from CIMERWA?	Yes 1 No 2

B3	Does the cement dust from CIMERWA reaches your home? Or your workplace?	Yes1 No.....2
B4	If yes , explain	
B5	Does cement dust from CIMERWA reach your drinking water?	Yes1 No.....2
B6	Does cement dust from CIMERWA reach your food?	Yes1 No.....2
B7	Does cement dust from CIMERWA reach your respiratory air?	Yes1 No.....2
B8	Do you think that cement dust has side effect on people life	Yes1 No.....2
B9	If yes which ones? List them	
B10	Do you know someone who had had some of those side effects?	Yes1 No.....2
B11	If yes which ones? List them	
B12	Do you know how someone can prevent those side effects?	Yes1 No.....2
B13	If yes, how? Explain	

Section C: : Perception about cement dust

No	Questions and Filters	Responses and Codes
C1	Do you think cement Dust kill?	Yes.....1 No.....2
C2	Side effects from cement dust can treated and hilled?	Yes.....1 No.....2
C3	What advices can give some ones who met cement	

	dust side effect?	
C4	What do you do to prevent your drinking water cement dust exposition?	Yes1 No.....2.
C5	What do you do to prevent your food cement dust exposition?	
C6	What do you do to prevent your respiratory air cement dust exposition?	
C7	Do cement factory authorities do something to solve this problem? explain	Yes1 No.....2
C8	Do cement factory authorities do something to explain how to prevent this problem? explain	Yes1 No.....2
C9	Do health services do something to explain how to prevent this problem? explain	Yes1 No.....2

2. INFORMED CONSENT STATEMENT

1. Invitation to Participate and Description of the Proposed Study:

You are invited to participate in our “ Knowledge, attitude and perception of population about cement dust health effects of the Mashyuza cement factory’. We are conducting this study with an aim to identify the effectiveness of cement dust side effect on population health prevention, Care & Treatment and to help improve the cement dust side effect on population health program among people living around CIMERWA. Before agreeing to be part of this study, please read and/or listen to the following information carefully. Remember that your participation in this research is totally voluntary and please, you should feel free to ask questions at any point when anything skip your understanding.

2. Description of the Study:

The study will be conducted across three sectors, MUGANZA, GITAMBI and NYAKABUYE in RUSIZI district in the Western Province. The study population is comprised of all population exposed to cement dust from CIMERWA.

Enumeration sites have been selected from RUSIZI District as exposed to cement dust from CIMERWA. Consent/assent is requested from all study participants. Prior to the commencement of data collection, a workplan has been drawn setting up interview dates and times for the selected respondents according to their availability and the study schedule. If you participate in this study, you are asked to let us know whether you are comfortable answering our interview questions here and now or whether you would propose a different venue and/or time. A research team supervised by the lead researcher of this study **Mr. BAYIHIKI Basile** will be responsible for the data collection.

3. Risks and Inconveniences.

There is a possibility that some of the questions in the interviews may make you feel uncomfortable. We will be asking you about personal experiences and you may feel embarrassed at times when talking about personal experiences. But if you do feel uncomfortable, you can do any of the following:

-
- you can choose not to answer certain questions;
 - you can choose to stop the interviews, or
 - You can seek further information from the supervisor of the study (**Mr BAYIHIKI Basile.**) to talk about your feelings.

4. Benefits:

You may not directly benefit from this study; however, your participation strongly contributes to the well-being of the People Living around CIMERWA. In addition, what we learn from this study will help us improve health of people, care and treatment programs and interventions among people living around CIMERWA.

5. Confidentiality:

Any and all information obtained from you during the study will be confidential. Your privacy will be protected at all times. You will not be identified individually in any way as a result of your participation in this research. The data collected however, will be used as part of the cement dust prevention among population around CIMERWA.

6. Voluntary Participation:

Your participation in this study is entirely voluntary. You may refuse to participate in this research. Such refusal will not have any negative consequences for you. If you begin to participate in the research, you may at any time, for any reason, discontinue your participation without any objection or negative consequences.

7. Compensation (or other) considerations:

There will be no monetary compensation to your time but the researcher highly recognizes your participation and sacrifice of your time to be part of this study.

