ORIGINAL ARTICLE

Lifestyle and cardiovascular risk in asymptomatic individuals in the Kenitra region, Morocco

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ABSTRACT

Background and aim: Cardiovascular illnesses are the foremost cause of death globally, accounting for around 17.9 million fatalities per year. In Morocco, the national death rate attributable to cardiovascular diseases has attained 38%. The objective of our study is to identify asymptomatic individuals at risk of developing cardiovascular disease and to find the link between this risk and several factors in the province of Kenitra, a city in northeastern Morocco.
Methods: This cross-sectional study was performed at the Zemouri provincial hospital of Kenitra, over a period of more than three months (from 13 March to 19 June 2025). The assessment of socio-demographic factors and lifestyle was based on a questionnaire. About Anthropometry, an electronic scale was used to obtain weight (in kg) with an accuracy of 0.1 kg, and a measuring rod with an accuracy of 0.1 cm was used to measure height (in m). Obesity was assessed based on BMI (kg/m²). The blood pressure was measured using arm blood pressure monitors, blood sugar was measured using a glucometer, and total cholesterol, triglycerides, LDL cholesterol and HDL cholesterol were measured using a lipid profile analyzer. Regarding cardiovascular risk, an estimation was made using the "office-based" table of the Globorisk score in Morocco.
Results: According to our results the majority of people (40.91%) have a high cardiovascular risk, 34.85% have a moderate risk, and 24.24% have a low risk. Also, a strong and statistically significant positive correlation

Received: 29 August 2025 | Accepted: 5 November 2025
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between age and cardiovascular risk (r=0.74; p=0.00) and between systolic blood pressure and cardiovascular risk (r=0.69; P=0.00), as well as a notable prevalence of obesity (48.48%) and 25.68% have high blood pressure.
Conclusions: Our study revealed the presence of cardiovascular risk in certain asymptomatic individuals, even though it affects only a small number of people. This calls for constant vigilance, and the general public must be warned of the increasing seriousness of the situation. (www.actabiomedica.it)

Key words: cardiovascular diseases, risk factors, awareness, prevention, Morocco

Introduction

The cardiovascular system consists of the heart and blood vessels (1). Numerous disorders can manifest in this system, such as endocarditis, rheumatic heart diseases, or irregularities in the conduction system (2). On an international scale, cardiovascular diseases remain the leading cause of mortality, with approximately 17.9 million deaths annually, representing nearly 32% of total deaths worldwide (3). The incidence of cardiovascular disease (CVD) increases with age in both sexes, but appears to be lower in premenopausal women than in men of the same age group, then begins to increase more rapidly in postmenopausal women. Beyond the age of 65, the prevalence is higher in women than in men (4). To date, the medical profession and the general public are not sufficiently aware of the risk of CVD. Morocco is not exempt from this scourge, as the national mortality rate related to cardiovascular diseases has reached 38%, with the main causes being ischemic heart conditions (31%) and strokes (22.5%) (5). The impact of cardiovascular disease on quality of life has been documented in several studies. People with these conditions have lower scores than people without chronic conditions, and cardiovascular disease has an impact on frailty and is also associated with limited mobility and loss of functional abilities, which can lead to dependence in performing daily activities and a reduced quality of life for older people (6). One of the effective tools integrated into cardiovascular disease prevention programs is the assessment of the overall risk of these diseases. This is typically revealed over a 10-year period, considering age, sex, blood pressure, smoking status, total cholesterol levels, and diabetes. Generally, primary prevention of cardiovascular disease targets asymptomatic individuals who do not have clinically evident cardiovascular disease. It is considered a series of organized actions aimed at eliminating or reducing the impact of cardiovascular disease on the individual and the community (7). The Globorisk test, which has recently been adjusted, allows for the estimation of cardiovascular risk for each country, thereby contributing to the prevention of the onset of coronary diseases and strokes. The Globorisk test, which has recently been adjusted, estimates cardiovascular risk for each country, thereby contributing to the prevention of coronary heart disease and stroke, which generates costs for the national health system, and helps doctors make appropriate treatment decisions and avoid under- or over-treatment. One of the limitations of assessing cardiovascular risk using Globorisk scores is that they do not estimate risk in individuals under the age of 40, (8, 9). In Morocco, there is a shortage of epidemiological data regarding the assessment of cardiovascular risk (10, 11), and no information is available for the province of Kenitra concerning cardiovascular disease or its risk factors. The objective of our study is to identify asymptomatic individuals at risk of developing cardiovascular disease and to find the link between this risk and several factors in the province of Kenitra, a city in northeastern Morocco, using the Globorisk model, which estimates the risk of developing cardiovascular disease over the next ten years.

