Under 5 Child Mortality in the Maghreb countries

Mortalité des enfants moins de 5 ans dans les pays du Maghreb

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RÉSUMÉ

Introduction: La mortalité infantile est un excellent indicateur de l'état de santé d'une population. L'objectif de cette étude est de décrire les tendances de la mortalité des enfants moins de 5 ans et les facteurs qui lui sont associés dans les pays du Grand Maghreb au cours des trois dernières décennies, de 1990 à 2019.

Méthodes: Il s'agit d'une étude descriptive observationnelle de la mortalité des enfants de moins de cinq ans, fondée sur la base de données « Global Burden of Diseases, Injuries, and Risk Factors »

Résultats : La tendance générale dans les cinq pays du Maghreb a été vers la baisse des taux de mortalité pour tous les groupes d'âge et pour les deux sexes. La Mauritanie reste en tête de liste en termes de nombre de décès, suivie par le Maroc. Le nombre de décès d'enfants de moins de 5 ans a été plus élevé chez les garçons dans tous les pays du Maghreb et le groupe d'âge le plus touché a été celui des moins d'un an. En ce qui concerne la mortalité des moins de 5 ans, les cinq principales causes de décès étaient les mêmes pour les cinq pays de Maghreb; à l'exception de la Mauritanie où les maladies infectieuses demeuraient la 1e cause de mortalité des moins de 5 ans.

Conclusion : Malgré la forte baisse des taux de mortalité des enfants de moins de 5 ans, beaucoup reste à accomplir dans les pays du Maghreb afin d'améliorer encore plus la santé des enfants.

Mots clés : Mortalité- Mortalité infantile- Causes de la mortalié- Taux- Le Maghreb- Enfants- Nouveau-né- Algérie- Tunisie- Libye- Maroc- Mauritanie.

SUMMARY

Introduction: Mortality, particularly at younger ages, is a key measure of population health. The aim of our work is to describe under 5 children mortality trends and its related factors in the Great Maghreb countries over the last three decades 1994-2019.

Methods: We conducted an observational descriptive study to clarify the situation in the Maghreb countries with regard to the under-five death rates and the various causes related to them during the last three decades (1990-2019). The data was collected from the Global Burden of Diseases, Injuries, and Risk Factors (GBD).

Results: The overall trend for the five Maghreb countries was towards the decrease in the mortality rates for all age groups and for both sexes. Mauritania remains at the top of the list in term of the number of deaths followed directly by Morocco. The number of deaths of under-5 children is higher among boys in all Maghreb countries and the most affected age group is under 1 year old. Regarding the causes of under-5 mortality in Maghreb countries, the top-5 causes were similar; except in Mauritania where infectious diseases remain the leading under-5 mortality cause, like in other sub-Saharan countries.

Conclusion: Despite the big drop in under 5 child Mortality rates, a lot remains to be done in Maghreb countries to improve children health.

Key Words: Mortality – Child Mortality – Infant Mortality – Cause of Death - Rate - Maghreb – children – Newborn -Algeria- Tunisia- Libya- Morocco- Mauritania

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ملخص

المقدمة: تعد نسبة وفيات الاطفال الاقل من 5 سنوات معيار اساسي لتقييم الحالة الصحية العامة للسكان. الهدف من عملنا هذا هو وصف اتجاهات وفيات الاطفال الاقل من 5 سنوات والعوامل المرتبطة بها في بلدان المغرب الكبير على مدى الثلاثة عقود الماضية 1990–2019 باستخدام بيانات من بنك المعلومات العالمي.

الاساليب المعتمدة: أجرينا دراسة وصفية رصدية لتوضيح الوضع في البلدان المغاربية فيما يتعلق بمعدلات وفيات الأطفال دون سن الخامسة والأسباب المرتبطة بها خلال العقود الثلاثة الماضية وقد تم جمع المعلومات باستخدام بنك المعلومات العالمي.

النتائج: كان الاتجاه العام للبلدان المغاربية الخمسة نحو الانخفاض في معدلات الوفيات لجميع الفئات العمرية ولكلا الجنسين. وتبقى موريتانيا على رأس القائمة فيما يخص عدد الوفيات متبوعة مباشرة بالمغرب وكانت نسبة الاطفال المتوفين الذكور اكثرمن الاناث. في جميع البلدان المغاربية وكانت الفئة العمرية الأكثر تضرراً تخص الاطفال اصحاب الفئة العمرية الاقل من سنة. اما فيما يتعلق بأسباب وفيات الأطفال دون سن الخامسة فقد كانت متشابهة في البلدان المغاربية كلها ما عدا موريطانيا ، حيث لا تزال الأمراض المعدية تشكل السبب الرئيسي لوفيات الأطفال دون سن الخامسة ، كما هو الحال في اغلب بلدان جنوب الصحراء الكبرى.

الخلاصة: على الرغم من الانخفاض الكبير في معدلات وفيات الأطفال دون الخامسة، لا يزال هناك الكثير الذي يتعين القيام به في البلدان المغاربية لتحسين صحة الأطفال.

الكلمات المفتاحية :

INTRODUCTION

Mortality, particularly at younger ages, is a key measure of population health. Avoiding premature mortality from any cause is a crucial goal for every health system, and mortality reduction is a core target in the developmental agenda to improve global health (1). Particularly, age-specific mortality represents a crutial input that enables health systems to target interventions to specific populations. Understanding how all-cause mortality has changed with respect to development status can identify exemplars for for best practice.

Every child death is a tragedy for the family and the whole community, it deserves a deep analysis of conditions and circumstances in order to understand and avoid such a situation. In this purpose, various programs have been established to improve the situation worldwide. Millennium Development Goal 4 (MDG 4), ‘‘Reduce child mortality,’’ called for the reduction of the under-5 mortality rate by two-thirds between 1990 and 2015(2). The new Sustainable Development Goals (SDGs) call for an end to preventable deaths of newborns and children by 2030, with all countries aiming to reduce neonatal mortality to at least as low as 12 per 1,000 live births and under-5 mortality to at least as low as 25 per 1000 live births (2).

According to Levels and Trends in Child Mortality Report 2015, released by the United Nations International Children’s Emergency Fund (UNICEF), the World Health Organization (WHO), the World Bank Group, and the Population Division of the UN Department of Economic and Social Affairs (DESA), under-five deaths have dropped from 12.7 million per year in 1990 to 5.9 million in 2015 (3). The under-five mortality rate fell to 39 deaths per 1,000 live births in 2017 from 93 in 1990, a 58 per cent reduction. This is equivalent to 1 in 11 children dying before reaching age 5 in 1990, compared to 1 in 26 in 2017 (4).

This remarkable progress in reducing children mortality remains insufficient, an estimated 6.3 million children and young adolescents in developing countries died in 2017, mostly from preventable causes, children under age 5 accounted for 5.4 million of these deaths, with 2.5 million deaths occurring in the first month of life, 1.6 million at age 1–11 months, and 1.3 million at age 1−4 years (4).

Disparities in mortality across regions and countries require a deep understanding of different factors contributing to child deaths in order to drive preventive initiatives according to geography and social-economic status.

The aim of our work is to describe infant mortality trends and its related factors in the Great Maghreb countries over the last three decades 1990-2019 using data from the Global Burden of Disease.

METHODOLOGY

The Greater Maghreb is politically constituted of five countries: Algeria, Tunisia, Libya, Morocco and Mauritania. This zone is located in the north of the African continent, between the Mediterranean Sea, the desert of Libya, the Sahara and the Atlantic Ocean. It is home to nearly 100 million people and depicts high fertility rates, ranging from 1.8 in Tunisia to 4.2 in Mauritania(5) The main demographic and socio-economic characteristics of the five countries of the Greater Maghreb are summarized in Box 1 (6).

We conducted an observational descriptive study to clarify the situation in the Maghreb countries with regard to the under-five death rates and the various causes related to them during the last three decades, starting from the year 1990, taking as plotter years the central year of each quaternary: 1992 for the period from 1990 to 1994, 1997 for the period from 1995 to 1999 … and so on.

The data was collected from the Global Burden of Diseases, Injuries, and Risk Factors (GBD) enterprise which is a systematic, scientific effort to quantify the comparative magnitude of health loss due to diseases, injuries, and risk factors by age, sex, and geography for specific points in time. The GBD approach provides an opportunity to see the big picture, to compare diseases, injuries, and risk factors, and to understand in a given place, time, and age-sex group what are the most important contributors to health (7)

In this analysis we used all available GBD 2017 data sources to estimate mortality rates and causes of death for under-5 age children, by sex, for five locations (Algeria, Tunisia, Libya, Morocco and Mauritania) from 1990 to 2019. We analyzed first all-cause under-5 mortality and death rates by sex and age group: <1 year, 1-4 years and >5 years in the different quarters between 1990 and 2019. Then we estimated the cause-specific mortality results from GBD 2017 and the changes in leading causes of death in children younger than 5 years in the Maghreb region during the same period. In the end, we tried to compare the results in the five countries

Box 1 . Main demographic and socio-economic characteristics of the five Great Maghreb countries in 2015 (7)

	Algeria	Tunisia	Libya	Morocco	Mauritania
General Population(millions)	40	11	6,2	33	4,3
Population <15 years (%)	28	23	30	28	40
Population > 60 years (%)	7	11	7	8	5
Life expectancy man (years)	75	74	69	74	63
Life expectancy woman (years)	77	78	75	77	65
Total expenditure on health per inhabitant ($)	932	785	806	447	148
Health expenditure relative to GDP (%)	7,2	7	5	5,9	3,8
Maternel mortality	89	46	15	120	320
Child mortality /1000 LB	21,4	12	11,4	21,8	55,8
Neonatal mortality /1000 LB	15,5	8	7	15,8	35,1
Under-5 child mortality /1000 LB	25	15	15	30	90

LB: Living Birth

RESULTS

During 1990-2019, the trend in under-five mortality rates has decreased in all the countries of the greater Maghreb and was more marked in Tunisia. However, a raise in under-5 mortality between 2010 and 2012 was noted. In Mauritania, and during the same period of time, despite the downward trend, it remains the country with the highest rates of under-five mortality in the Maghreb (fig 1).

