The first national rare disease registry in Libya: A step toward improving healthcare system, healthcare management and public health in Libya

Maryem E. Ismail, Muftah A. Elbahloul*
Faculty of Medicine, Misurata University, Misurata, Libya
Haider M. Elsaeh
National Center of Disease Control, Libya
Khadija A. Amer
Faculty of Health Sciences, Misurata University, Misurata, Libya
Ali E. Grera
Faculty of Medicine, University of Tripoli, Tripoli, Libya
Aziza I. Kadwar
Faculty of Medicine, University of Benghazi, Benghazi, Libya
Hussien A. Elaswdi
Faculty of Medicine, Misurata University, Misurata, Libya
*muftah@med.misuratau.edu.ly

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Abstract:

Background: Rare disease (RD) affects a small proportion of the population but collectively impose a significant healthcare burden. With over 10,000 rare conditions—80% of which are genetic—comprehensive data collection is essential. In Libya, a lack of centralized data and diagnostic infrastructure has limited understanding of disease prevalence and outcomes. **The aim** of this study was to establish the first national rare disease registry in Libya and provide an epidemiological overview of rare diseases to support healthcare planning and policy development. **Methodology:** This was a retrospective observational registry study conducted from March to November 2024. Data were collected from 625 patients across multiple healthcare centers in Libya using hospital records, clinical interviews, and genetic test results. **Results:** Of the 625 patients, 62.9% were male and 37.1% female, with the majority aged 5–14 years. The most prevalent disease categories were rare hematological (31.5%), neuromuscular and neurological (23.0%), and inborn errors of metabolism (20.3%). Sickle cell anemia (13.8%), Duchenne muscular dystrophy (8.6%), and cystic fibrosis (8.5%) were among the most frequently diagnosed

conditions. Statistically significant variations were observed across age groups, regions, and healthcare centers ($p < 0.001$). **Conclusion:** This first national rare disease registry in Libya highlights substantial regional and age-related disparities in disease distribution. It underscores the urgent need for improved diagnostic capabilities, targeted awareness, and decentralized specialized care.
Keywords: rare diseases, epidemiology, health policy, genetic disorders, Libya.

أول سجل وطني للأمراض النادرة في ليبيا: خطوة نحو تحسين نظام الرعاية الصحية وإدارة الرعاية الصحية والصحة العامة في ليبيا

د. مريم البشير إسماعيل، د. مفتاح عبد السلام البهلول*

كلية الطب البشري - جامعة مصراتة - ليبيا

د. حيدر مفتاح السائح

المركز الوطني لمكافحة الأمراض - ليبيا

أ. خديجة علي عامر

كلية العلوم الصحيّة - جامعة مصراتة - ليبيا

د. علي المهدي قريرة

كلية الطب - جامعة طرابلس - ليبيا

د. عزيزة عزالدين قضوار

كلية الطب البشري - جامعة بنغازي - ليبيا

أ.د. حسين علي العصودي

كلية الطب البشري - جامعة مصراتة - ليبيا

*muftah@med.misuratau.edu.ly

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الملخص:

الخلفية: تؤثر الأمراض النادرة (RD) على نسبة صغيرة من السكان ولكنها تفرض مجتمعة عبئًا كبيرًا على الرعاية الصحية. مع وجود أكثر من 10000 حالة نادرة –80% منها وراثية– فإن جمع البيانات الشاملة أمر ضروري. في ليبيا، أدى نقص البيانات المركزية والبنية التحتية للتشخيص إلى فهم محدود لانتشار المرض ونتائجه. كان الهدف من هذه الدراسة هو إنشاء أول سجل وطني للأمراض النادرة في ليبيا وتقديم نظرة عامة وبائية للأمراض النادرة لدعم تخطيط الرعاية الصحية ووضع