Materials and Methods

Study parameters and sample

This cross-sectional study was performed at the Zemouri provincial hospital of Kenitra, over a period of more than three months (from 13 March to 19 June 2025). The targeted population consists of 90 individuals with a sex ratio of 214.28, aged between 40 and 84 years. The participants are not selected randomly, and the exclusion criteria are individuals presenting chronic or regular symptoms (cardiovascular), individuals not residing in the Kenitra region, and pregnant women suffering from gestational hypertension or preeclampsia. The inclusion criteria are individuals aged 40 years and older, those who participated in data collection; specifically, those who underwent lipid and glucose level analyses. The individuals must belong to the Kenitra region (urban and rural).

Variables measured during the interview

Data collection was carried out using a questionnaire. Regarding the question selection process, the STEPS instrument was used as a basis for developing our questionnaire, which consists of four parts:

- Sociodemographic factors, namely: age, sex, dwelling area, education level, and monthly income.
- Lifestyle: stress level, snoring during sleep, and level of physical activity;
- Anthropometry: height, weight, body mass index (BMI) defined as weight (kg) divided by height squared in m^2, waist circumference, systolic blood pressure (SBP), and diastolic blood pressure (DBP).
- Health status: hypertension, diabetes, dyslipidemia (e.g., cholesterol, LDL/HDL, triglycerides), as well as other conditions.

The addition and removal of some questions was validated by experts at our university.

Measuring instruments

Weight and height measurements were taken according to WHO recommendations. An electronic scale was used to obtain weight (in kg) with an accuracy of 0.1 kg, and a measuring rod with an accuracy of 0.1 cm was used to measure height (in m). Obesity was assessed based on BMI (kg/m^2).

Blood pressure was measured using arm blood pressure monitors, blood sugar was measured using a glucometer, and total cholesterol, triglycerides, LDL cholesterol and HDL cholesterol were measured using a lipid profile analyzer. Regarding cardiovascular risk, an estimation was made using the "office-based" table of the Globorisk score in Morocco, as a low- and middle-income country (12).

Statistical analysis

Statistical analyses were performed after recoding all variables examined into explanatory and dependent variables, using primarily Microsoft Excel 2010 software, then Statistical Package for Social Science (SPSS) Version 17.5 software. The correlation between cardiovascular risk and certain variables was assessed using Pearson's test. Statistical tests are considered significant if the p-value is < 0.05.

Ethical considerations

In accordance with the Helsinki Declaration (Finland, June 1964), all measures were implemented to preserve the confidentiality and secrecy of the personal data of individuals participating in the study. After obtaining permissions from the Regional Directorate of Health and Social Protection in Kenitra and the administrations of Higher Institute of Nursing and Health Technology Professions of Kenitra (ISPITS) and Regional Hospital Center, informed consent from the participants was also obtained.

Results

Evaluation of anthropometric parameters

Table 1 presents the main anthropometric data of our sample. The results of our sample show that the average age of hospitalized subjects is 55.38 (SD: 12.66) years, the average weight is 72.80 (SD: 11.74) kg, the average height is 1.70 (SD: 0.06) m, the average body mass index BMI is 25.05 (SD: 3.82) kg/m^2, the

Table 1. Main anthropometric data for the study sample.