Table I summarizes under-5 child mortality rates per 100,000 inhabitants by sex and by age among the five Greater Maghreb countries in the tracer years of the last six quaternaries from 1990 to 2019 according to the IHME GBD database. The overall trend for the five Maghreb countries was towards the decrease in the mortality rates for all age groups and for both sexes. Mauritania remains at the top of the list in term of the number of deaths followed directly by Morocco. The number of deaths of under-5 children is higher among boys in all Maghreb countries and the most affected age group is under 1 year old.

Mortality rates in under-5 children males are higher than in females in all the five Maghreb countries (fig 2). The top cause of under-5 children mortality in 2017 was

the “maternal and neonatal“ (fig 2, 3). Preterm birth complications, neonatal encephalopathy, congenital defects especially cardiac ones, lower respiratory infections, neonatal sepsis, and diarrheal disease were mostly the top causes of under-5 deaths (fig 3). Infectious (communicable) diseases in Mauritania are more involved in under-5 children mortality while motor vehicle and road injuries are remarkably more prevalent in the other Great Maghreb countries (fig 2,3).

Figures (4-8**)** show the evolution over twenty-seven years (1990-2017) of under-5 children mortality causes in Maghreb countries. The major causes of death in all our Maghreb countries are generally preventable with some differences to be highlighted. A marked improvement over the last 27 years (1990-2017) has been noted in infectious causes, especially respiratory and diarrheal diseases, except in Mauritania where the situation remains stationary besides measles, which is ranked 36 in 2017. On the other hand, in Libya, injuries rose to the second position in 2017. Motor road vehicle injuries are also a frequent cause of death especially among Tunisian and Algerian children.

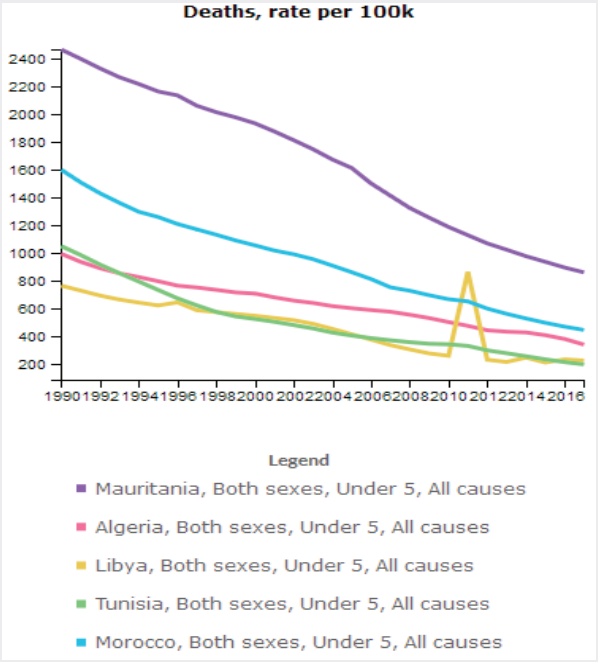


Figure 1. Mortality rates for children under-five years old in the Great Maghreb during the period 1990-2017 (GBD 2017)

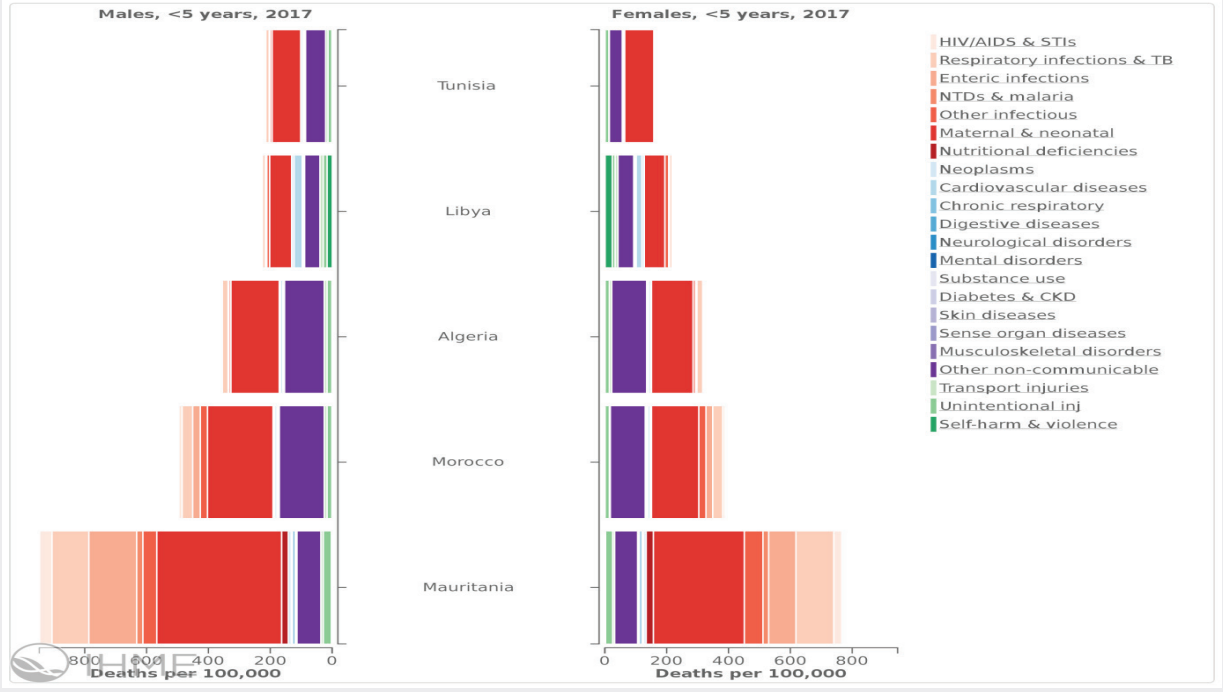
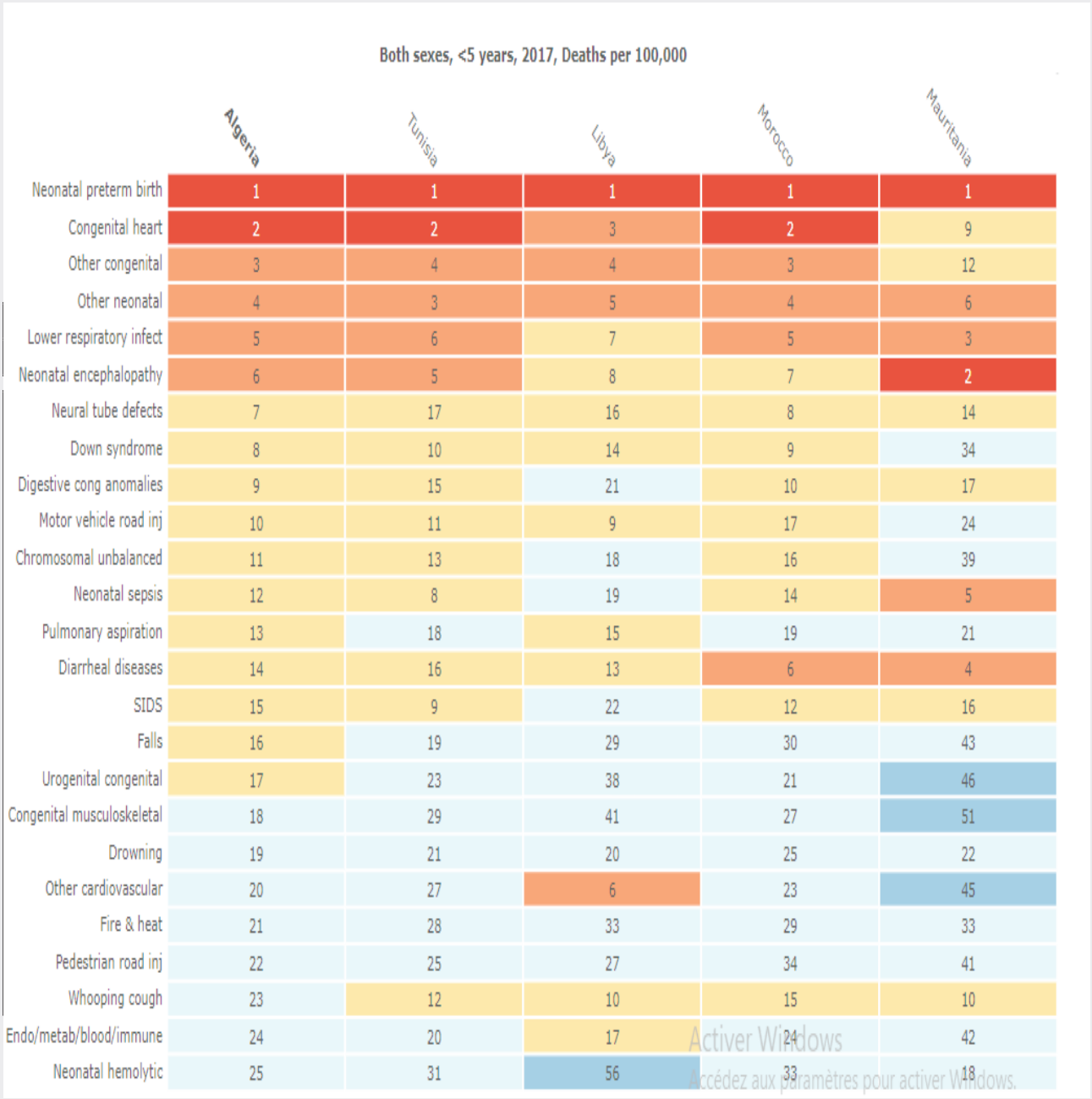


