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ORIGINAL ARTICLE

# Epidemiological factors of cholera in Gozo, Malta in 1837

Joseph Galea, Liberato Camilleri

The second world cholera pandemic reached Malta in early June 1837. It arrived on the island of Gozo one month later. The Health Board of this island installed to combat cholera recorded all the cases reported up to the end of August of the same year on a special register. This manuscript register still exists at the Gozo Public Library. It contains the minutes of the Gozo cholera board meetings that took place during June, July and August 1837 and includes a list of cholera patients including their names, their village or town of abode, the dates of diagnosis, the dates of recovery or death and if they were treated in hospital or at home. Fifteen percent of patients had their age recorded. There were 740 cholera cases registered with a total mortality from the disease of 47%. Using statistical analysis the study showed that patients treated in hospital were more likely to die than if they were treated at home but there was no relation of death to gender or location of abode.

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The second world cholera pandemic raged throughout Europe and North America between 1829 and 1849. It affected Russia in 1830, the United Kingdom in 1831, Marseille in 1835 and Naples and Sicily in the spring of 1837. By the summer of the same year, it had reached the Maltese shores, having already massacred 62 million people worldwide. The first cases of cholera in Malta were reported at the Ospizio in Floriana on 9 June 1837. The Government, belatedly appointed Committees of Health to deal with the consequences of the epidemic, cholera hospitals were opened in the cities and villages, directives issued, and healthcare workers and priests mobilized. The malady wreaked havoc for 3 months attacking 8785 and killing 4252 individuals. Many Maltese doctors feared contagion and would not attend the cholera hospital; however other Maltese doctors and a few British army and navy doctors did not believe in the contagion theory of cholera and gave their services caring for the sick and the dying.[1]

The first cases of certified cholera in Malta appeared at the Old People's Hospital (Ospizio) in Floriana on 9 June 1837 and, in the first 10 days, 200 inmates died from the disease. On 19 June, Governor Henry Frederick Bouverie (1783-1852) appointed a Central Health Committee on nine Maltese and English members to supervise the reported cases and deal with the cholera epidemic. The committee included the physicians of the Naval and Military Hospitals and the Police.

The dreadful news arriving from the main island led the inhabitants of Rabat, Gozo to plead with the Lieutenant Governor of the island Major C.A. Bayley C.M.G. to form a Committee of Health for Gozo and to adopt the same measures taken in Malta. The Gozo Committee met for the first time on 21 June 1837. The minutes from its meetings are found in a manuscript located at the Gozo Public Library in Victoria, Gozo.[2]

The Gozo *Comitato* was made up of Magistrate Giovanni Battista Schembri (as President), Mr James Somerville, Dr Eduardo Dingli, the Reverend Pro-Vicar Canon Fr. Publius Gauci, Father Guardian Pelagio, Dr Michel'Angelo Mizzi, Dr Eduardo Mallia, Dr Giuseppe Cutajar and Giovanni Montanaro. Dr Fortunato Mizzi served as the Committee Secretary keeping the minutes of the meetings.[3] It was decided that the Committee should meet every day at the Lieutenant Governor's Office in Rabat and at any hour of the day if this became necessary. It also had to forward a report of its deliberations and activities to the Lieutenant Governor of Gozo.

During the first meeting, regulations similar to those enacted by the sister committee in Malta were proposed and accepted:

1. From then on, the dead were to be buried in cemeteries and not in churches, with the exception of those individuals who had a private tomb. The burial had to be under *sette palmi di terra* plus the necessary quantity of *calcina* (lime mortar), and conducted in the presence of a Police Sergeant who was responsible to ensure that the burial was carried according to the regulations. If anybody wanted to use their personal burial plot, permission was necessary from the Health Committee – in the knowledge that this burial might be prohibited or controlled in case of cholera or suspected cholera, depending on what the committee decides in each particular circumstance.
2. The Lieutenant Police Officer of Rabat (Gozo) and the Deputy Lieutenants of the various villages were obliged to inform the committee of all the suspected cases and

deaths that occur in the districts they were responsible for. The parishes were prohibited from moving or interning the cadavers without prior written permission from the Committee of Health.

3. Every morning the medical practitioners were to report any cases in their care – which report was to be given immediately in cases of death or suspected cholera.
4. All church burials were to be well sealed.
5. Due to the current circumstances, the *Magistrato del Mercato* was requested to pay special attention about the state and quality of fish, cured meat and other alimentary items that were being sold to the public and to perform frequently the obligatory inspection accompanied by one of the medics appointed by the Committee for Health.

The register of reported cases included the name, date of diagnosis, whether they were hospitalized or managed at home, and the date of death or recovery. They were recorded consecutively using the date of diagnosis (figure 1).

## Incidence and Demography of the Epidemic

### Incidence

The first cholera case in Gozo occurred on 6 July 1837 and, by 31 August, 743 patients had been registered. The cases of cholera peaked between the 20-27 July 1837 and the register stops abruptly when the Committee was dissolved on 31 August (figure 2) during which period 743 cases of cholera had been recorded. In the beginning of 1837, the population of Gozo was recorded at 16 534 [4] giving an infection incidence of 4.5% of the Gozitan population.

Most patients were treated at home, but after the fifth week of the epidemic, the number of patients treated at home was the same as those treated in hospital. Both home and hospital treated patients peaked in the 3rd week (figure 3).