السياسات. **المنهجية:** كانت هذه دراسة سجل مراقبة بأثر رجعي أجريت من مارس إلى نوفمبر 2024م. تم جمع البيانات من 625 مريضًا من مراكز رعاية صحية متعددة في ليبيا باستخدام سجلات المستشفيات والمقابلات السريرية ونتائج الاختبارات الجينية. **النتائج:** من بين 625 مريضًا، كان 62.9% من الذكور و37.1% من الإناث، وتراوحت أعمار الأغلبية بين 5 و14 عامًا. كانت فئات الأمراض الأكثر انتشارًا هي أمراض الدم النادرة (31.5%)، والأمراض العصبية العضلية والعصبية (23.0%)، والأخطاء الخلقية في التمثيل الغذائي (20.3%). كان فقر الدم المنجلي (13.8%)، وضمور العضلات دوشين (8.6%)، والتليف الكيسي (8.5%) من بين أكثر الحالات تشخيصًا. ولوحظت اختلافات ذات دلالة إحصائية بين الفئات العمرية والمناطق ومراكز الرعاية الصحية (قيمة الاحتمال < 0.001). **الخلاصة:** يُبرز هذا السجل الوطني الأول للأمراض النادرة في ليبيا تفاوتات كبيرة بين المناطق وبين الفئات العمرية في توزيع الأمراض. ويُؤكد على الحاجة المُلحة لتحسين القدرات التشخيصية، والتوعية المُستهدفة، والرعاية التخصصية اللامركزية.

الكلمات المفتاحية: الأمراض النادرة، علم الأوبئة، السياسة الصحية، الاضطرابات الوراثية، ليبيا.

1. Introduction:

The lack of common definition of rare disease makes it challenging to calculate the total number and types of rare diseases in the world. It's frequently cited there are over 7000 rare diseases in total(Guo et al., 2021)(1). Although recently Rare diseases are defined as conditions that affect a small number of individuals within a population, typically characterized by a prevalence of fewer than 200,000 people in the U.S. or less than 5 per 10,000 in the European Union(Liaqat et al., 2024; Chojnacka et al., 2024). Collectively, these diseases impact a significant portion of the global population, with approximately 10,000 recognized rare diseases, 80% of which have genetic origins(Iyer et al., 2024).

Rare Disease Registries (RDRs) offer databases to enhance clinical and epidemiological knowledge, promoting patient-centered care. They provide a framework for monitoring treatment outcomes and improving healthcare practices(Guo, 2021). Registries can also support the identification of patients for clinical trials. As seen in the French National Rare Disease Registry(Subervie et al., 2024).While Data quality remains a significant issue, particularly in monogenic diseases, where accurate genetic information is crucial(Subervie et al., 2024). The RD-Connect project provided an integrated platform connecting databases, registries, biobanks, and clinical bioinformatics for RD research. This multidisciplinary project, which later gave rise to the RD-Connect Community, united partners from the EU and beyond to create an integrated global infrastructure in the field of RDs(RD-Connect Project, 2012).

Various national registries for rare diseases have been created (especially in North America and Europe) which could provide the basis for expanded international initiatives leading to more comprehensive and homogeneous data being collected(Mateus et al., 2017). It was statistically estimated that, in India, the rare disease and disorder population was 72,611,605 as per published data of national population census of 2011 or later(Mohanty et al., 2016), in Japan, there are approximately 300 projects conducting research on rare diseases supported by the Ministry of Health, Labour and Welfare of Japan (MHLW) and the Japan Agency for Medical Research and Development (AMED)(Furusawa et al., 2019), in Colombia ~ 3 million of patients are affected by rare diseases(Stanimirovic et al., 2019). and according to rough estimates, there are approximately 150,000 rare disease (RD) patients in Slovenia(Grant et al., 2023).

Although significant progress has been made in genomic diagnostics and resource development, challenges remain in establishing a comprehensive rare disease registry in the MENA region.

Various genetic service provisions and national-level programs have been implemented across the MENA region, though there is an imbalanced response to genetic disease burdens. More research and better monitoring of existing programs are needed to address these gaps(Radhakrishnan et al., 1988).

A study conducted in Benghazi, Libya from 1983 to 1986 identified several rare neurological diseases, including spinal muscular atrophy, myasthenia gravis, progressive supranuclear palsy, and subacute sclerosing pan encephalitis. The study highlighted the high frequency of hereditary motor neuropathy due to consanguineous marriages(Stanimirovic et al., 2019). In Misurata, Libya 2022, 57 patients were included in this study; 39 patients were male (68.4%) and 18 patients were females (31.6%) [M: F= 2.17:1] and the mean age at diagnosis was 1.9 years. Consanguinity was reported in 47 patients (82.5%), with family history being found in 71.9% of patients. 16 patients have mucopolysaccharidosis (28.1%), 11 patients have Glycogen storage diseases (19.3%),4 Nieman pick disease (7%), while the rest constitute the small molecular weight disease(Ismail et al., 2022).