	Average	Standard deviation
Age (years)	55.38	12.66
Weight (kg)	72.80	11.74
Height (m)	1.70	0.06
BMI (Kg/m^2)	25.05	3.82
SBP (mmHg)	129.77	20.31
DBP (mmHg)	75.15	12.52
Blood glucose (g/l)	1.17	0.58
Total cholesterol (TC) (g/l)	1.67	0.42
High Density Lipoprotein (HDL) (g/l)	0.48	0.17
Low Density Lipoprotein (LDL) (g/l)	0.99	0.35
Triglycerides (TG) (g/l)	1.31	0.63
cardiovascular risk score (%)	11.62	11.85

average systolic blood pressure (SBP) is 129.77 (SD: 20.31) mmHg, the average diastolic blood pressure (DBP) is 75.15 (SD: 12.52) mmHg, the average blood glucose level is 1.17 (SD: 0.58) g/l, the average total cholesterol is 1.67 (SD: 0.42) g/l, and the average cardiovascular risk score is 11.62 (SD: 11.85) %.

Identity and status of participants

Figure 1 presents some socio-demographic characteristics and lifestyle factors of our sample. Among the 90 subjects participating in this study, 68.18% are men and 31.82% are women, giving a sex ratio of 214.28; 57.58% live in urban areas and 42.42% live in rural areas. 46.97% are illiterate, almost 42.42% have high stress levels, 62.12% report having no income, and 30.30% earn between 1,500 and 3,000 Moroccan dirhams per month (equivalent to 142.77 and 285.55 euros or 165.74 and 331.48 US dollars). In addition, the majority consume fruit, vegetables and meat on a daily basis.

Health status

Figure 2 shows the stacked bar chart of the percentage of muscle pain, hypertension, diabetes, swelling and obesity. The results show that 48.48% are obese, 60.21% of individuals suffer from muscle pain and 39.79% do not feel any pain. In our sample, 25.68 % are hypertensive, 63.51% do not have hypertension, and 10.81% report that they do not know. With regard to diabetes, the results show that 28.38% of individuals have diabetes, 60.81% do not, and 10.81% stated that they did not know. In addition, 46.97% suffer from swelling, 53% do not.

Figure 3 shows a histogram of heart pathology types. The results show that 63.64% report having no disease, followed by 10.61% suffering from acute coronary syndrome, 7.58% with heart disease, 4.55% with left heart failure, 3.03% with ischemic heart disease, angina pectoris and heart valve disease with 1.51%.

Figure 4 shows the distribution of cardiovascular risk scores in the study population. The results are divided into three categories: low CVR (≤ 9%), moderate CVR (10–29%), and high CVR (> 30%). We observe that almost half of individuals (40.91%) have a high cardiovascular risk. In contrast, 34.85% of individuals have a moderate risk and 24.24% have a low cardiovascular risk.

The association between cardiovascular risk (CVR) and other factors

Regarding stress level, the odds ratio (OR= 3.32) means that people with high stress levels are approximately 3.32 times more likely to have high cardiovascular risk than those with low/moderate stress levels. However, the confidence interval [1.19-9.31] is very wide and does not include 1, so the association is statistically significant. Regarding tobacco use, the odds ratio OR= 3.6 means that smokers are approximately 3.6 times more likely to have a high cardiovascular risk compared to non-smokers. In other words, smoking appears to increase cardiovascular risk. However, the confidence interval [1.27-10.11] does not contain the value 1, which shows that the association is statistically significant ($p > 0.05$). We can conclude that there is a real difference. Regarding physical activity, the odds ratio (OR= 2.4) means that people who are physically inactive or sedentary are approximately 2.4 times more likely to have a high cardiovascular risk than those who are physically active. However, the confidence interval [0.83-6.4] includes 1, so the association is not