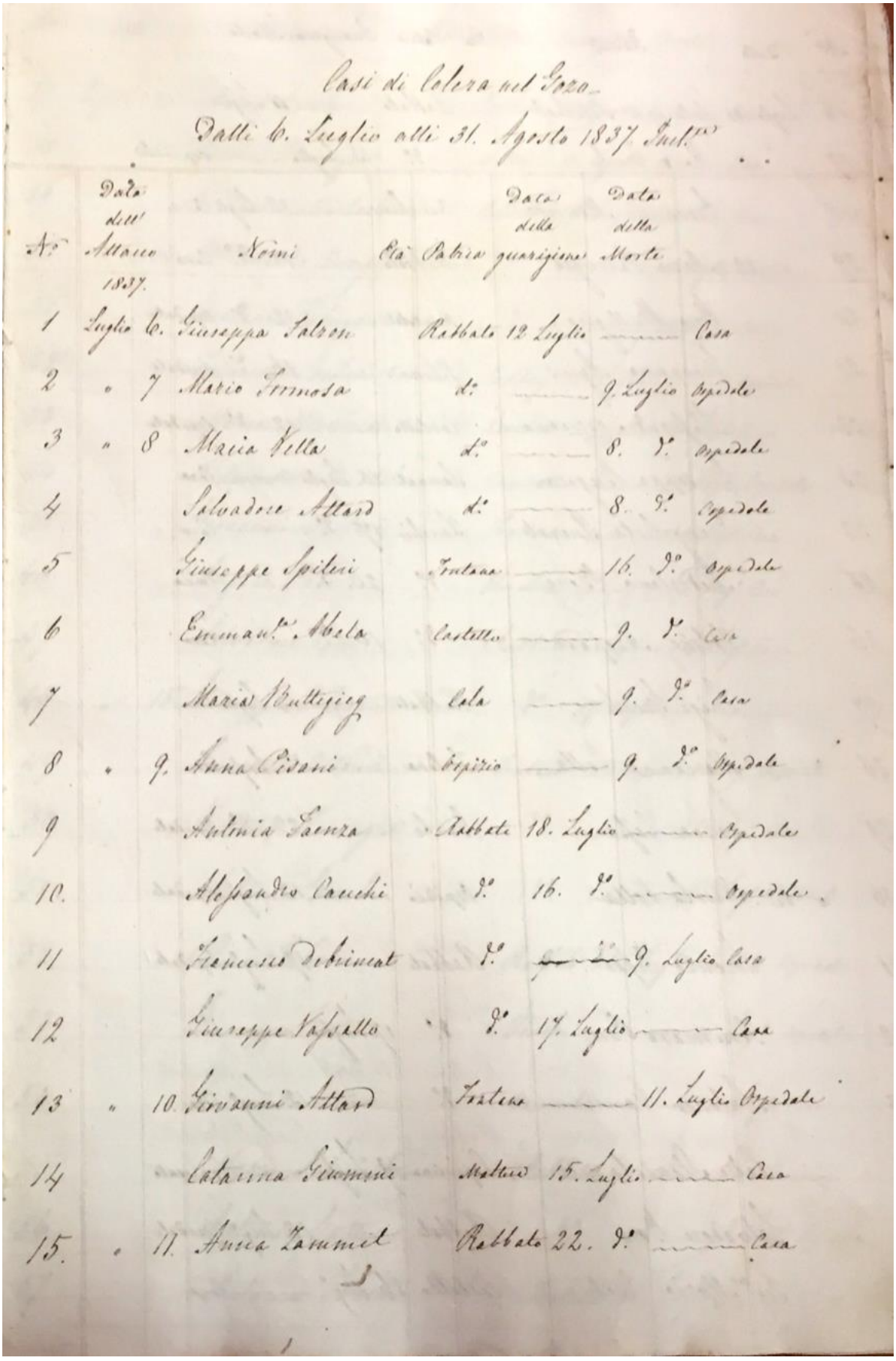
### Gender

Up to 31 August the number of females afflicted was 392 (53%) and that of males was 351 (47%). The female population of Gozo was 8377 (affliction rate of 4.7%) and the male population was 8157 (affliction rate of 4.3%). Females after correction for the population were affected more than males.

### Age

The age was not recorded in all patients, but using the data available in the register, it appears that the larger majority of infected cases were adults aged 21-60 years. (figure 4).