Another study focused on neuromuscular disorders, reporting cases of Duchene's muscular dystrophy, limb-girdle muscular dystrophy, and Guillain-Barre Syndrome, among others. The prevalence rates were significant, with familial disorders being common due to genetic factors(Radhakrishnan et al., 1987).

A rare disease registry would integrate data from various sources, providing a comprehensive knowledge base for researchers and healthcare providers. This system would improve the efficiency of diagnosing rare diseases and facilitate

the sharing of case data(Lu et al., 2022). Registries are essential for clinical research, allowing for the assessment of long-term treatment outcomes and the development of treatment algorithms. They also help in understanding the demographic-specific prevalence of diseases(Deliverska, 2016).

This study aims to establish the first national rare disease registry in Libya, providing a comprehensive epidemiological analysis of rare diseases within the population. By examining demographic patterns, regional variations, and healthcare access disparities, the research seeks to enhance understanding of disease distribution and support the development of targeted healthcare policies, improved diagnosis, and specialized treatment strategies.

Despite growing global efforts to document rare diseases, there remains a lack of systematic epidemiological data on their distribution in Libya. Existing studies focus on individual diseases or regional analyses, with insufficient evidence on demographic variations, healthcare accessibility, and disease classification. This study addresses these gaps by introducing a national registry, facilitating structured data collection, and informing future healthcare initiatives for rare disease management.

Establishing a structured national registry with standardized diagnostic and treatment guidelines will enhance rare disease management in Libya. Integrating the registry with international databases will facilitate research collaborations and improve diagnostic capabilities. Expanding specialized medical centers and training healthcare professionals will strengthen patient care and resource allocation.

2. Materials and methods:

2.1 Study Design and population.

This study is a retrospective observational registry aimed at collecting and analyzing data on rare diseases in Libya. The study included 625 patients, categorized by demographic characteristics, disease classification, and regional distribution. Data were collected from medical records and patient registries across multiple healthcare centers.

Patients included in the registry met the following criteria:

- Confirmed diagnosis of a rare disease based on **Orphanet criteria**.
- Inclusion of suspected cases based on clinical and genetic findings.
- Libyan nationals or residents seeking medical care within Libya.
- Patients of all age groups and genders.
- Written informed consent obtained from patients or legal guardians.

Exclusion criteria:

- Patients with incomplete medical records.
- Cases lacking diagnostic confirmation by a qualified specialist.

2.2 Data Collection.

Patient data were collected from [hospitals, genetic clinics, tertiary care centers, specialized departments] across Libya between [17/03/2024] and [17/11/2024]. Information was gathered through:

- Electronic health records (EHRs) and hospital databases.
- Clinical interviews with patients and their families.
- Genetic and laboratory test results, when available.

Collected data included:

1. Demographics: Age, gender, geographic distribution.
2. Diagnosis: Genetic tests, imaging, laboratory findings.
3. Treatment & Management: Medications, surgical interventions, follow-up care.

2.3 Ethical Considerations.

- Approval was obtained from the [Institutional Review Board (IRB)/Ethical Committee] of [national center for disease control].
- Written informed consent was secured from all participants or legal guardians.
- Patient confidentiality was maintained following Helsinki Declaration guidelines and local regulations.

2.4 Data Analysis.

All statistical analyses were conducted using SPSS (Statistical Package for the Social Sciences) software. Descriptive statistics, including frequencies and percentages, were used to summarize categorical variables such as sex distribution, disease categories, and regional distribution.

Chi-square (χ^2) tests were applied to assess the association between categorical variables, including the relationship between sex and age distribution, disease categories across different regions, and disease classification among healthcare centers. A p-value of <0.05 was considered statistically significant.

The age distribution was analyzed across four groups (up to 5 years, >5–14 years, >14–18 years, and >18 years) to determine whether certain diseases were more prevalent in specific age ranges. Additionally, the distribution of disease categories across regions and healthcare centers was assessed to identify geographic patterns of rare disease occurrence.

The results of the statistical analysis were interpreted to identify significant trends, disparities, and associations in disease prevalence, contributing to a deeper understanding of the epidemiological patterns within the studied population.