8. Other considerations and questions. Please feel free to ask any questions about anything that seems unclear to you and consider this research and consent form carefully before you sign.

Authorization for participants aged 18 years and above

I have read or listened to the above information and I have decided that I will participate in the study ‘ Knowledge, attitude and perception of population about cement dust health effects of the Mashyuza cement factory ‘ described above. The data collector has explained the study to me and answered all my questions and now I know what will be asked of me. I understand that the purpose of the study is to expand the evidence base for prevention of cement dust among population around CIMERWA. If I don't participate, there will be no penalty or loss of rights. I also understand that I hold the right to refuse to answer some questions and/or stop participating at any time at will, even after I have started the interview

I give my informed consent and voluntarily agree to participate in this study.

Respondent's signature: _____

Respondent's name: _____

Date of interview: _____

If you have further questions about this research project, please contact the principal investigator, [Mr.BAYIHIKI Basile, at (250) 0788652593, or e-mail her at: bbayihiki@yahoo.com]

Appendix4: Consent and/or Assent Documents (Kinyarwanda)

INYITO: *‘Ubushakashatsi bugamije gukurikirana ubumenyi n’imyumvire y’abaturage baturaye uruganda rwa CIMERWA ku bibazo by’ubuzima bishobora guterwa n’ivumbi rya sima ritumuka riva mu ruganda rwa CIMERWA n’uburyo byo kwirinda ibyo bibazo*

IFISHI YO KWEMERERAHO GUKORERWAHO UBUSHAKASHATSI KU BUSHAKE

1. Kurarikirwa kugira uruhare n’Ibisobanuro k’ubushakashatsi buteganyijwe

Tunejewe no kubasaba kugira uruhare muri ubu *“Ubushakashatsi bugamije gukurikirana ubumenyi n’imyumvire y’abaturage baturaye uruganda rwa CIMERWA ku bibazo by’ubuzima bishoboraguterwa n’ivumbi rya sima ritumuka riva mu ruganda rwa CIMERWA n’uburyo byo kwirinda ibyo bibazo”*. Turimo gukora ububushakashatsi mu rwego rwo kunoza gahunda ishinzwe kurwanya ingaruka zishobora guturuka kw’ivumbi rya sima mu baturage baturaye uruganda rwa CIMERWA ndetse nokuzamura uruhare *rw’abaturage, abayobozi b’uruganda ndetse n’abashinzwe ubuzima* mu gukangurira abantu baturaye urwo ruganda uburyo bwo kwirinda no kwivuzza izo ngaruka. Intego z’ubu bushakashatsi ni ugupima uburyo urwego rw’ubumenyi ku ngaruka zituruka ku ivumbi rya sima riva muri CIMERWA, kwirinda ndetse no kwivuzza izo ngaruka kw’abantu baturaye urwo ruganda.

Mbere yo kwemera kugira uruhare muri ubu bushakashatsi, turabasaba kubanza gusoma cyangwa gutega amatwi mwitonze ibi bikurikira. Mwibuke ko kugira uruhare muri ubu bushakashatsi ari ku bushake kandi mufite uburenganzira busesuye bwo gusobanuzza igihe cyose hari ikintu mutumvise neza.

2. Ibisobanuro by’uko amakuru y’ubushakashatsi azakusanywa:

Ubu bushakashatsi burakorerwa mu mirenge itatu yo ariyo; Muganza, Gitambi na Nyakabuyemu karere ka Rusizi muntara y'iburengerazuba. Ubu bushakashatsi bureba gusa abaturage baturaye uruganda rwa CIMERWA. Uduce tuzakorerwamo ububushakashatsi twatoranijwe hakurikijwe uburyo abaturage begereye uru ruganda n'ukuntu bagerwaho n'ivumbi rya sima ituruka muri uru ruganda. Kugira uruhare muri ubu bushakashatsi ni kubushake; nta muntu uzabazwa atabanje kubyemera mu nyandiko kubushake. N'ugira uruhare muri ubu bushakashatsi, turagusaba kutubwira niba wumva ntakibazo ko tunganirira hano aka kanya cyangwa se niba watubwira ahandi hantu n'isaha ikiganiro cyaberaho. Itsinda rigizwe n'abagenzuzi n'abakusanyamakuru y'ubushakashatsi riyobowe na Bwana Bayigiki Basile rifite inshingano zo gukusanya amakuru y'ubushakashatsi.