Figure 2. Mortality rates for under-5 Grand Maghreb Countries children by sex and cause (GBD 2017)

Table 1. Mortality rates (per 1000k) for Great Maghreb countries over 27 years (1990-2019) (GBD 2017)

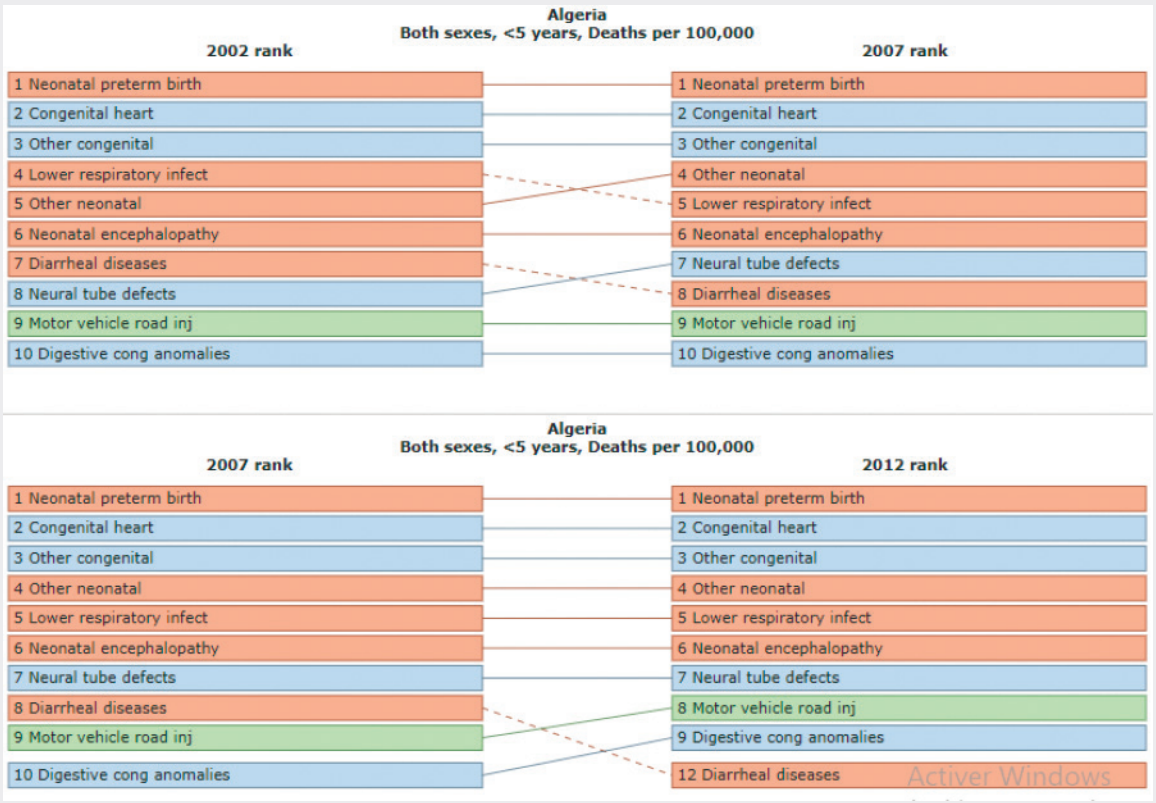
Country		1990-1994			1995-1999			2000-2004			2005-2009			2010-2014			2015-2019		
		1992			1997			2002			2007			2012			2017		
		< 1	01-04	<5	< 1	01-04	<5	< 1	01-04	<5	< 1	01-04	<5	< 1	01-04	<5	< 1	01-04	<5
Algeria	Male	41	1	**10**	33	1	**8**	28	1	**7**	24	1	**6**	18	1	**5**	15	1	**4**
	Female	33	2	**8**	27	2	**7**	23	1	**6**	20	1	**5**	16	1	**4**	13	1	**3**
	All	37	2	**9**	30	1	**7**	25	1	**7**	22	1	**6**	17	1	**4**	14	1	**3**
Libya	Male	30	2	**8**	25	2	**6**	19	2	**5**	11	2	**3**	7	1	**2**	7	1	**2**
	Female	25	2	**6**	22	2	**5**	18	2	**5**	10	1	**3**	6	1	**2**	7	1	**2**
	All	28	2	**7**	23	2	**6**	19	2	**5**	10	2	**3**	7	1	**2**	7	1	**2**
Morocco	Male	64	3	**15**	54	2	**13**	47	1	**11**	37	1	**8**	30	1	**7**	23	1	**5**
	Female	51	3	**13**	42	2	**11**	36	2	**9**	27	1	**7**	22	1	**5**	17	1	**4**
	All	57	3	**14**	48	2	**12**	41	2	**10**	32	1	**8**	26	1	**6**	20	1	**4**
Mauritania	Male	76	11	**25**	70	9	**22**	64	7	**20**	55	5	**15**	46	3	**12**	38	2	**9**
	Female	59	11	**21**	55	9	**19**	52	7	**16**	45	4	**13**	36	3	**10**	30	2	**8**
	All	67	11	**23**	63	9	**21**	58	7	**18**	50	5	**14**	41	3	**11**	34	2	**9**
Tunisia	Male	42	2	**10**	28	2	**7**	20	1	**5**	16	1	**4**	13	1	**3**	9	1	**2**
	Female	34	2	**8**	23	1	**5**	18	1	**4**	14	1	**3**	11	0	**3**	8	0	**2**
	All	38	2	**9**	25	1	**6**	19	1	**5**	15	1	**4**	12	1	**3**	9	0	**2**
Maghreb	Male	50	2	**12**	41	2	**10**	35	2	**9**	28	1	**7**	23	1	**5**	18	1	**4**
	Female	40	3	**10**	33	2	**9**	28	2	**7**	22	1	**6**	18	1	**5**	14	1	**3**
	All	45	3	**11**	37	2	**9**	31	2	**8**	25	1	**6**	20	1	**5**	16	1	**4**



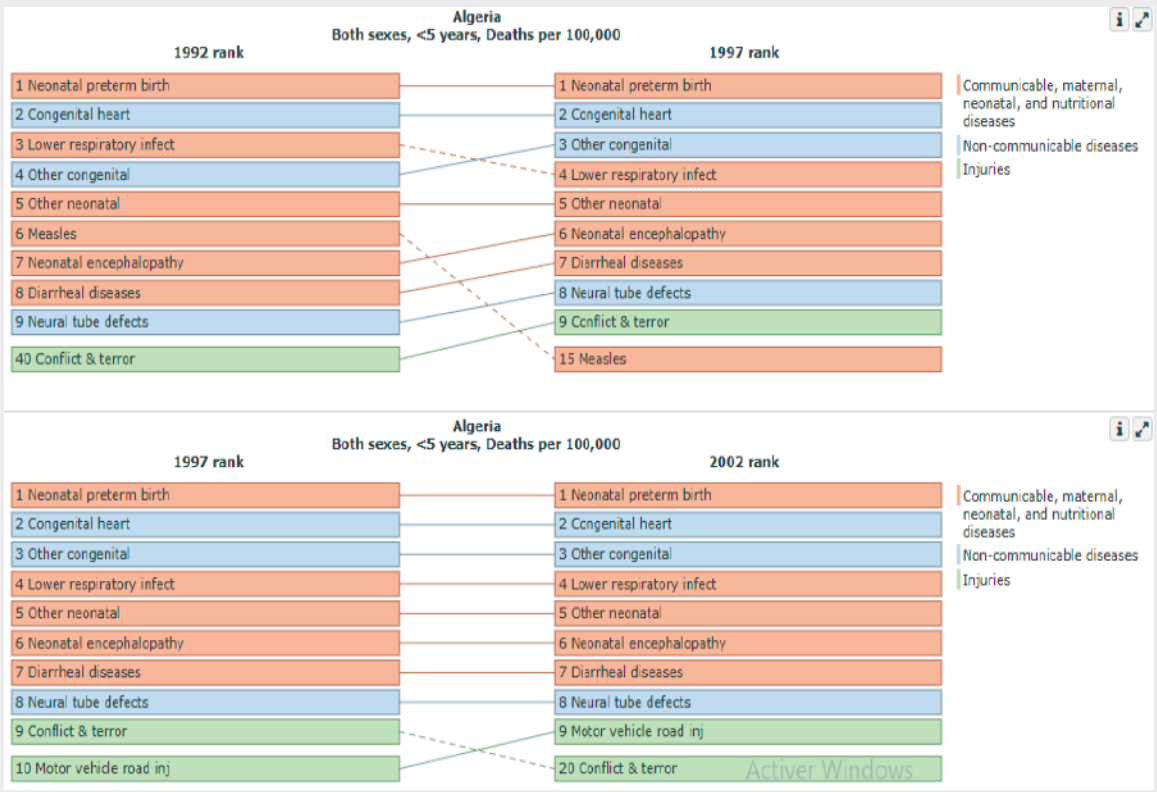
	Algeria	Tunisia	Libya	Morocco	Mauritania
Neonatal preterm birth	1	1	1	1	1
Congenital heart	2	2	3	2	9
Other congenital	3	4	4	3	12
Other neonatal	4	3	5	4	6
Lower respiratory infect	5	6	7	5	3
Neonatal encephalopathy	6	5	8	7	2
Neural tube defects	7	17	16	8	14
Down syndrome	8	10	14	9	34
Digestive cong anomalies	9	15	21	10	17
Motor vehicle road inj	10	11	9	17	24
Chromosomal unbalanced	11	13	18	16	39
Neonatal sepsis	12	8	19	14	5
Pulmonary aspiration	13	18	15	19	21
Diarrheal diseases	14	16	13	6	4
SIDS	15	9	22	12	16
Falls	16	19	29	30	43
Urogenital congenital	17	23	38	21	46
Congenital musculoskeletal	18	29	41	27	51
Drowning	19	21	20	25	22
Other cardiovascular	20	27	6	23	45
Fire & heat	21	28	33	29	33
Pedestrian road inj	22	25	27	34	41
Whooping cough	23	12	10	15	10
Endo/metab/blood/immune	24	20	17	24	42
Neonatal hemolytic	25	31	56	33	18