3. Results:

Table (1): General characteristics of the studied group

Sex	Specification	Age groups				Total
		Up to 5 years	> 5 years - 14Years	> 14 Years - 18 Years	> 18 Years	
Male	Count	85	161	47	100	393
	% within sex	21.6%	41.0%	12.0%	25.4%	100.0%
	% within age groups	62.5%	60.5%	70.1%	64.1%	62.9%
	% of Total	13.6%	25.8%	7.5%	16.0%	62.9%
Female	Count	51	105	20	56	232
	% within sex	22.0%	45.3%	8.6%	24.1%	100.0%
	% within age groups	37.5%	39.5%	29.9%	35.9%	37.1%
	% of Total	8.2%	16.8%	3.2%	9.0%	37.1%
Total	Count	136	266	67	156	625
	% within sex	21.8%	42.6%	10.7%	25.0%	100.0%
	% within age groups	100.0%	100.0%	100.0%	100.0%	100.0%
	% of Total	21.8%	42.6%	10.7%	25.0%	100.0%

Table (2): Disease category among the studied group

No	Disease category	Frequency	Percent
1	Rare hematological disease	197	31.5
2	Rare inborn error of metabolism	127	20.3
3	Rare neuromuscular and neurological disease	144	23.0
4	Rare respiratory disease	54	8.6
5	Rare GIT/hepatic disease	6	1.0
6	Rare bone disease	24	3.8
7	Rare skin disorder	26	4.2
8	Rare rheumatic and immunology disease	27	4.3
9	Rare endocrine	3	.5
10	Rare ophthalmic disorder	4	.6
11	others	13	2.1
Total		**625**	**100.0**

Table (2) shows disease category among the studied group. Among the studied patients, rare hematological diseases were the most frequently observed category (31.5%), followed by rare neuromuscular and neurological diseases (23.0%) and rare inborn errors of metabolism (20.3%). The distribution of

disease categories was found to be highly significant (χ^2= 797.098, p –value <0.000).

Table (3): The disease classification among the studied group

No	Disease classification	Frequency	Percent
1	Hemophilia	45	7.2
2	Sickle cell anemia	86	13.8
3	Thalassemia	12	1.9
4	Organic academia	14	2.2
5	Aminoacidopathy	45	7.2
6	Niemann-Pick disease A\B	10	1.6
7	Duchen muscular dystrophy	54	8.6
8	Cystic Fibrosis	53	8.5
9	Osteogensis imperfecta	11	1.8

When analyzing specific disease types, sickle cell anemia was the most prevalent condition (13.8%), followed by Duchenne muscular dystrophy (8.6%) and cystic fibrosis (8.5%). Hemophilia and aminoacidopathy each accounted for 7.2% of cases. The chi-square analysis confirmed a highly significant variation in disease distribution (p χ^2= 3301, p -value = .000). (Table 3)

Table (4): Disease category among the region of birth

Disease category	Region of birth							Total
	Tripoli	Western	Central	Southern	Eastern	Benghazi	others	
Rare Hematological Disease	49	11	17	83	8	24	5	197
Rare Inborn Error Of Metabolism	41	14	45	9	5	12	1	127
Rare Neuromuscular And Neurological Disease	47	16	12	23	12	31	3	144
Rare Respiratory Disease	31	16	0	1	2	3	1	54
Rare GIT/Hepatic Disease	1	1	0	1	3	0	0	6
Rare Bone Disease	5	2	10	1	4	1	1	24
Rare Skin Disorder	5	1	11	0	1	8	0	26
Rare Rheumatic And Immunology Disease	12	1	4	0	1	9	0	27
Rare Endocrine	0	0	0	0	0	2	1	3
Rare Ophthalmic Disorder	0	0	0	0	0	4	0	4
Others	6	1	2	0	0	2	2	13
Total	197	63	101	118	36	96	14	625

Table (4) shows the disease category among the region of birth. The majority of disease category among the s region of birth was in Tripoli (about 197patients). And that was highly significant (χ^2= 317.862, p-value = .000).