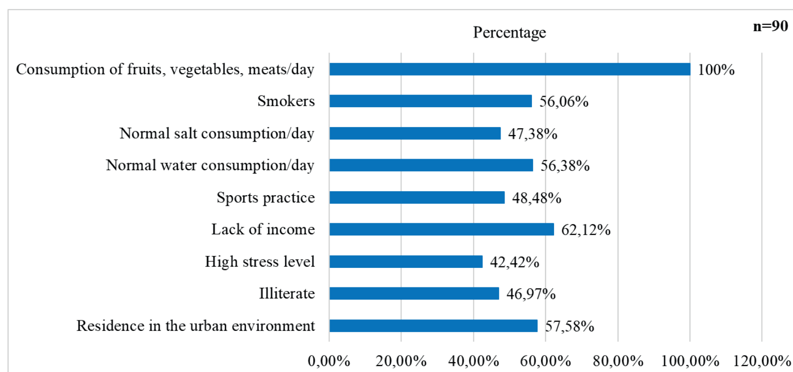

Figure 1. Sociodemographic characteristics and lifestyle.

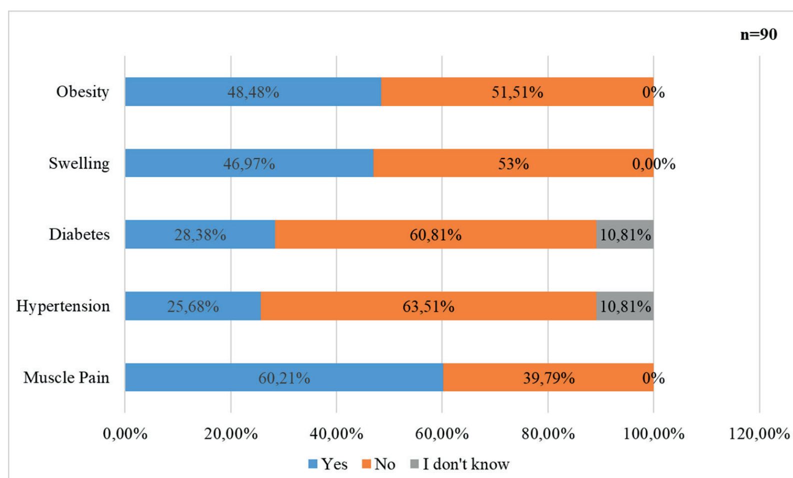

Figure 2. Distribution of the population according to the prevalence of muscle pain, hypertension, diabetes and swelling.

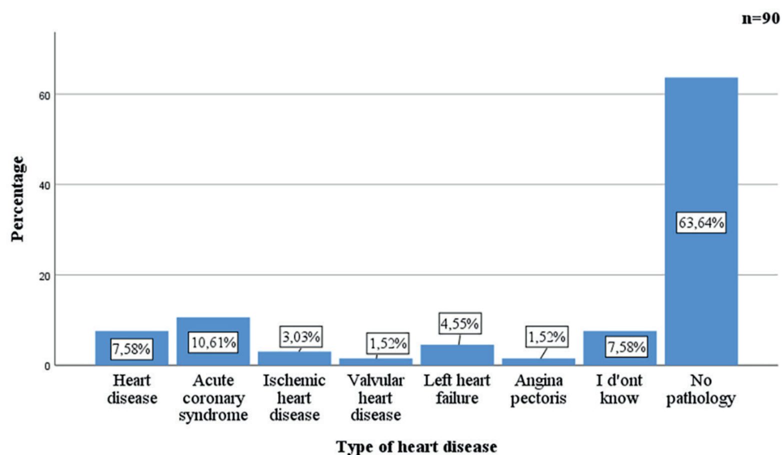

Figure 3. Percentage of different diseases affecting individuals in the sample.