Figure 3. Mortality rates for top 25 causes of under-5 mortality in Great Maghreb countries (GBD 2017)

(a)


Algeria
Both sexes, <5 years, Deaths per 100,000
2002 rank
2007 rank
1 Neonatal preterm birth
2 Congenital heart
3 Other congenital
4 Lower respiratory infect
5 Other neonatal
6 Neonatal encephalopathy
7 Diarrheal diseases
8 Neural tube defects
9 Motor vehicle road inj
10 Digestive cong anomalies
1 Neonatal preterm birth
2 Congenital heart
3 Other congenital
4 Other neonatal
5 Lower respiratory infect
6 Neonatal encephalopathy
7 Neural tube defects
8 Diarrheal diseases
9 Motor vehicle road inj
10 Digestive cong anomalies
Algeria
Both sexes, <5 years, Deaths per 100,000
2007 rank
2012 rank
1 Neonatal preterm birth
2 Congenital heart
3 Other congenital
4 Other neonatal
5 Lower respiratory infect
6 Neonatal encephalopathy
7 Neural tube defects
8 Diarrheal diseases
9 Motor vehicle road inj
10 Digestive cong anomalies
1 Neonatal preterm birth
2 Congenital heart
3 Other congenital
4 Other neonatal
5 Lower respiratory infect
6 Neonatal encephalopathy
7 Neural tube defects
8 Motor vehicle road inj
9 Digestive cong anomalies
12 Diarrheal diseases
Activer Windows

(b)


Algeria
Both sexes, <5 years, Deaths per 100,000
1992 rank
1997 rank
1 Neonatal preterm birth
2 Congenital heart
3 Lower respiratory infect
4 Other congenital
5 Other neonatal
6 Measles
7 Neonatal encephalopathy
8 Diarrheal diseases
9 Neural tube defects
40 Conflict & terror
1 Neonatal preterm birth
2 Congenital heart
3 Other congenital
4 Lower respiratory infect
5 Other neonatal
6 Neonatal encephalopathy
7 Diarrheal diseases
8 Neural tube defects
9 Conflict & terror
15 Measles
Communicable, maternal, neonatal, and nutritional diseases
Non-communicable diseases
Injuries
Algeria
Both sexes, <5 years, Deaths per 100,000
1997 rank
2002 rank
1 Neonatal preterm birth
2 Congenital heart
3 Other congenital
4 Lower respiratory infect
5 Other neonatal
6 Neonatal encephalopathy
7 Diarrheal diseases
8 Neural tube defects
9 Conflict & terror
10 Motor vehicle road inj
1 Neonatal preterm birth
2 Congenital heart
3 Other congenital
4 Lower respiratory infect
5 Other neonatal
6 Neonatal encephalopathy
7 Diarrheal diseases
8 Neural tube defects
9 Motor vehicle road inj
20 Conflict & terror
Communicable, maternal, neonatal, and nutritional diseases
Non-communicable diseases
Injuries
Activer Windows

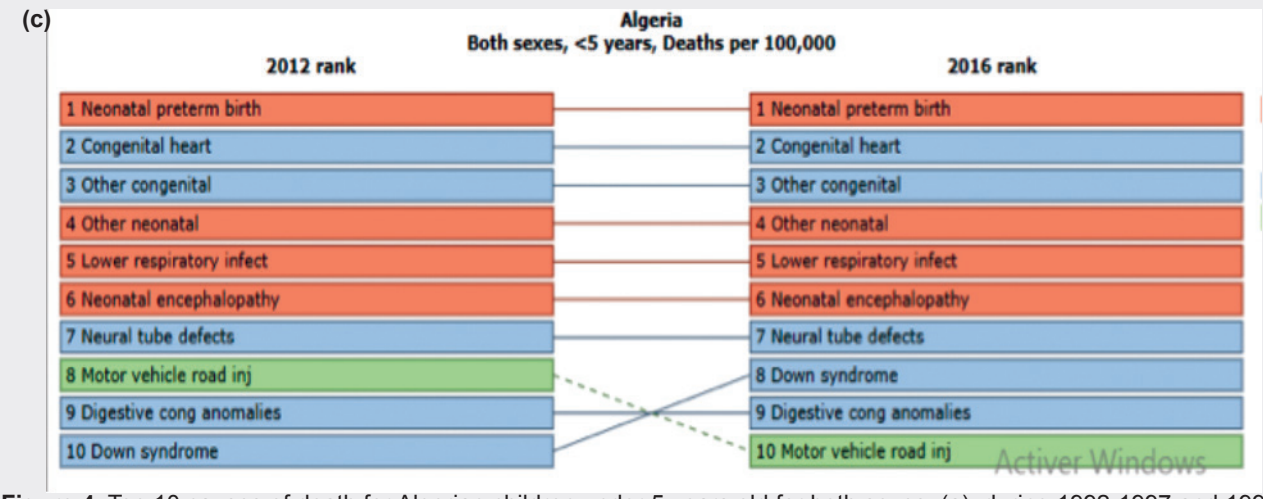
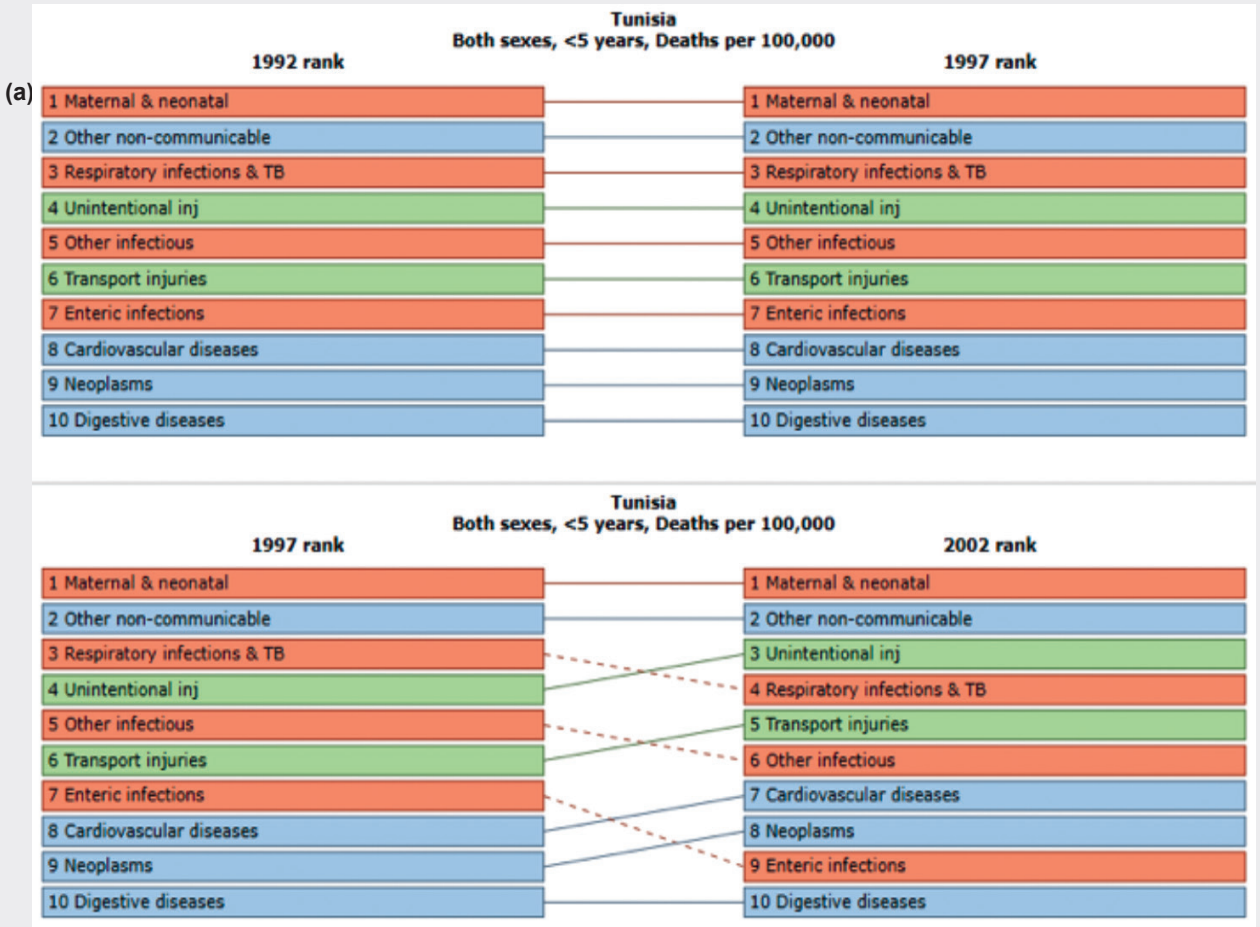


Figure 4. Top 10 causes of death for Algerian children under 5 years old for both sexes, (a): during 1992-1997 and 1997-2002, (b): during 2002-2007 and 2007-2012, (c): during 2012-20 (GBD 2017)