Table 5: **Disease category among the region of residence**

Disease category	Region residence						Total
	Tripoli	Western	Central	Southern	Eastern	Benghazi	
Rare hematological disease	63	12	20	71	5	26	197
Rare inborn error of metabolism	39	13	46	11	5	13	127
Rare neuromuscular and neurological disease	49	16	12	22	12	33	144
Rare respiratory disease	37	14	0	1	0	2	54
Rare GIT/hepatic disease	1	1	0	1	3	0	6
Rare bone disease	5	2	11	1	4	1	24
Rare skin disorder	4	2	11	0	0	9	26
Rare rheumatic and immunology disease	12	1	4	0	1	9	27
Rare endocrine	1	0	0	0	0	2	3
Rare ophthalmic disorder	0	0	2	0	0	2	4
Others	6	1	2	0	0	4	13
Total	**217**	**62**	**108**	**107**	**30**	**101**	**625**

The majority of disease category among the s region of birth was in Tripoli (about 217patients) and that was highly significant (χ^2= 266.888, p- value = .000) (table 5).

Table (6): disease category among the different age group

Disease Category	age groups				Total
	Up to 5 years	> 5 years - 14Years	> 14 Years - 18 Years	> 18 Years	
Rare hematological disease	24	86	21	66	197
Rare inborn error of metabolism	46	58	5	18	127
Rare neuromuscular and neurological disease	25	58	24	37	144
Rare respiratory disease	19	21	11	3	54
Rare GIT/hepatic disease	0	4	0	2	6
Rare bone disease	5	14	1	4	24
Rare skin disorder	6	13	1	6	26
Rare rheumatic and immunology disease	6	7	2	12	27
Rare endocrine	0	2	1	0	3
Rare ophthalmic disorder	0	0	0	4	4
others	5	3	1	4	13
Total	**136**	**266**	**67**	**156**	**625**

The majority of disease category among the age groups was between (> 5 years - 14Years) (about 266 patients) and that was highly significant (χ^2= 93.738, p- value = .000) (table 6).

Table (7): disease category among the Centre of management

Disease category	Centre					Total
	Tripoli	Benghazi	Misrata	Sabha	Kufra	
Rare hematological disease	71	23	24	71	8	197
Rare inborn error of metabolism	49	9	61	7	1	127
Rare neuromuscular and neurological disease	63	45	14	22	0	144
Rare respiratory disease	51	2	0	1	0	54
Rare GIT/hepatic disease	1	3	1	1	0	6
Rare bone disease	5	5	14	0	0	24
Rare skin disorder	4	10	12	0	0	26
Rare rheumatic and immunology disease	12	7	5	0	3	27
Rare endocrine	1	0	0	0	2	3
Rare ophthalmic disorder	0	2	2	0	0	4
others	7	4	2	0	0	13
Total	**264**	**110**	**135**	**102**	**14**	**625**

The majority of disease category among the Centre of management was Tripoli (about 264 patients) and that was highly significant (χ^2= 344.952, p-value = .000) (table 7).

Table (8): disease classification among the region of birth

Disease Classification	Region Birth							Total
	Tripoli	Western	Central	Southern	Eastern	Benghazi	others	
Hemophilia	26	6	6	2	0	3	2	45
Sickle cell anemia	0	1	1	74	5	3	2	86
Thalassemia	0	0	0	4	0	7	1	12
Aplastic anemia	6	0	1	1	0	1	0	9
Organic academia	7	0	7	0	0	0	0	14
Aminoacidopathy	21	1	7	6	3	7	0	45
Niemann-Pick disease A\B	0	0	9	0	0	1	0	10
Duchen muscular dystrophy	14	5	4	19	5	6	1	54
Cystic Fibrosis	31	16	0	1	2	2	1	53
Osteogensis imperfecta	1	1	8	0	0	1	0	11
Total	**197**	**63**	**101**	**118**	**36**	**96**	**14**	**625**

Table (8) shows Disease Classification among the region. The majority of Disease Classification among the s region of birth was in distributed in different regions and that was highly significant (χ^2= 1790.155, p- value = .000). Table 9

shows Disease Classification among the region of residence. The majority of Disease Classification among the s region of residence was in distributed in different regions and that was highly significant = χ^2= 1604.586, p- value = .000

Table (9): disease classification among the region of residence

Disease Classification	Region Residence						Total
	Tripoli	Western	Central	Southern	Eastern	Benghazi	
Hemophilia	31	6	4	1	0	3	45
Sickle cell anemia	5	0	7	67	3	4	86
Thalassemia	5	0	0	0	0	7	12
Aplastic anemia	5	1	1	1	0	1	9
Organic academia	6	1	6	1	0	0	14
Aminoacidopathy	20	1	6	8	3	7	45
Niemann-Pick disease A\B	0	0	10	0	0	0	10
Duchen muscular dystrophy	14	5	4	19	5	7	54
Cystic Fibrosis	37	14	0	1	0	1	53
Osteogensis imperfecta	1	1	8	0	0	1	11
Total	**217**	**62**	**108**	**107**	**30**	**101**	**625**