**Figure 1** The first 15 consecutive patients on the list of patients afflicted with cholera.



Casi di Colera nel Forzo

Dalli 6. Luglio alli 31. Agosto 1837 Inclusive

| N.° | Data dell'Attacco 1837. | | Nomi | Età | Patria | Data della guarigione | Data della Morte | |
|---|---|---|---|---|---|---|---|---|
| 1 | Luglio | 6. | Giuseppa Falzon | | Rabbato | 12 Luglio | ——— | Casa |
| 2 | " | 7 | Mario Formosa | | d.° | ——— | 9. Luglio | Ospedale |
| 3 | " | 8 | Maria Vella | | d.° | ——— | 8. d.° | Ospedale |
| 4 | | | Salvadore Attard | | d.° | ——— | 8. d.° | Ospedale |
| 5 | | | Giuseppe Spiteri | | Fontana | ——— | 16. d.° | Ospedale |
| 6 | | | Emmanu.l Abela | | Castello | ——— | 9. d.° | Casa |
| 7 | | | Maria Buttigieg | | Cola | ——— | 9. d.° | Casa |
| 8 | " | 9. | Anna Cesari | | Ospizio | ——— | 9. d.° | Ospedale |
| 9 | | | Antonia Farrugia | | Rabbato | 18. Luglio | ——— | Ospedale |
| 10. | | | Alessandro Caruchi | | d.° | 16. d.° | ——— | Ospedale |
| 11 | | | Francesco Debrincat | | d.° | ——— | 9. Luglio | Casa |
| 12 | | | Giuseppe Vassallo | | d.° | 17. Luglio | ——— | Casa |
| 13 | " | 10. | Giovanni Attard | | Fontana | ——— | 11. Luglio | Ospedale |
| 14 | | | Catarina Giommi | | Malta | 15. Luglio | ——— | Casa |
| 15. | " | 11. | Anna Zammit | | Rabbato | 22. d.° | ——— | Casa |