3. Ingorane n'Imbogamizi.

Birashoboka ko ibibazo bimwe na bimwe bikubiye muri ububushakashatsi byabatera ipfunwe. Turababaza ibintu birebana n'ubuzima bwanyu bwite kuburyo hari igihe byabatera guhungabana. Ntangorane zizwi zifitanye isano n'ubu bushakashatsi. Uramutse wumvise ibibazo bikubangamiye, ushobora gukora kimwe muri ibi bikurikira:

- Ushobora guhitamo kudasubiza ibibazo bimwe na bimwe;
- Ushobora guhitamo guhagarika ubushakashatsi/ikiganiro, cyangwa
- Ushobora guhamagara uhagarariye ububushakashatsi Bwana Bayihiki Basile ukamusobanurira impungenge zawe.

4. Inyungu. Hari igihe ku giti cyawe utagira inyungu ubona muri ubu bushakashatsi, ariko amakuru utanga azadufasha kurwanya ingaruka zituruka ku ivumbi rya sima ndetse no ko ngera imbaraga muruhare rw'abaturage baturaye uruganda rwa CIMERWA, abayobozi b'uruganda n'abashinzwe ubuzima muri icyo gikorwa.

5. Kugira ibanga. Amakuru yose muzaduha muri ubu bushakashatsi azakomeza kuba ibanga. Ubutavogerwa bwa muntu buzarindwa igihe cyose. Kugira uruhare muri ububushakashatsi

ntibizatuma umenyekana kugiticyawe. Ibizava mu bushakashatsi nibyo bizakoreshwa gusa mu rwego rwo kunoza porogaramu yo kurwanya ingaruka ziterwa n'ivumbi rya sima mu baturiyeye uru ruganda.

6. **Kugira uruhare mu bushakashatsi ku bushake.** Kugira uruhare muri ububushakashatsi ni kubushake ijana ku ijana. Ushobora kwanga kubugiramo uruhare. Uko kwanga ntikuzakugiraho ingaruka izo arizo zose. Uramutse utangiye kugira uruhare muri ububushakashatsi, ushobora igihe icyo aricyo cyose, ku mpamvu iyoya ryo yose, guhagarika kubugiramo uruhare kandi ntangaruka n'imwe wagira.
7. **Ibirebana n'amafaranga:** Ntabwishyu bw'amafaranga bugenewe abazagira uruhare muri ubu bushakashatsi. icyakora uruhare rwa buri wese umushakashatsi arabumushimira kuko ari ntagereranywa.
8. **Ibindi bibazo.** Turabasaba gusobanura ikibazo icyo aricyo cyose kungingo iyo ariyo yose mwumva idasobanutse maze mukabanza mugasobanukirwa neza ubu bushakashatsi n'ifishi umuntu yemereraho kubushake mbere yo gushyiraho umukono wanyu.

Gutanga uburenganzira kubafite imyaka iri hejuru ya18:

Nasomye cg numvise ibikubiye aha haruguru none niyemeje k'ubushake kugira uruhare muri ubu bushakashatsi. Ukora ubushakashatsi yansobanuriye, asubiza n'ibibazo nari mfite byose. Ubu nzi ibyo baza kumbaza. Nsobanukiwe ko intego y'ububushakashatsi ari ukugira amakuru menshi afatika yashingirwaho mu guteza imbere gahunda yokurwanya ingaruka zituruka ku ivumbi rya sima iva mu ruganda rwa CIMERWA. Ndamutse ntabugizemo uruhare, ntahano ndetse nta n'uburenganzira bwanjye navutswa. Nshobora guhagarika kugira uruhare muri ubu bushakashatsi igihe icyo aricyo cyose kabone n'iyoya naba nabutangiyeye.

Umukonow'ubazwa: _____

Izinary'ubazwa: _____

Itariki: _____

Niba ufite ibindi usobanuzza kuri ububushakashatsi, wabaza ukuriye ububushakashatsi, Bwana BAYIHIKI Basile, kuri telephone igendanwa (+250) 0788652593 cyangwa e-mail: bbayihiki@yahoo.com].