Table (10): disease classification among the different age group

Disease Classification	Age Groups				Total
	Up to 5 years	> 5 years - 14Years	> 14 Years – 18 Years	> 18 Years	
Hemophilia	4	21	3	17	45
Sickle cell anemia	12	34	10	30	86
Thalassemia	2	4	2	4	12
Aplastic anemia	0	3	1	5	9
Organic academia	7	5	1	1	14
Aminoacidopathy	19	23	1	2	45
Niemann-Pick disease A\B	0	3	1	6	10
Duchen muscular dystrophy	8	27	10	9	54
Cystic Fibrosis	19	21	10	3	53
Osteogensis imperfecta	2	9	0	0	11
Total	**136**	**266**	**67**	**156**	**625**

Chi-Square = 539.395[a] p- value = .000

Table (10) shows Disease Classification among the different age group. Disease Classification was significantly affected by age groups (χ^2= 539, p-value = .000)**.**

Table (11): disease classification among the Centre of management

Disease Classification	Center					Total
	Tripoli	Benghazi	Misrata	Sabha	Kufra	
Hemophilia	32	1	9	1	2	45
Sickle cell anemia	7	3	5	67	4	86
Thalassemia	4	6	1	0	1	12
Aplastic anemia	6	1	1	1	0	9
Organic academia	7	0	7	0	0	14
Aminoacidopathy	23	4	12	6	0	45
Niemann-Pick disease A\B	0	0	10	0	0	10
Duchen muscular dystrophy	19	12	4	19	0	54
Cystic Fibrosis	51	1	0	1	0	53
Osteogensis imperfecta	0	1	10	0	0	11
Total	**264**	**110**	**135**	**102**	**14**	**625**

Table (11) shows Disease Classification among the Centre of management. Disease Classification was significantly affected by the healthcare facility (χ^2= 1314, 84, p-value = .000).

4. Discussion:

Libya, with an area of almost 1.8 million square kilometers (700,000 sq. mi) has multi ethnicity background. This study population comprised 625 patients. The prevalence of rare diseases is estimated to be between 6–8% (Subervie et al., 2024). This estimation is based on 5,000–8,000 rare diseases, whereas the current registry includes fewer than 2,000. Consequently, our study indicates a significant under-reporting of cases in which the documented prevalence has been estimated: 1.275 per 10,000 people per year (~943 new cases annually in 8 months' duration need for targeted healthcare resources and awareness. This scenario highlights the fact that Based on global prevalence estimates, between 442,590 to 590,435 rare disease cases in Libya may be undiagnosed or unrecorded. This highlights the significant gap in case identification and reporting, emphasizing the need for enhanced diagnostic and registry efforts.135 different diseases have been documented, with males constituting the majority (62.9%) and females accounting for 37.1%. Population characteristics are summarized in Table (1). The age distribution revealed that the largest proportion of cases (42.6%) belonged to the age group of >5–14 years, followed by >18 years (25%), up to 5 years (21.8%), and >14–18 years (10.7%). The chi-square test indicated no statistically significant association between sex and age distribution (p = 0.521), suggesting that the prevalence of rare diseases is independent of sex within different age categories.

The analysis of regional variation showed that the highest number of patients was from Tripoli; both in terms of birth region (31.5%) and residence (34.7%).

The chi-square test results (p = 0.000) suggest that the geographic distribution of patients is significantly non-uniform, with certain diseases clustering in specific regions. This finding highlights potential disparities in genetic factors, healthcare accessibility, or environmental influences that may contribute to the regional variations observed.

The most affected age group was >5–14 years, with 266 cases (42.6%), and this was statistically significant (p = 0.000). Rare hematological diseases were particularly prevalent among this group, indicating the need for early diagnostic and therapeutic interventions. Notably, certain conditions such as inborn errors of metabolism were more common in younger children, while neuromuscular diseases appeared to have a broader age distribution.