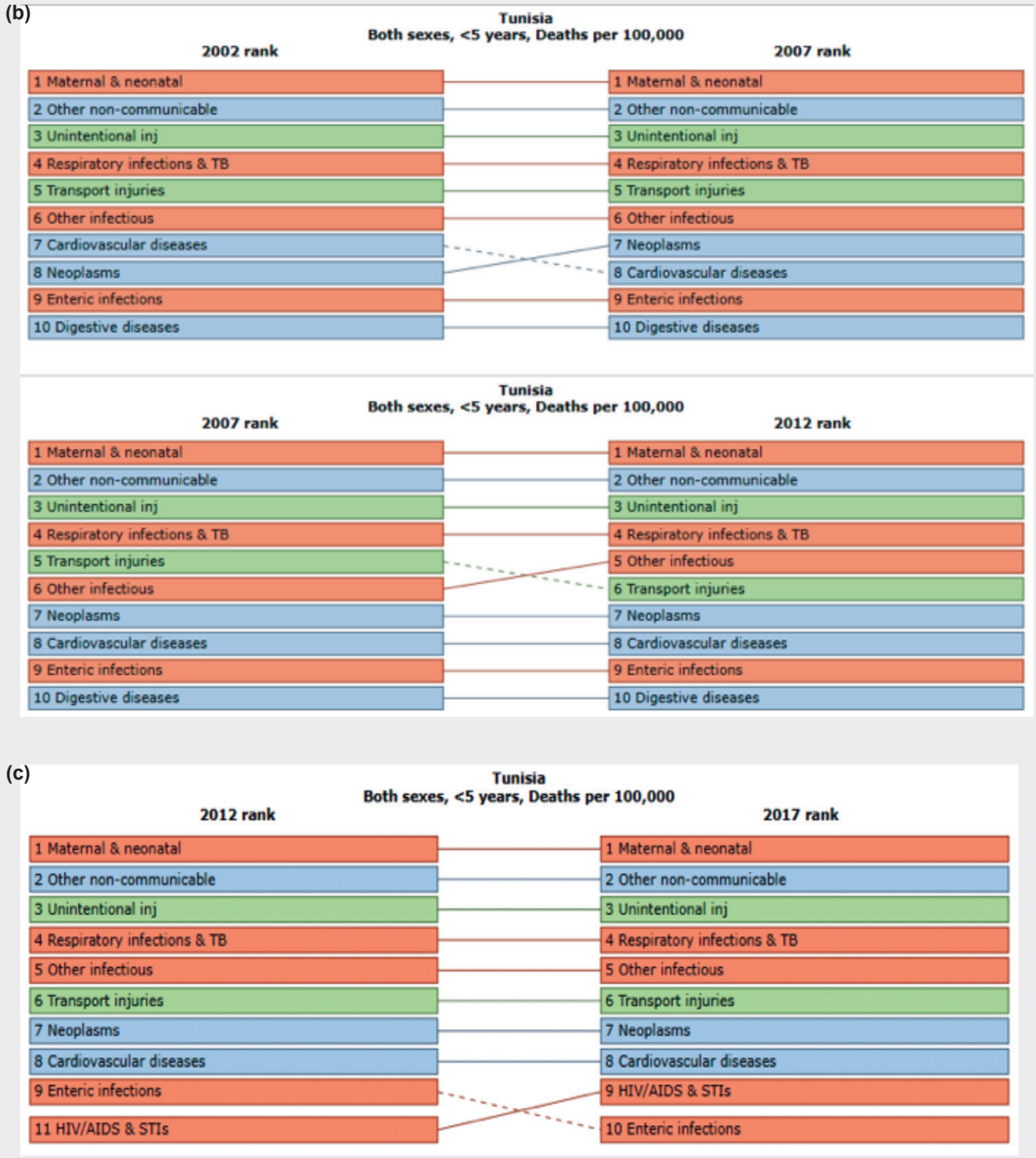
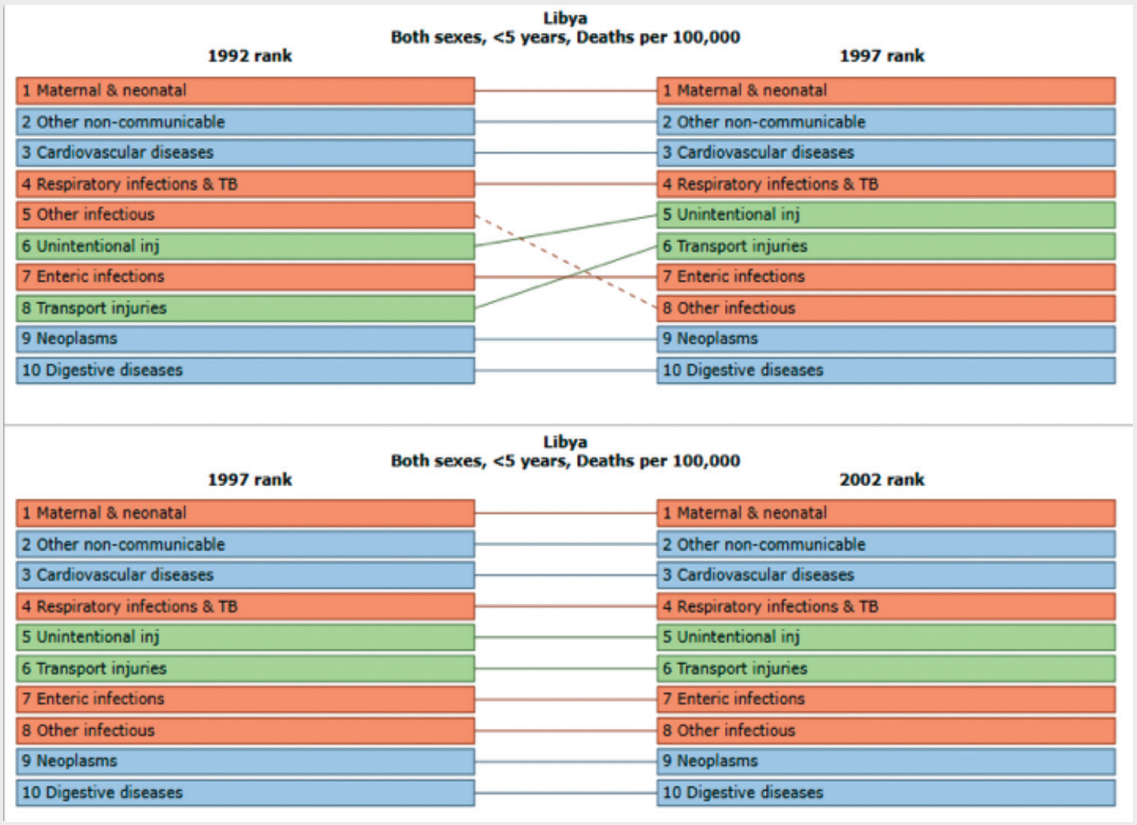
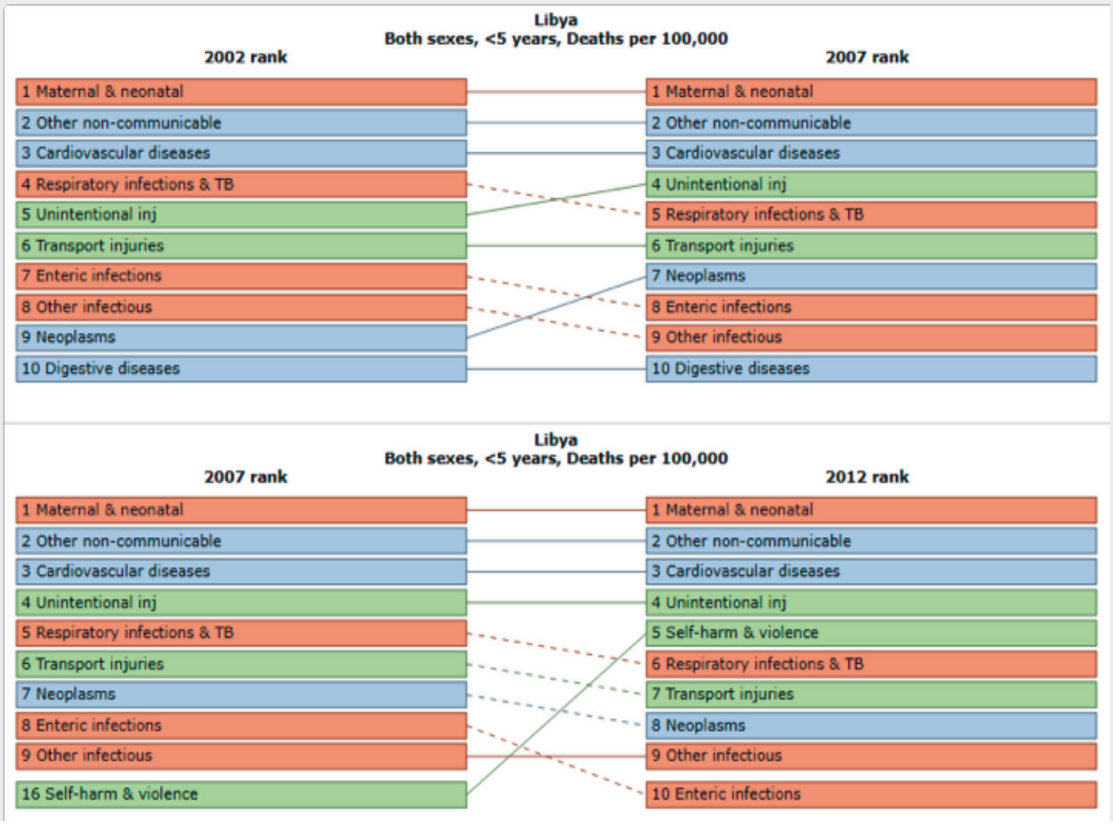


Figure 5. Top 10 causes of death for Tunisian children under 5 years old for both sexes, (a): during 1992-1997 and 1997-2002, (b): during 2002-2007 and 2007-2012, (c): during 2012-2017 (GBD 2017)