**Figure 2** Cases of cholera diagnosed in July and August of 1837.

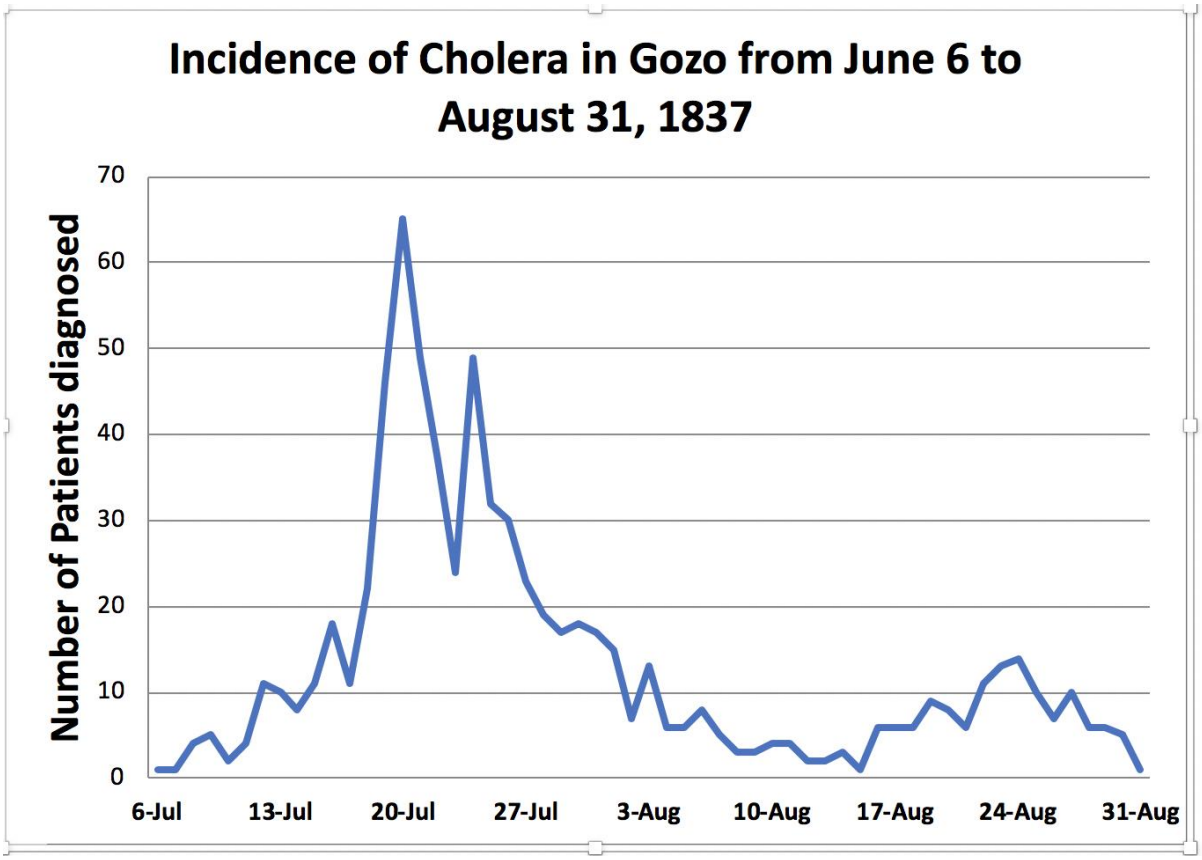



**Figure 3** The number of patients treated at home and in hospital during the cholera epidemic in Gozo.

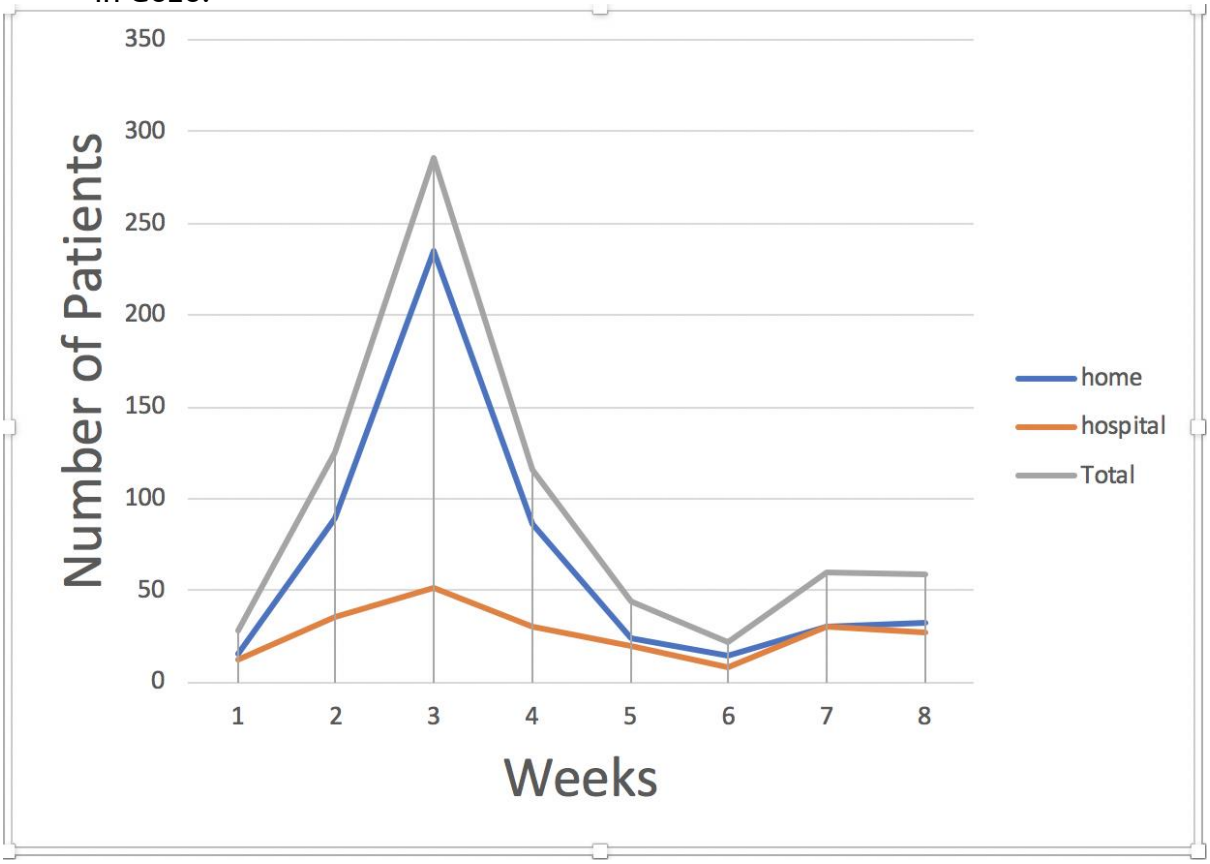


**Figure 4** The frequency of cholera patients for different age groups (*n*=96).

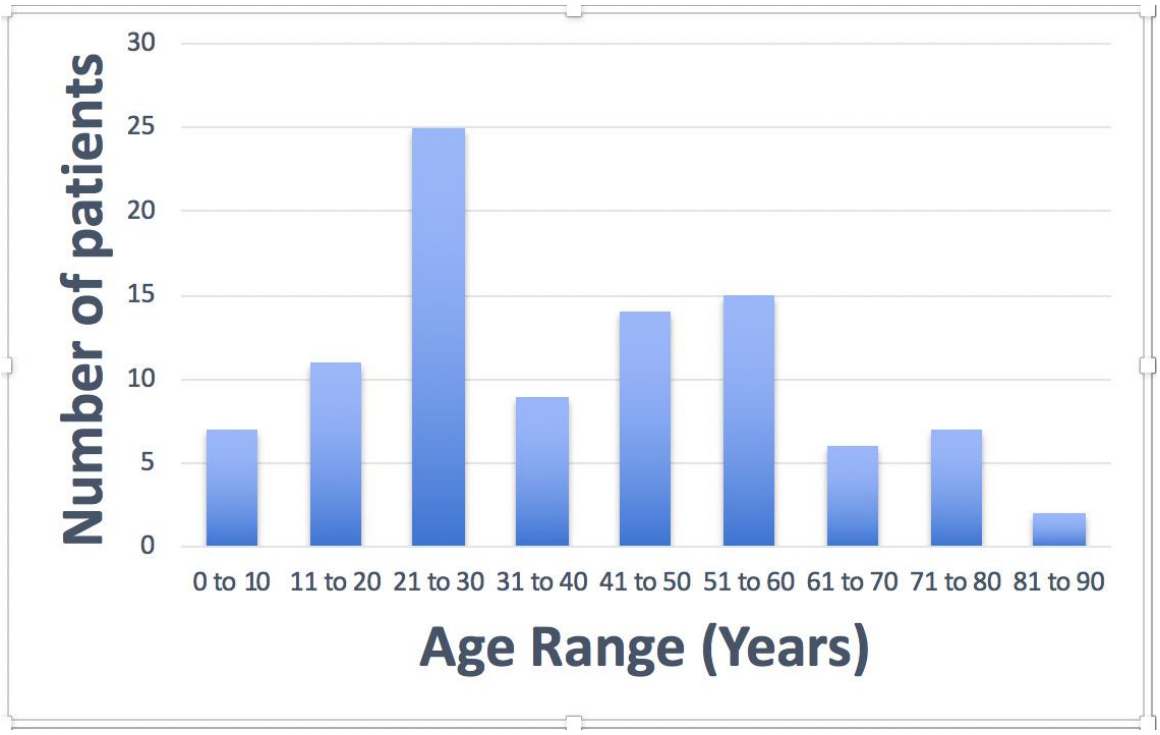



**Table 1** Location of Habitation of Cholera patients in Gozo for July and August 1837

| **Districts of Gozo** | **Cholera Cases** | **Population 1842 census[5]** |
|---|---|---|
| Rabat, Castello, Kercem and area* | 380 | 4904 (7.7)§ |
| Xagħra | 180 | 1720 (10.4) |
| Xewkija | 77 | 1391 (5.5) |
| Sannat and Munxar | 39 | 899 (4.3) |
| Żebbug and Għasri | 9 | 720 (1.25) |
| Nadur, Qala, Għajnsielem | 20 | 3295 (0.61) |
| Għarb | 4 | 1413 (0.28) |
| Ospizio and Ospedali civili | 15 | - |
| Others | 3 | - |

*Belliegħa (17), Għajn Qatet (7), Ħammimiet (1), Wied Sara (1), Wara s-Sur (1), Għammiesa (3) Għajn Tuta (2) Mandraġġ (1), Lunzjata (4), Ħamrija (8) u Fontana (41)

§ These percentages are only indicative because the cholera epidemic occurred 5 years earlier.

## Distribution in Towns and Villages

The distribution of cholera cases in Gozo shows the majority of patients to come from Rabat and its surrounding territories, Xagħra and Xewkija. The incidence of cholera in Għarb, Nadur, Qala, Għajnsielem was comparatively low. No information of population size by village for 1837 is available, however information is available from the first national census in 1842. Although the population size was different in 1842 compared to 1837, the 1842 population distribution provides a reasonable picture of regional habitations sizes which would have changed little in a five-year period of the mid-19$^{th}$ century. While the infection incidence per district cannot be worked accurately, an approximate indication is therefore possible using the 1842 census data. The highest incidence thus appeared to have occurred in Xagħra (at about 10.4%) followed by Rabat, Xewkija and Sannat (7.7%, 5.5%, and 4.3% respectively). Għarb has the lowest incidence (about 0.28%) but Nadur-Qala-Għajnsielem and Żebbuġ-Għasri also show a relatively low incidence (0.61% and 1.25% respectively) (table 1).