Tripoli was the predominant center for patient management (42.2%), followed by Misurata and Benghazi. This distribution may reflect regional disparities in healthcare infrastructure and specialized services for managing rare diseases. The chi-square results (p = 0.000) indicate a significant difference in disease prevalence across healthcare centers, underscoring the importance of decentralizing specialized care to improve access and equity in treatment.

In table (3) Documented prevalence of SCD in Libya: 0.116 per 10,000 people (~1.16 per 100,000). Compared to Global prevalence: Varies widely (0.2–3 per 10,000), with Libya's rate being lower than MENA averages (0.2–0.5 per 10,000)(Piel et al., 2013). While that Libya's CF prevalence (0.072 per 10,000) is on the lower end of the spectrum compared to many of its North African and Middle Eastern neighbors. Most of the neighboring countries, such as Tunisia, Algeria, and Saudi Arabia, have a higher prevalence (0.1–0.5 per 10,000)((Wang et al.). Documented DMD prevalence in Libya: 0.073 per 10,000 people (~0.73 per 100,000). In spite that the expected DMD prevalence in Libya (based on MENA average): ~0.3 per 10,000 (~3 per 100,000).

4.1. Public Heath implication.

Public health implications of rare diseases include a heavy economic burden on patients and society, severe effects on physical and mental health, decreased quality of life and social inclusion, and challenges for caregivers, education, and employment. Rare diseases, despite each being rare, collectively affect a large population, making them a significant global public health concern requiring increased awareness, improved diagnosis, equitable access to care, and policy support for affected individuals and families.

5. Conclusion:

This study underscores the significance of establishing a national Rare Disease (RD) registry in Libya as a pivotal step toward enhancing the healthcare system for individuals affected by rare diseases. The integration of a comprehensive RD registry, alongside the development of an ICT backbone for

the RD ecosystem, is essential for improving healthcare accessibility, optimizing the utilization of existing institutional resources, and ensuring targeted interventions.

6. Limitations:

Despite being the first initiative to systematically record rare diseases in Libya, this study encountered significant challenges, including under-reporting of cases. This was primarily attributed to the limited experience and knowledge of healthcare professionals regarding rare diseases. Additionally, the severe nature of many rare diseases, which often leads to poor outcomes and short-term survival despite appropriate management, contributed to the under-reporting. These limitations highlight the need for continuous education and training for healthcare providers, as well as enhanced awareness and reporting mechanisms to ensure comprehensive data collection in future iterations of the registry.

Authors' Contributions:

Conception and design: Muftah Abdulssalam Elbahloul, Maryem Elbashir

Collection and assembly of data: Maryem Elbashir Ismail, Haider Elsaeh

Drafting of the article: Khadija Ali Amer

Critical revision of the article for important intellectual content: Muftah Abdulssalam Elbahloul, Maryem Elbashir, Aziza I.Kadwar

Final approval of the article: Muftah Abdulssalam, Hussien A. Elaswdi, Ali Elmehdi Grera

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The authors declare no conflicts of interest.

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Rare diseases specification registered in Libya

No	Diagnosis
	Rare hematological disease
1	Hemophilia
2	Fanconi anemia
3	Sickle cell anemia
4	Thalassemia
5	Aplastic anemia
6	G6PD
7	hereditary spherocytosis
8	Protin c &s defecieny
9	Von willebrand disease
10	Protien C Deficieny
11	Hypofibrinogenemia
12	Thrombasthenia
13	factor V DEFECIENCY
14	Sideroblastic Anemia
15	factor Xlll deficiency
16	factor VII defeciency
17	FACTOR1 &5 DEFECIENCY
18	Refractory Iron Defaciency Anemia Defaciency
19	Sickle cell anemia + Thalassemia
20	Severe Thrombotic Microanglopathy
21	Rare inborn error of metabolism
22	Organic academia
23	Aminoacidopathy
24	Niemann-Pick disease A\B
25	Mucopolysaccharidosis type I
26	Mucopolysaccharidosis type II
27	Fabry Disease
28	Neuronal Ceroid Lipofuscinosis
29	Fanconi Syndrome
30	Niemann-Pik Typy C1
31	Wilson Disease
32	Multiple Mitochondrial Dysfunctions Syndrome 4
33	Gaucher Disease
34	Congenital Bile Acid Synthesis Deficiency Deficiency
35	Hyper Phosphetemia
36	Glucose_Galactos Malabsorption
37	Galactosemia
38	GM1 Gangliosidosis
39	pyrovate dehydrogenase defeciency