(a)


Libya
Both sexes, <5 years, Deaths per 100,000
1992 rank
1997 rank
1 Maternal & neonatal
2 Other non-communicable
3 Cardiovascular diseases
4 Respiratory infections & TB
5 Other infectious
6 Unintentional inj
7 Enteric infections
8 Transport injuries
9 Neoplasms
10 Digestive diseases
1 Maternal & neonatal
2 Other non-communicable
3 Cardiovascular diseases
4 Respiratory infections & TB
5 Unintentional inj
6 Transport injuries
7 Enteric infections
8 Other infectious
9 Neoplasms
10 Digestive diseases
Libya
Both sexes, <5 years, Deaths per 100,000
1997 rank
2002 rank
1 Maternal & neonatal
2 Other non-communicable
3 Cardiovascular diseases
4 Respiratory infections & TB
5 Unintentional inj
6 Transport injuries
7 Enteric infections
8 Other infectious
9 Neoplasms
10 Digestive diseases
1 Maternal & neonatal
2 Other non-communicable
3 Cardiovascular diseases
4 Respiratory infections & TB
5 Unintentional inj
6 Transport injuries
7 Enteric infections
8 Other infectious
9 Neoplasms
10 Digestive diseases

(b)


Libya
Both sexes, <5 years, Deaths per 100,000
2002 rank
2007 rank
1 Maternal & neonatal
2 Other non-communicable
3 Cardiovascular diseases
4 Respiratory infections & TB
5 Unintentional inj
6 Transport injuries
7 Enteric infections
8 Other infectious
9 Neoplasms
10 Digestive diseases
1 Maternal & neonatal
2 Other non-communicable
3 Cardiovascular diseases
4 Unintentional inj
5 Respiratory infections & TB
6 Transport injuries
7 Neoplasms
8 Enteric infections
9 Other infectious
10 Digestive diseases
Libya
Both sexes, <5 years, Deaths per 100,000
2007 rank
2012 rank
1 Maternal & neonatal
2 Other non-communicable
3 Cardiovascular diseases
4 Unintentional inj
5 Respiratory infections & TB
6 Transport injuries
7 Neoplasms
8 Enteric infections
9 Other infectious
16 Self-harm & violence
1 Maternal & neonatal
2 Other non-communicable
3 Cardiovascular diseases
4 Unintentional inj
5 Self-harm & violence
6 Respiratory infections & TB
7 Transport injuries
8 Neoplasms
9 Other infectious
10 Enteric infections

(c)

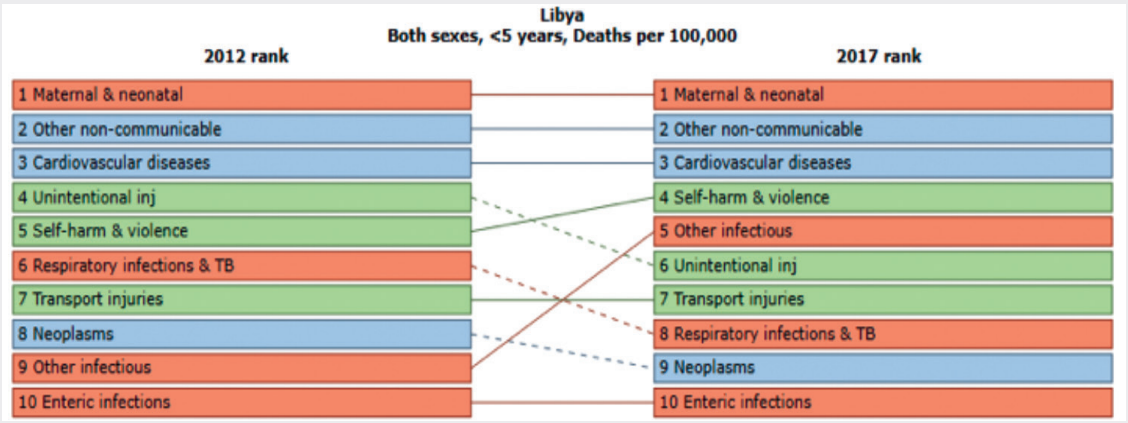
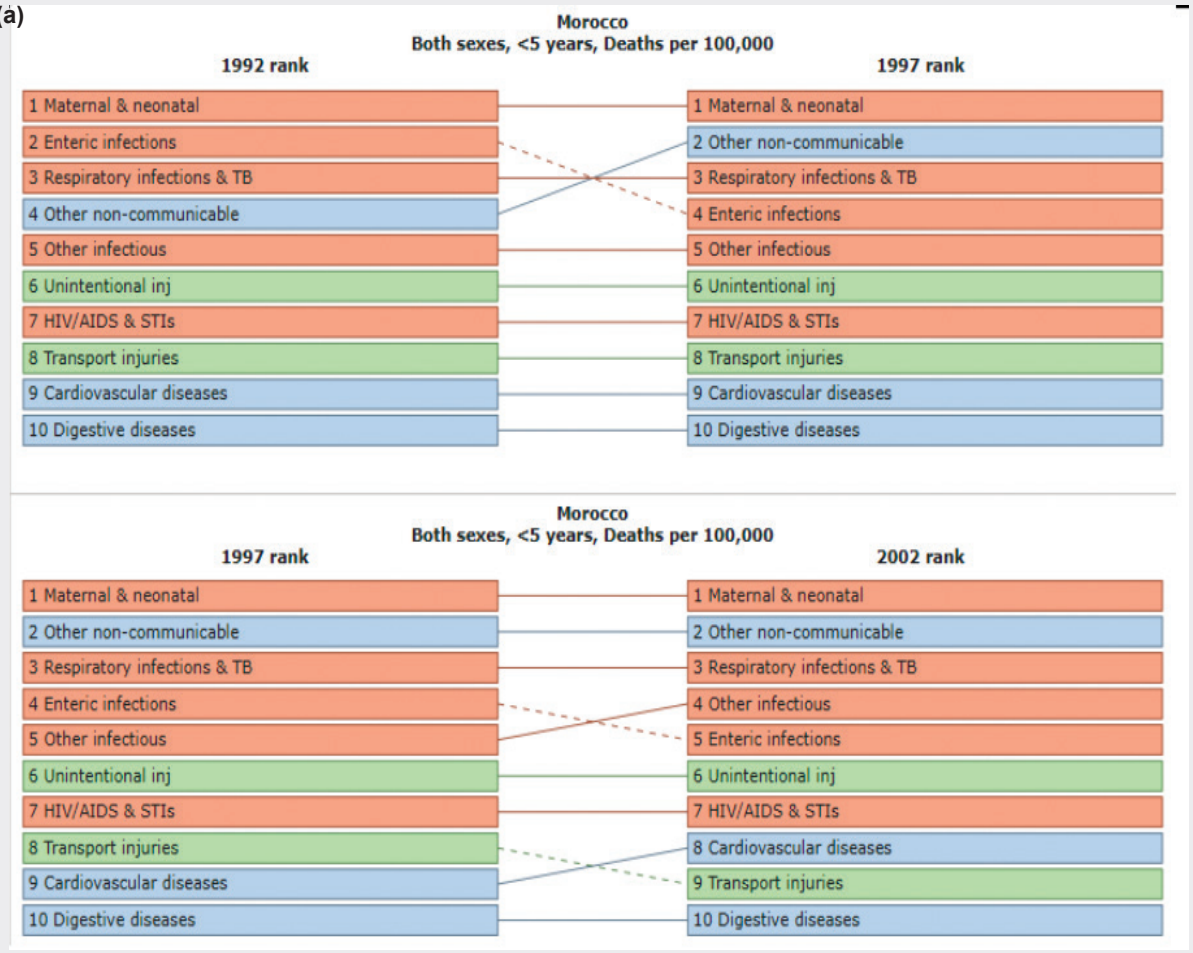
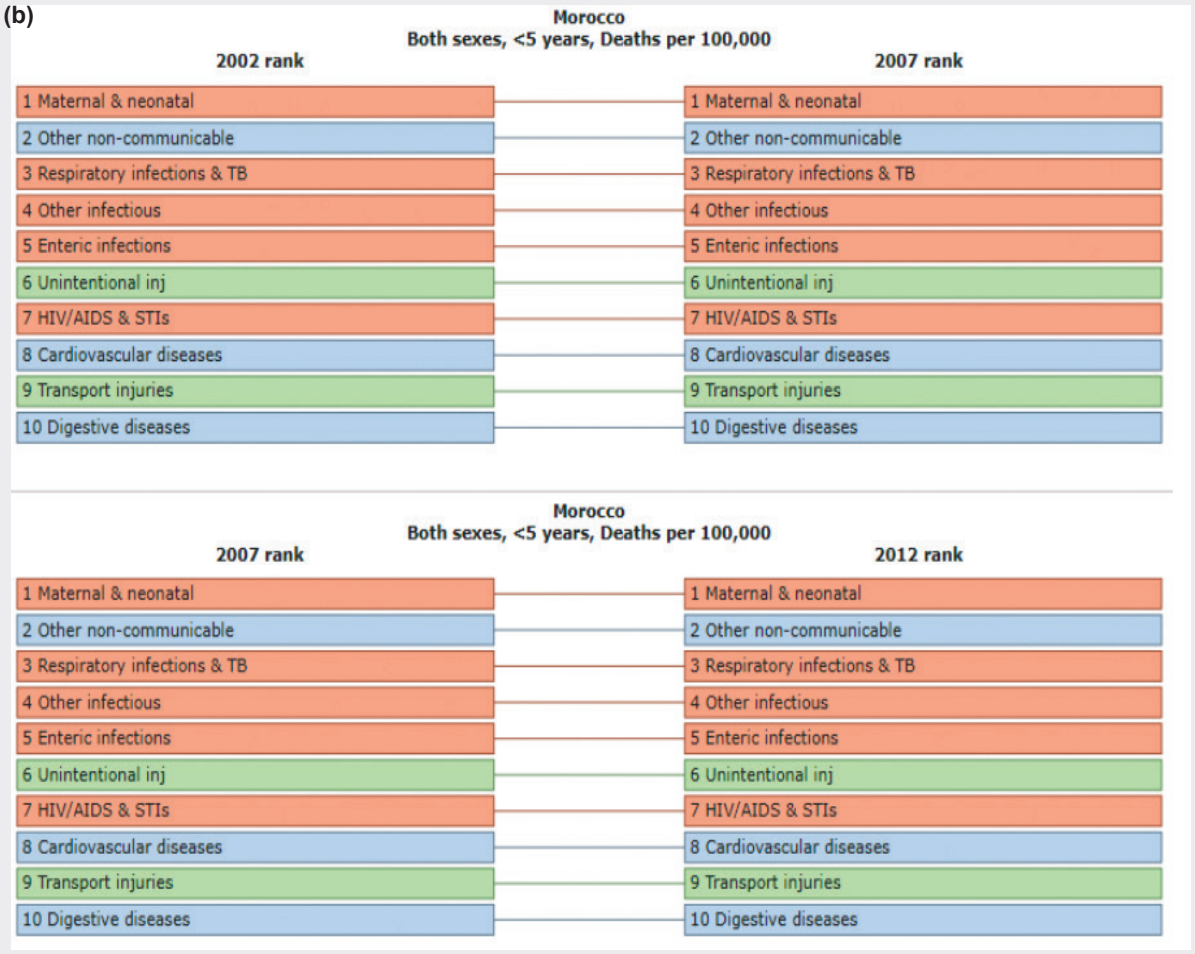