## Mortality from the Disease

Of all the infected cases, 345 (46.5%) patients succumbed to the disease while 395 (53.5%) survived up to end of August. Data from other sources show that the mortality rate for the three summer months (July- September) was 359 of 804 patients (44.6%).[6] The mortality rate registered in Gozo was therefore less than that registered in Malta, which stood at 3893 of 7981 (48.8%) infected individuals. Possible contributions to a better outcome of cholera patients in Gozo compared to Malta include the timely preparations taken by the Lieutenant Governor and the Committee before the epidemic attacked Gozo and cleaner air and water in Gozo.

## Mortality in Relation to the Place of Treatment (Home vs Hospital)

The duration of the illness, i.e. whether it ended in recovery or death, was also recorded in the register. The data from the registry shows that the mean duration of illness for survivors was 7.8 days (n= 393, SD 4.05, SEM 0.20) and for the deceased was 2.5 (n= 346, SD 2.08, SEM 0.11). During their treatment 71.4% of the cholera patients remained at home, while the remaining 28.6% of the patients were sent for management to hospital. The crosstab shows a larger percentage of cholera patients treated in hospital who eventually died (64.0%) when compared to those who were treated at home (39.5%). This percentage difference is significant (Table 2).

The survival plot (figure 5) shows that the survival probability for the cholera patients in hospital is lower than their counterparts who stayed at home. The Log-Rank test shows that the survival distributions of the two groups of cholera patients whose convalescence period was at home or in hospital differ significantly since the p-value (approximately 0) is less than the 0.05 level of significance.

