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Exploring the determinants associated with adult mortality in Malta: A cohort study between 2014 and 2020

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ABSTRACT

Objective: The study set to explore the mortality causes across six years and identify potential mortality determinates at a population level in Malta.
Study design and methods: A longitudinal follow-up of a Malta based cross-sectional national representative study across 6 years (2014–2020) was carried out. The study population was cross-linked to the mortality register and causes of death obtained. Population characteristics gathered during initial examination were analysed through univariant and multivariant logistic regressions.
Results: A total of 66 adults, mostly male (65.15 % $n = 43$) died, with commonest cause being cancer (42.42 % CI95 %: 31.24–54.45) mostly due to malignant neoplasm of bronchus and lung. This was followed by cardiac pathologies including acute myocardial infarction, ischaemic cardiomyopathy, and cardiomegaly (25.76 % CI95 %: 16.67–37.51). Multivariant logistic regression analyses revealed positive associations between age (OR: 1.99 $p = 0.02$), history of coronary heart disease (OR: 11.78 p=<0.001), smoking for 31 years or more (OR: 8.22 p=<0.001) and presence of multimorbidity (OR: 1.32 $p = 0.02$).
Conclusion: It is evident that occurrence of cancers is a concern in Malta, and it requires targeted action including the reduction of smoking habits. Understanding the mortality causes and the associated determining factors at a population level enable the institution of preventive actions while strengthening healthcare services to safeguard the population from premature mortality and co-morbidity.

Mortality is a burden of disease measure that provides an indication of the population health status and is a fundamental pillar for public health decisions and policymaking [1]. Mortality is a natural phenomenon that typically occurs in advanced age, yet modifiable determinants might be contributing to earlier mortality occurrences. This was especially observed during the COVID-19 pandemic, where vulnerable individuals, such as those with chronic diseases, experienced a higher risk of mortality [2]. Hence, establishing the mortality causes and the associated determinates in a population will enable targeted institution of preventive policies and strengthening of healthcare services.

The country of Malta situated in the middle of the Mediterranean Sea has an archipelago of 316 km^2 and is composed of two sister islands. Geographically they are divided into six districts. This island state consists of an ageing population with an average life expectancy of 80.2 years for males and 84.6 years for females. Additionally, Malta is a known cardiometabolic country with more than a quarter of the adult population suffering from multimorbidity [3], making it the ideal country to investigate for cardiometabolic determinates potentially associated with mortality. Small countries, like Malta, provide the perfect setting to undergo national studies however these countries experience challenges in research conduction due to lack of resources, resulting in limited health data accessibility [4]. Indeed, in 2022 only 0.69 % of Malta's gross domestic expenditure (GDP) was allocated for research and development [5]. Therefore, this study is timely and aims to explore for mortality causes across six years and determine potential factors associated with mortality at a population level. To the author's knowledge this is the first study to determine the mortality causes and their associations for Malta.

1. Malta's mortality cohort's characteristics

A national representative adult (18–70 years) population cohort ($n = 3947$) with a male majority ($n = 1998$) underwent a health examination survey between 2014 and 2016 [6]. A weighting factor was applied to each participant while considering the respondents and non-respondents for each town by age and gender, in addition to

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Table 1
Relationships between different determinants and mortality.

Independent variables		Univariant analyses			Multivariant analyses		
		OR	CI95 %	*p*-value	OR	CI95 %	*p*-value
Gender	Male	0.54	0.33–0.89	0.015	–	–	0.27
	Female	Reference					
Age	Age (continuous)	1.12	1.09–1.16	<0.001	1.985	1.14–3.47	0.02
Medical history	Newly diagnosed DM	2.72	1.23–6.03	0.014	–	–	0.08
	Non-DM	Reference					
	Previously diagnosed DM	2.75	1.43–5.31	0.002	–	–	0.09
	Non-DM	Reference					
	Myocardial infarction history	4.56	1.92–10.83	<0.001	–	–	0.82
	No history	Reference					
	Coronary heart disease history	9.3	5.02–17.25	<0.001	11.78	4.64–29.89	<0.001
	No history	Reference					
	Hypertension history	1.97	1.21–3.21	0.001	–	–	0.57
	No history	Reference					
	Stroke	5.54	1.93–15.88	0.001	–	–	0.26
	No history	Reference					
Multimorbidity	Yes	2.52	1.53–4.15	<0.001	1.32	0.12–0.82	0.02
	No	Reference					
Physical activity	No activity	–	–	0.53			
	Walk	–	–	0.54			
	Moderate activity	–	–	0.94			
	Vigorous activity	Reference					
Years of smoking	31+ years	8	4.51–14.19	<0.001	8.22	3.98–16.95	<0.001
	21–30 years	3.51	1.57–7.84	0.002	4.36	1.82–10.48	0.001
	10–20 years	2.73	1.39–5.35	0.003	3.46	1.66–7.23	0.001
	≤ 9 years	Reference					
Alcohol	Yes	0.483	0.30–0.79	0.004	–	–	0.93
	No	Reference					

Dependent variable – Cohort that died vs. those that did not die.
DM – Diabetes mellitus.

considering the total population size within each town. Ultimately, each participant was representative of approximately 1 % of the population of each Maltese town [6]. In 2021, following ethical approval (FRECMDS_1819_133) and permissions, the Directorate for Health Information and Research cross-linked the study's participants with the national mortality register and provided the ICD-10 codes for those that died.