Figure 6. Top 10 causes of death for Libyan children under 5 years old for both sexes, (a): during 1992-1997 and 1997-2002, (b): during 2002-2007 and 2007-2012, (c): during 2012-2017 (GBD 2017)

(a)





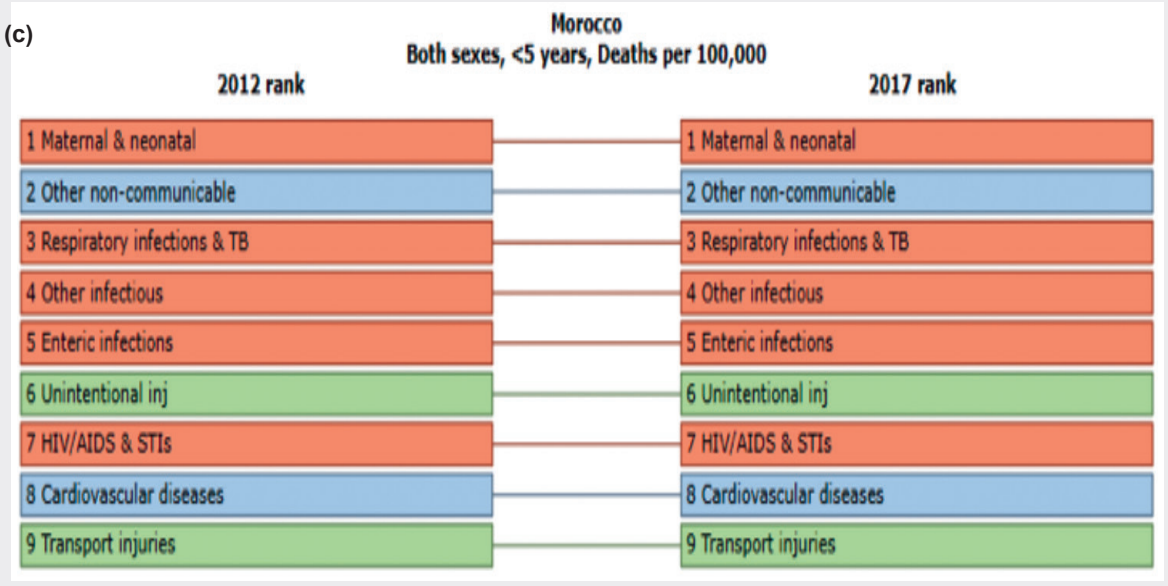
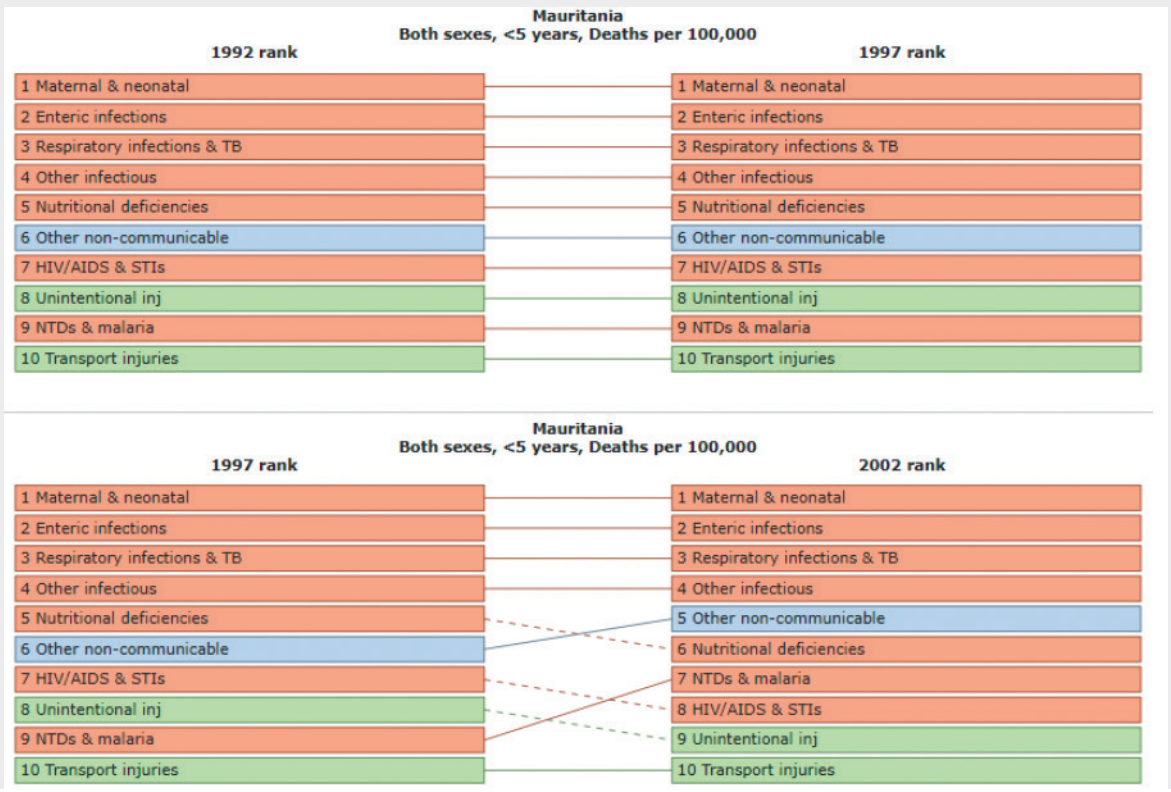
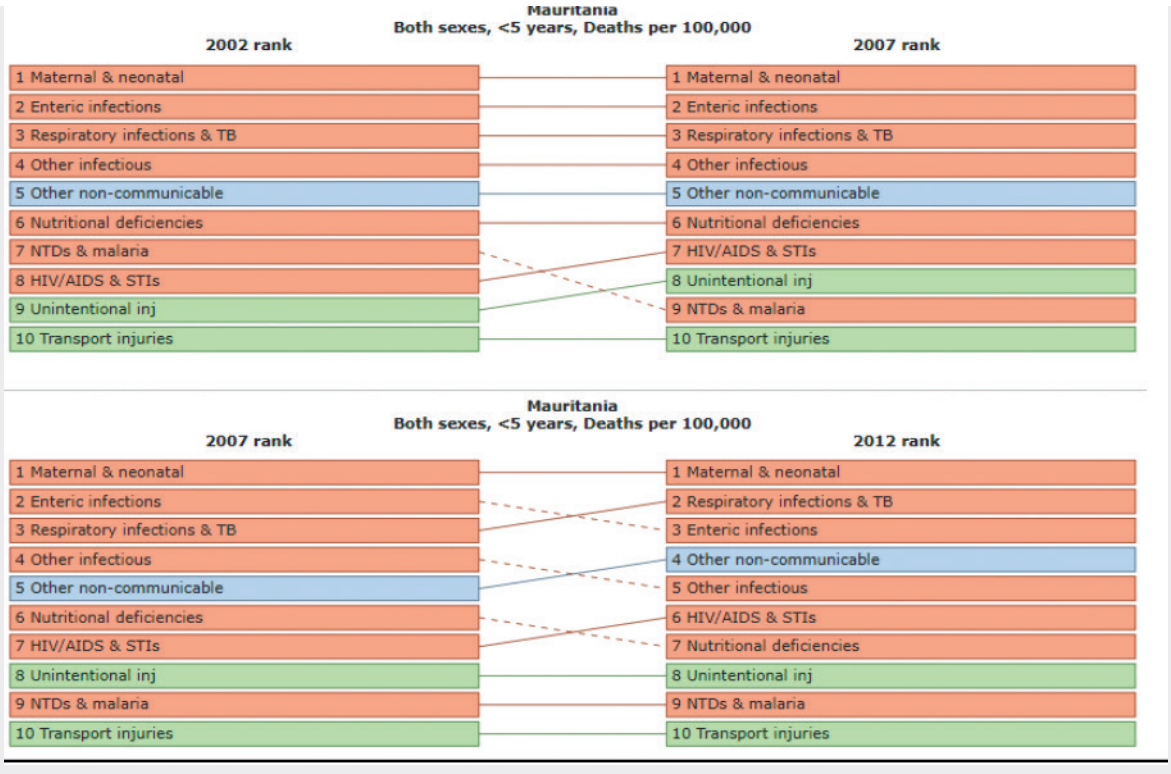