## Residence Locality

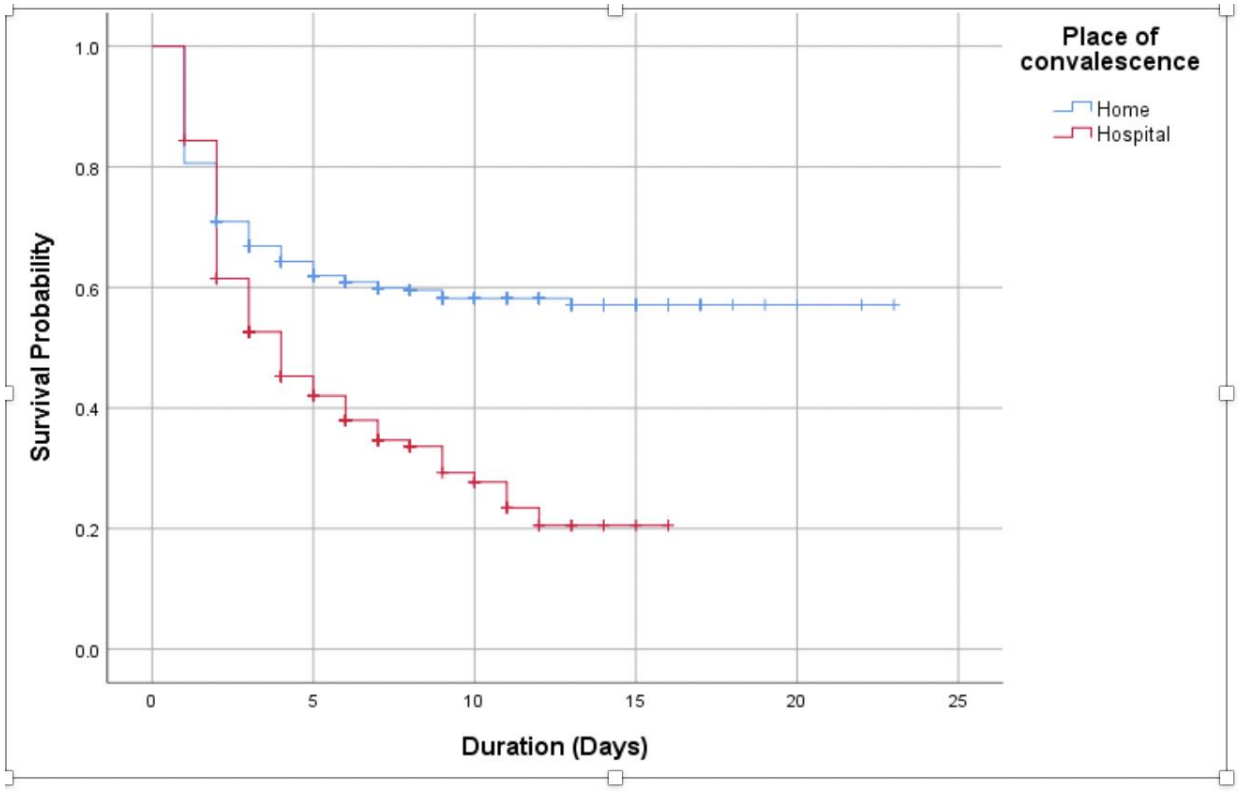
The crosstab shows larger numbers of cholera patients from Rabat, Xaghra, Xewkija and Kercem compared to other Gozitan towns. 46.6% of all cholera patients eventually died. The crosstab also shows that the percentages of patients who died vary marginally between the residence localities and percentage differences are not significant since the p-value (0.255) exceeds the 0.05 level of significance (Table 3).

**Table 2** Percentage of cholera patients who died or survived, grouped by place of treatment.

| | | | Status | | Total |
|---|---|---|---|---|---|
| | | | Die | Survive | |
| Place of Treatment | Home | Count | 208 | 318 | 526 |
| | | Percentage | 39.5% | 60.5% | 100.0% |
| | Hospital | Count | 135 | 76 | 211 |
| | | Percentage | 64.0% | 36.0% | 100.0% |
| Total | | Count | 343 | 394 | 737 |
| | | Percentage | 46.5% | 53.5% | 100.0% |

$X^2(1) = 36.145$, $p<0.001$

**Figure 5** Survival probabilities of cholera patients treated at home/hospital by convalescence duration




**Overall Comparisons**

| | Chi-Square | df | P-value |
|---|---|---|---|
| Log Rank (Mantel-Cox) | 32.534 | 1 | .000 |

**Table 3** Percentage of cholera patients who died or survived, grouped by residence locality

| | | | Status | | Total |
|---|---|---|---|---|---|
| | | | Die | Survive | |
| Locality | Rabat/ Fontana/ Lunzjata | Count | 148 | 177 | 325 |
| | | Percentage | 45.5% | 54.5% | 100.0% |
| | Xaghra | Count | 82 | 98 | 180 |
| | | Percentage | 45.6% | 54.4% | 100.0% |
| | Xewkija | Count | 41 | 35 | 76 |
| | | Percentage | 53.9% | 46.1% | 100.0% |
| | Kercem | Count | 21 | 39 | 60 |
| | | Percentage | 35.0% | 65.0% | 100.0% |
| | Munxar/Sannat | Count | 18 | 20 | 38 |
| | | Percentage | 47.4% | 52.6% | 100.0% |
| | Zebbug/Ghasri | Count | 5 | 4 | 9 |
| | | Percentage | 55.6% | 44.4% | 100.0% |
| | Qala/ Ghajnsielem/ Nadur/ Mgarr | Count | 14 | 6 | 20 |
| | | Percentage | 70.0% | 30.0% | 100.0% |
| | Gharb/ S.Lucija/ S.Lawrenz | Count | 3 | 4 | 7 |
| | | Percentage | 42.9% | 57.1% | 100.0% |
| | Ospedale/ Ospizio | Count | 13 | 12 | 25 |
| | | Percentage | 52.0% | 48.0% | 100.0% |
| Total | | Count | 345 | 395 | 740 |
| | | Percentage | 46.6% | 53.4% | 100.0% |

$X^2(8) = 10.151$, $p=0.255$

The survival plot (figure 6) shows the survival probabilities of cholera patients residing in each village by convalescence duration. The Log-Rank test shows that these survival distributions do not differ significantly since the p-value (0.052) exceeds the 0.05 level of significance.