40	Leigh Syndrome
41	Glycogen Storage Disease Type I
42	Glycogen Storage Disease Type III
43	Mucopolysaccharidosis Type IV
44	Beta-Mannosidosis Is Possible
45	Primary Hyperoxaluria Type 1
46	Rare neuromuscular and neurological disease
47	Progressive cerbellar degeneration
48	Musculer Dystrophy
49	Duchen muscular dystrophy
50	Limb Girdle Muscular Dystrophy
51	Multiple Sclerosis
52	Amyotrophic Lateral Sclerosis
53	Tuberous Sclerosis
54	Spinal Muscular Atrophy due to homozygous deletion of exon 7 in SMN1
55	Neurofibromatosis
56	Becker muscular dystrophy
57	Press Disease
58	Cerebral Folate Deficiency
59	Charcot-Marie-Tooth Disease
60	Cerebral Atrophy
61	Fahr Disease
62	chppra-amiel-gordon syndrome
63	Early On Set Ataxia With Oculomotor Aprexia
64	Emery-Dreifuss Muscular Dreifuss
65	Bethlem Myopathy
66	Oxitativ phosphorylation mitochondria
67	Facioscapulohumeral Muscular Dystrophy
68	Myosin Storage Myopathy
69	Joubert syndrome
70	CAMRQ syndrome
71	RETT syndrome
72	cerebellar ataxia,mental retardation,and disequilibrium syndrome type 4
73	Central Core Disease
74	Congental Muscular Dystrophy
75	Infantile Neuroaxinal Dystrophy
76	Hereditary Spastic Paraplasia
77	Hereditary Sensory And Autonomic
78	Friedreich Ataxia
79	segawa syndrom

80	Coffin Siris Syndrome
81	Hereditary Motor Sensory Neuropathy Peripheral Neuropathy And Myopathy
82	Rare respiratory disease
83	Cystic Fibrosis
84	Primarily Ciliary Dyskinesia
85	Rare GIT/hepatic disease
86	Familial Adenomatous Polyposis
87	Primitive Sclerosing Cholangite
88	DUBIN-JOHNSON SYNDROME
89	Triple A syndrome
90	Rare bone disease
91	Osteogensis imperfecta
92	Chondrodysplasia Punctata
93	Cherubism
94	Progressive pseudorheumatoid dysplasia
95	Ollier Syndrome
96	Larsen Syndrome
97	Enchondromatosis
98	Osteopetrosis
99	Rare skin disorder
100	Epidermolysis Bullosa
101	Ichthyosis
102	Lipoid Protein Osis
103	Xeroderma Pigmentosum Groupe C
104	Congenital Anhidrosis
105	Anhydrotic Ectodermal Dysplasia
106	Incontinentia Pigmenti
107	Alopecia Universalis
108	ICTHIOSIS(change 7\92)
109	Keratitis-Ichthyosis-Deafness Syndrome(change 7\92)
110	Keratoderma Variabilis
111	Familial Keratosis Lichenoides Chronica
112	darier disease
113	Rare rheumatic and immunology disease
114	Wiskott-Aldrich syndrom
115	Familial Mediterranean Fever
116	Hereditary Angioedema
117	antiphospholipid syndrom
118	Behcet Disease
119	Sjogren's Syndrome
120	Ankylosing Sponalylitis

121	Neuromyelitis Optica
122	Imune-BARE Lymphocyte Syndrom Type Ll
123	Autoimmune Lymphoproliferative Syndrom Type I B
124	Anti-MOG syndrome
125	Gracile Syndrome Type 2
126	Myasthenia Gravis
127	Camptodactyly-Arthropathy-Coxa Vara-Pericarditis Syndrome
128	Rare endocrine
129	pseudo hypothyroidism
130	Congenital Adrenal Hyperplasia
131	Rare ophthalmic disorder
132	Congenital Glaucoma
133	Vogt-Koyanagi-Harada Syndrome
134	Bilateral Cons Dystrophy
135	others
136	Usher Sydrom
137	Marfan Syndrome
138	Cockayne Syndrome
139	Kartagener Syndrom
140	Prader will syndrome
141	Spermatogenic Failure Type 5
142	Corenella Delang Syndrome
143	Floating Harbor Syndrome
144	Takayasu's arteritis
145	Deficiency Chrom 16.'P12.21 Delayion Syndrome