Over the course of six years (2014–2020), a total of 66 adults died among this population cohort ($n = 3947$), with a male predominance (65.15 % $n = 43$). The highest mortality incidence was for the year 2020 (22.73 % CI95 %:14.18–34.28) although none of these deaths were reported to be due to COVID-19. The commonest cause of mortality was cancer (42.42 % CI95 %: 31.24–54.45) mostly due to malignant neoplasm of bronchus and lung, followed by cardiac pathologies including acute myocardial infarction, ischaemic cardiomyopathy, and cardiomegaly (25.76 % CI95 %: 16.67–37.51).

The characteristics of the cohort that died were compared to those that did not die (Supplement material). It was established that the majority that died were above the age of 60 years (72.73 % CI95 %: 60.89–82.07; p=<0.001), lived within the Northern Harbour district (33.33 % CI95 %: 23.12–45.38; p=<0.001), were smokers (34.85 % CI95:% 24.45–46.92; p=<0.001) or used to smoke (39.39 % CI95 %: 28.49–51.47; p=<0.001), with a cardiovascular medical history (66.67 % CI95 %: 54.62–76.88; p=<0.001) or presence of multimorbidity i.e., suffering from concurrent two or more chronic disease (34.85 % CI95 %: 24.45–46.92; p=<0.001).

Univariant relationships between different determinants and mortality were evident, as shown in Table 1. A positive association was established between dying and increase in age (OR 1.12 p=<0.001); having had diabetes diagnosed during the initial study (OR 2.72 $p = 0.014$); with having a prior history of: diabetes (OR: 2.75 $p = 0.002$), myocardial infarction (OR: 4.56 p=<0.001), coronary heart disease (OR: 9.3 p=<0.001), hypertension (OR: 1.97 $p = 0.001$), stroke (OR: 5.54 $p = 0.001$); having smoked for 31 years or more (OR: 8 p=<0.001) and the presence of multimorbidity (OR: 2.52 p=<0.001). Following multivariant logistic regression analyses while adjusting for confounders (residing location, educational levels) the positive associations between age (OR: 1.99 $p = 0.02$), history of coronary heart disease (OR: 11.78 p=<0.001), smoking for 31 years or more (OR: 8.22 p=<0.001) and presence of multimorbidity (OR: 1.32 $p = 0.02$) remained present.

2. Discussion

A Malta national representative population cohort was followed across 6 years to explore the causes of death and the potential determining factors associated with mortality. The leading cause of death for Malta in 2018 was reported to be cardiovascular disease (34 %) followed by cancer (28 %) mostly due to lung cancer [7]. This differs from what was observed as part of this study, although the commonest type of cancer i.e., lung cancer, is in par. These differences could be the result of

a small study sample size, even if the study was representing a national representative cohort. However, this still provides an important public health insight that the occurrence of cancer mortality might be on the incline in Malta, although this merits further research. The year 2020 saw the emergence of the COVID-19 pandemic however none of this study's mortality cohort was reported to have died due to this disease. It needs to be noted that swift mitigations and restrictions were implemented during the first COVID-19 wave in 2020 by the government and the public health officials in Malta, resulting in a low COVID-19 mortality rate [8]. This could explain the findings of this study, although one cannot exclude the small sample size that could be affecting this result.

It is evident through this study that ageing and having a history of metabolic disorders especially coronary heart disease are highly linked with mortality. Increase in age is known to enhances the risk of death as it follows a progressive physiological decline [9]. While, the presence of chronic diseases, including myocardial infarction (an acute event due to underlying coronary heart disease) have been found to have negative effects that are irreversible on ageing and health outcome [10]. Ageing is a natural process that is non-modifiable, like the genetic make-up of an individual, however, underlying modifiable determinates linked with chronic diseases can be acted upon. One such behavioural determinate is smoking, that is established to be a contributing factor for the developing of cardiovascular diseases, cancers, and diabetes [11]. A very strong association between smoking and mortality was established in this study along with the presence of multimorbidity which highlights the importance of smoking cessation among the population. It is common knowledge that smoking impacts on health and quality of life, yet it is still a prevailing issue across populations with no exception in Malta [12]. This could explain the high incidence of lung cancer in Malta [7] and supports this study's findings. Although this study did not establish significant links with other behavioural factors, promoting a healthy lifestyle and behavioural choices should be high up on every country's agenda by engaging in different initiatives targeting the individual, community, and the national levels. Furthermore, it was noted that the largest proportion of mortality occurred within the Northern Harbour district, which is the highest densely populated district in Malta [13]. This coincides with literature where high population density was associated with higher mortality rates due to cancers and cardiovascular causes [14]. Therefore, community specific preventive initiatives may be warranted. Additionally, educational campaigns across the life course need to be supported by a community environment that encourages healthy decisions and cultural changes. This needs to be backed up with country level support and legislations, where appropriate.

This study interpretation needs to be considered in view of both the strengths and limitations. The study is following a national representative population over a period of 6 years and is the first study to attempt to address the determinants of mortality among the adults in Malta. The small country's population size and the associated high cardiometabolic status make this study's findings of significance as it provides evidence that can aid public health authorities both at a local level and otherwise, in the implementation of preventive strategies. However, the mortality study population is small and could have affected the study's power and interpretation. The determinant factors considered in this study were all originating from a health interview survey conducted between 2014 and 2016 and prone to self-reporting bias as well as recall bias. This survey's medical history did not cover cancers or any other non-metabolic co-morbidities, which might have affected the study's analyses.

3. Conclusion

Understanding the mortality causes and the associated determining factors enable the institution of preventive actions while strengthening healthcare services to safeguard the population from premature mortality and co-morbidity as well as reduce associated health and economic burden.

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Ethical approval

Ethical approval was granted by the Faculty of Medicine and Surgery Ethics Committee e (FRECMDS_1819_133).

Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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Appendix A. Supplementary data

Supplementary data to this article can be found online at https://doi.org/10.1016/j.puhip.2024.100500.

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