### Gender

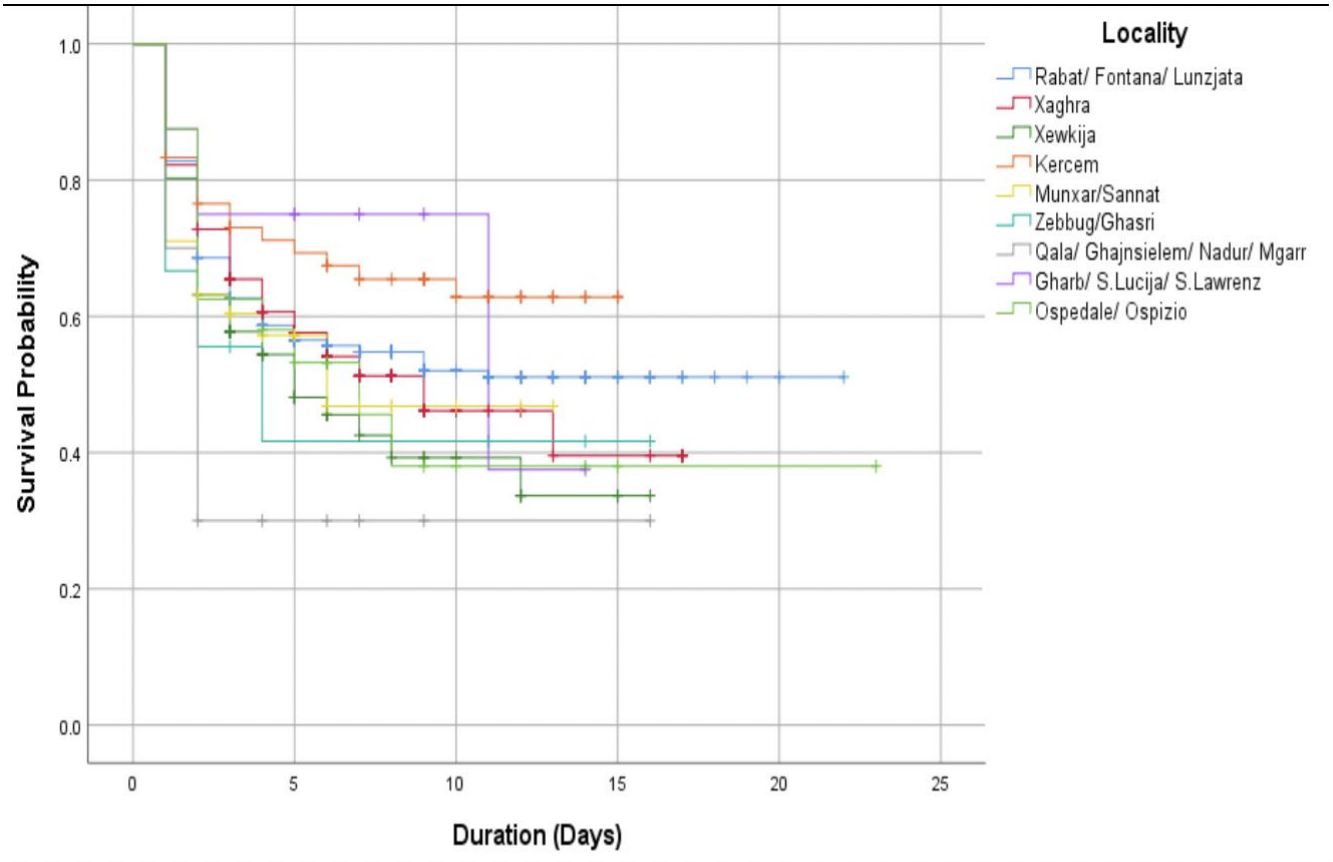
The crosstab (table 4) shows that the proportion of male patients who died of cholera (45.4%) is similar to the proportion of female patients (47.7%) and the difference is not significant since the p-value (0.538) exceeds the 0.05 level of significance.

The survival plot (figure 7) shows the survival probabilities of male and female cholera patients by convalescence duration. The Log-Rank test shows that these survival probabilities do not differ significantly since the p-value (0.713) exceeds the 0.05 level of significance.

## Cox Regression Model

When these three predictors (Gender, Residence locality and Place of convalescence) were analyzed collectively through a Cox regression model, only place of treatment was found to be significant (table 5).