Figure 7. Top 10 causes of death for Moroccan children under 5 years old for both sexes, (a): during 1992-1997 and 1997-2002, (b): during 2002-2007 and 2007-2012, (c): during 2012-2017 (GBD 2017)

(a)


Mauritania
Both sexes, <5 years, Deaths per 100,000
1992 rank
1997 rank
1 Maternal & neonatal
2 Enteric infections
3 Respiratory infections & TB
4 Other infectious
5 Nutritional deficiencies
6 Other non-communicable
7 HIV/AIDS & STIs
8 Unintentional inj
9 NTDs & malaria
10 Transport injuries
Mauritania
Both sexes, <5 years, Deaths per 100,000
1997 rank
2002 rank
1 Maternal & neonatal
2 Enteric infections
3 Respiratory infections & TB
4 Other infectious
5 Nutritional deficiencies
6 Other non-communicable
7 HIV/AIDS & STIs
8 Unintentional inj
9 NTDs & malaria
10 Transport injuries
5 Other non-communicable
6 Nutritional deficiencies
7 NTDs & malaria
8 HIV/AIDS & STIs
9 Unintentional inj

(b)


Mauritania
Both sexes, <5 years, Deaths per 100,000
2002 rank
2007 rank
1 Maternal & neonatal
2 Enteric infections
3 Respiratory infections & TB
4 Other infectious
5 Other non-communicable
6 Nutritional deficiencies
7 NTDs & malaria
8 HIV/AIDS & STIs
9 Unintentional inj
10 Transport injuries
7 HIV/AIDS & STIs
8 Unintentional inj
9 NTDs & malaria
Mauritania
Both sexes, <5 years, Deaths per 100,000
2007 rank
2012 rank
1 Maternal & neonatal
2 Enteric infections
3 Respiratory infections & TB
4 Other infectious
5 Other non-communicable
6 Nutritional deficiencies
7 HIV/AIDS & STIs
8 Unintentional inj
9 NTDs & malaria
10 Transport injuries
2 Respiratory infections & TB
3 Enteric infections
4 Other non-communicable
5 Other infectious
6 HIV/AIDS & STIs
7 Nutritional deficiencies

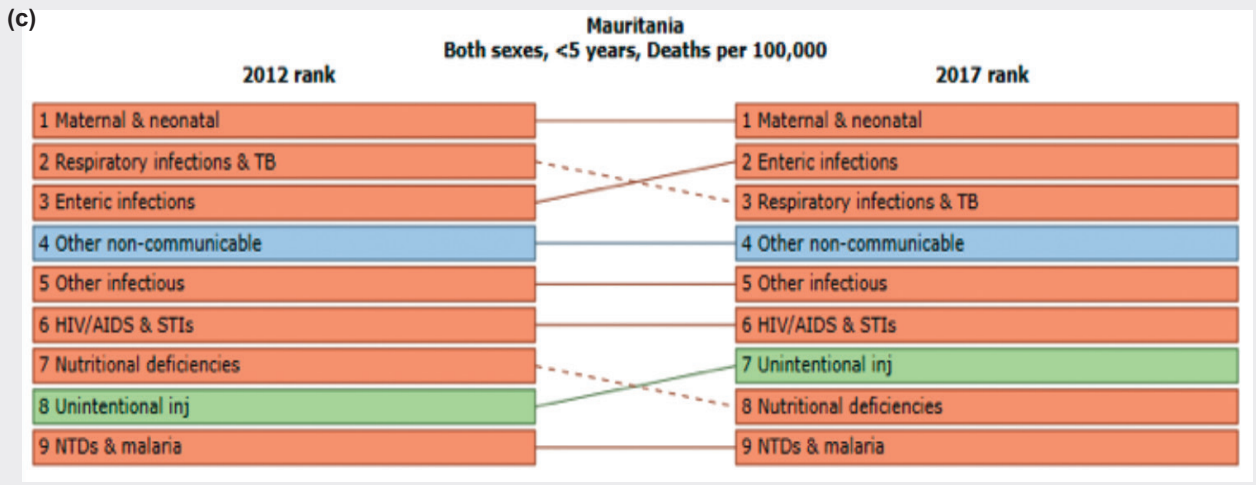


Figure 8. Top 10 causes of death for Mauritanian children under 5 years old for both sexes, (a): during 1992-1997 and 1997-2002, (b): during 2002-2007 and 2007-2012, (c): during 2012-2017 (GBD 2017)

DISCUSSION

In this study, data extracted from the Global Burden of Diseases, Injuries, and Risk Factors Study (GBD 2017) clearly shows a decrease of the annual total rate of deaths for children under five across the five Maghreb countries (fig 1). This change downward was estimated to be more than 50% as it is shown in (table I) (Algeria: 37 to 14 , Tunisia: 38 to 9, Libya 28 to 7, Morocco: 57 to 17 and Mauritania: 67 to 34) from 1990 up to 2017 following the global trend in the world (3) (4).

This fall of death rates in this age-specific range can be explained by the decrease in the global number of deaths due to preventable causes, especially of infectious origin (communicable diseases), this change has been also described in the adult population, actually, and since 1990, cardiovascular diseases have consistently been the leading cause of death in Algeria, Tunisia and Morocco. During the period 1990-2016, and at varying speeds, the positions of communicable and neonatal diseases declined, while non communicable diseases (particularly cardiovascular diseases, cancers, mental disorders, diabetes and neurological disorders) increased significantly, to be at the top of the list of components of the global burden of disease In 2016 (8).

Unfortunately, recent evidence reveals uneven trends in the reduction of child mortality rates in low- and middle-income countries across specific population subgroups: by sex and by wealth status, with absolute disparities in mortality declining between the poorest and richest households (9). Children face widespread regional and income disparities in their chances of survival and Sub-Saharan Africa continues to be the region with the highest under-five mortality rate in the world – 76 deaths per 1,000 live births in 2017. This translates to 1 child in 13 dying before his or her fifth birthday – 14 times higher than the average ratio of 1 in 185 in high-income countries and 20 times higher than the ratio of 1 in 263 in the region of Australia and New Zealand (4). These deaths reflect the limited access of children, especially in developing countries, to basic health interventions such as vaccination, medical treatment and adequate nutrition.

Among the five Maghreb countries, Mauritania presents the highest deaths' rate in the Maghreb region: according to the GBD, Mauritania is considered as a country of the a sub-Saharan region in Africa, and the situation there remains unsatisfactory (10)boys are more likely to die than girls. The detection of gender bias requires knowing the expected relation between male and female mortality rates at different levels of overall mortality without discrimination.

Specifically, sex-specific mortality rate (U5MR.

Specifically, sex-specific mortality in the Maghreb under-5 children is different; being more frequent in males than in females (fig 2). This sex-difference is seen worldwide with an estimated under-five mortality rate in 2017 of 41 deaths

per 1,000 live births for boys and 37 for girls (4). Reasons to this higher male mortality seem unknown (9) the same findings were reported in some developed countries like in the United Kingdom (in England and Wales) (11), and authors linked this sex-difference to accidents and violent deaths in adolescents and young adults but did not explain this difference for the under-5 age group.

In depth, most of deaths were occurring during the first year of life; and the early neonatal-age mortality remains a serious health-related problem in the hole Maghreb region like in many developing regions in the world (12-14). Similarly, in many developed countries with lower infant mortality compared to the Maghreb countries, the most affected age in the under-5 years mortality is the first year of life(12).

This increasing share of under-five deaths occurring during the neonatal period requires a greater focus. Deaths of newborns are the result of diseases and conditions that are associated with quality of care around the time of childbirth (4). Improving these conditions will likely contribute to lowering the mortality rate in this vulnerable pediatric population. We want to emphasize here the importance of breastfeeding (early initiated /exclusive for the first 6 months of life) and vitamin A supplementation during the first newborn days and in association with zinc for treatment of diarrhea to improve child health and survival (15).

Regarding the causes of under-5 mortality in Maghreb countries, the top-5 causes were similar (figures 4- 8); except in Mauritania where infectious diseases remain the leading under-5 mortality cause, like in other sub-Saharan countries (9). In fact, during 2017, the leading cause of under-5 child mortality for the hole Maghreb region was neonatal death: preterm birth and its complications is a major public health issue in the world and requires special attention from healthcare professionals as well as from political decision makers This phenomenon is closely linked to the living conditions of the dyad mother & child and the quality of premature newborns management during the first days of life.

The main other causes of under-5 child mortality for Algeria, Tunisia, Libya and Morocco were namely heart congenital defects, other congenital defects, respiratory infections and tuberculosis, diarrhea and neonatal asphyxia. In Mauritania, as previously specified, communicable diseases were the first reported causes. Recently, an outbreak of under-5 mortality was reported in Libya, directly tied to political unrest and war since 2011. As so, self-harm violence ranked as the fourth cause of death in Libyan under-5 years children.

CONCLUSION

Understanding comparative mortality rates and causes in the different Maghreb countries and how they are changing, has enormous implications for healthcare. Our results tracking mortality rates in the five Maghreb countries over 20 years, suggest that progress is being made in decreasing mortality rates; however, efforts have to be continued especially for the vulnerable age range of under 1 year by improving future mother healthcare and conditions of child birth. Special attention has to be given to Mauritania as one of sub Saharan countries where preventable causes of death are still at the top of the list. Ministries of health, non-governmental organizations, and civic society in the region need to ensure that child health receives the attention and resources needed to end preventable child deaths.

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