**Figure 6** Survival probabilities of cholera patients in each village by convalescence duration.




**Overall Comparisons**

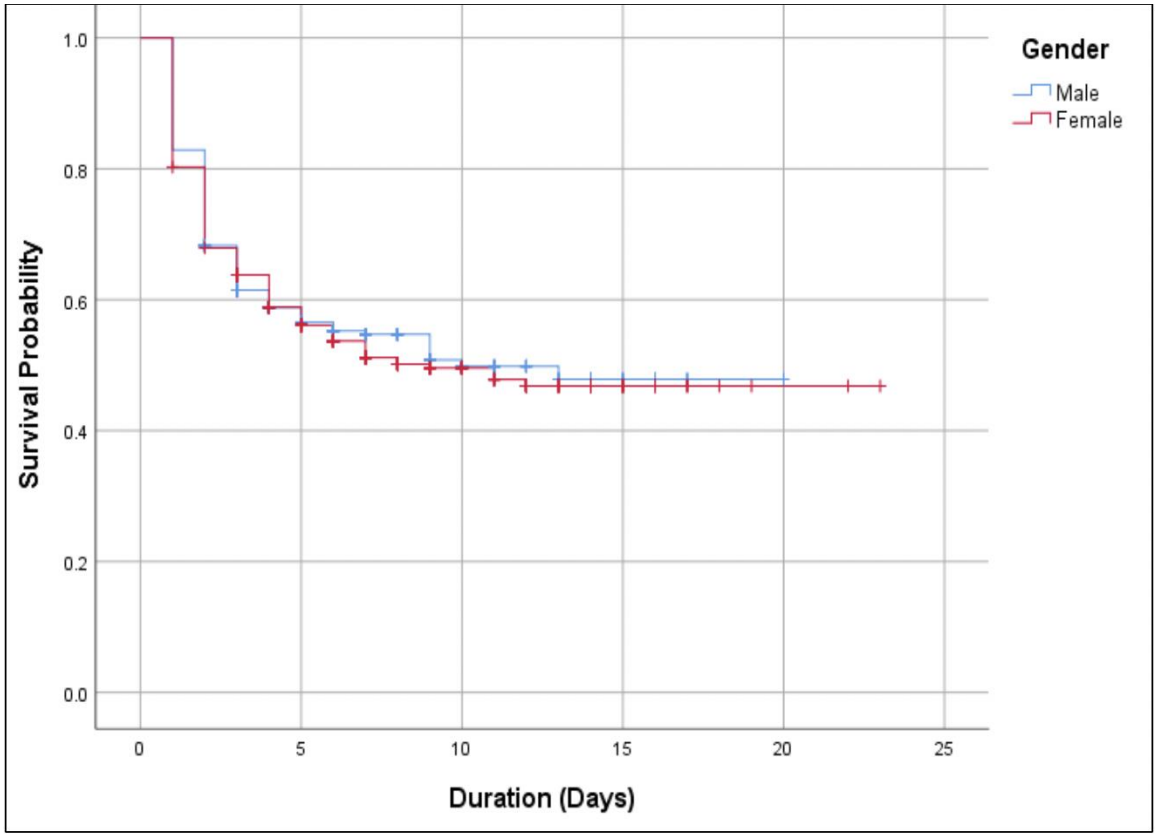
| | Chi-Square | df | P-value |
|---|---|---|---|
| Log Rank (Mantel-Cox) | 15.364 | 8 | 0.052 |

**Table 4** Percentage of cholera patients who died or survived, grouped by gender

| | | | Status | | Total |
|---|---|---|---|---|---|
| | | | Die | Survive | |
| Gender | Male | Count | 159 | 191 | 350 |
| | | Percentage | 45.4% | 54.6% | 100.0% |
| | Female | Count | 186 | 204 | 390 |
| | | Percentage | 47.7% | 52.3% | 100.0% |
| Total | | Count | 345 | 395 | 740 |
| | | Percentage | 46.6% | 53.4% | 100.0% |

$X^2(1) = 0.380$, $p=0.538$

**Figure 7** Survival probabilities of male and female cholera patients by convalescence duration.




**Overall Comparisons**

| | Chi-Square | df | P-value |
|---|---|---|---|
| Log Rank (Mantel-Cox) | 0.135 | 1 | 0.713 |

**Table 5** Cox regression analysis of the three predictors

| | Wald | df | P-value |
|---|---|---|---|
| **Gender** | 0.027 | 1 | 0.868 |
| **Residence locality** | 11.938 | 8 | 0.154 |
| **Place of treatment** | 26.440 | 1 | 0.000 |

## Discussion

The finding of a register of cholera patients diagnosed during the summer months of 1837 in Gozo, an island making part of the Maltese archipelago, sheds important light on various aspects of the cholera epidemic in this island. The epidemic reached the shores of Gozo four weeks after its appearance in Malta and the register provided the name and gender of the patients, the town or location where they lived and the date of admission followed by the date of discharge or death. It also informs us if the patient was treated at home or at the cholera hospital. The age of the patients was recorded in only 15% of patients. There is no information if patients were treated partly at home and partly in hospital. Some patients were transferred to the cholera hospital from the Ospizio or the Civil Hospital.

The census available closest to 1837 was that from the survey of 1842. Although this is 5 years after the affliction the population mobility of the time was very low and there would not have been any significant variation. The use of the 1842 census data to work out the incidence of disease necessitated a district/town selection similar to that given by the census. This showed the highest incidence of disease to be in Xagħra (10.4%) and the lowest to be in Għarb (0.28%). The mortality rate from cholera was 47% which is very similar to results from other places during the 18th century cholera epidemics[7,8] and to untreated cholera patients today[9].

The survival from cholera was significantly better if a patient was treated at home rather than in hospital. This could have occurred because sicker patients would have been taken to hospital rather than managed at home or patients were taken to hospital when their condition had deteriorated. The district/village designation was free from the fixation to the areas of the 1842 census in table 3 and allowed us to use purely geographic allocations e.g. pooling the village of Għarb with its hamlets of San Lawrenz and Santa Luċija. There was no significant differences in survival probabilities between the different towns and villages, and between males and females. The survival probabilities of cholera patients was not related to the age of the patient since age readings were only recorded for 15% of patients, which was not deemed to be a good representation.

In conclusion, using the Cox regression methodology this study has shown that the patients' gender and the resident locality were not significant predictors of mortality rate. However, the place of treatment was shown to be a significant predictor of mortality because cholera patients treated in hospital were more likely to die than those treated at home.

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