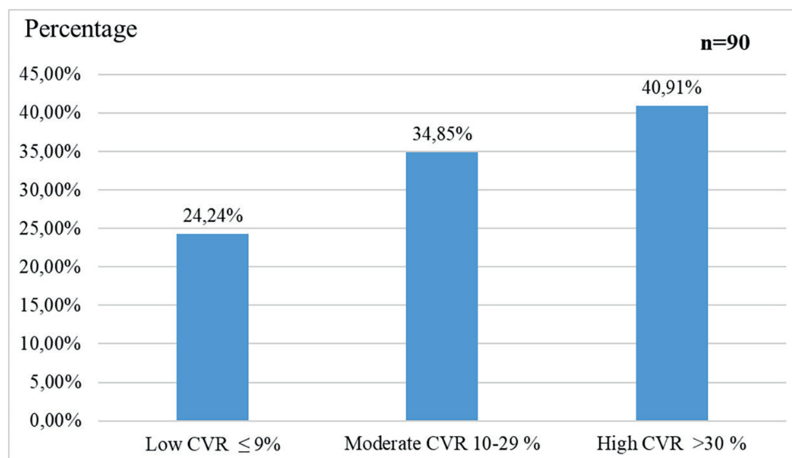

Figure 4. Population distribution according to cardiovascular risk score (RCV).

Table 2. Multivariate analysis of factors associated with the onset of cardiovascular disease.

Factors	Odds Ratio (OR)	Confidence Interval CI 95%	P-value
Stress level / cardiovascular Risk	3,32	1,19-9,31	0,02*
Smoking / cardiovascular Risk	3,6	1,27-10,11	0,01*
Physical activity / cardiovascular Risk	2,4	0,83-6,4	0,11**
Income/month / cardiovascular Risk	1,78	0,65-4,92	0,26**
Alcohol / cardiovascular Risk	2,97	1,7-8,26	0,034*
Diabetes / cardiovascular Risk	1,93	0,68-5,48	0,21**

*The correlation is significant; **The correlation is not significant.

statistically significant. With regard to monthly income, the odds ratio (OR= 1.78) means that people with a monthly income are approximately 1.78 times more likely to have a high cardiovascular risk than those without a monthly income. However, the confidence interval [1.19-9.31] does not include 1, so the association is not statistically significant. Regarding alcohol, the odds ratio (OR= 2.97) means that people who consume alcohol are approximately 2.97 times more likely to have a high cardiovascular risk than those who do not consume alcohol, and the confidence interval [0.68-5.48] includes 1, which shows that the association is statistically significant. Regarding diabetes, the odds ratio (OR= 1.93) means that people with diabetes are approximately 1.93 times more likely to have a high cardiovascular risk than those without diabetes. However, the confidence interval [0.83-6.4] includes 1, so the association is not statistically significant (Table 2).

Discussion

The results show that the average BMI is 25.05 (SD: 3.82) kg/m2, with 48.48% of people obese. Compared to the results of a study conducted between 1975 and 2014 covering 200 countries, this result revealed that the average body mass index worldwide has increased to 24.4 kg/m² for women, rising from 21.7 to 24.4 kg/m², and for men, it rose from 21.7 to 24.2 kg/m² (13). In addition, a high body mass index increases the risk of myocardial infarction, coronary insufficiency and sudden death, with the association appearing to be stronger with sudden death (14, 15). Therefore, obesity

could be seen as a significant modifiable risk factor for ischemic heart disease (16). With regard to the prevalence of diabetes, our results suggest that 28.38% of individuals have diabetes, 60.81% do not, and 10.81% say they do not know. These results are similar to those of other studies conducted in rural areas in the province of Ifran, Morocco, which show that 21.4% are diabetic (17). Diabetes can also contribute to the development of heart failure (18). A study conducted in Rabat in 2022 shows that the risk of cardiovascular disease in people with diabetes is significantly higher than in those without diabetes, leading to the development of well-established coronary macrovascular complications in these patients. In addition, the emergence of acute or chronic coronary syndrome is a common cause of hospitalization or death in this population (19, 20). The high blood pressure (HBP) is the most common variable risk factor for cardiovascular disease (CVD) and related deaths (21). Our results show that 25.68% of people are hypertensive, which is consistent with the results reported in a study conducted in the Meknes region (Morocco) (22), which found that 32% of people are hypertensive, and another study conducted in the rural area of Oujda-Angad, which showed that 22.1% of people are hypertensive (23). Hypertension is frequently associated with other risk factors, including tobacco use, diabetes and abdominal obesity. To a lesser extent, dyslipidaemia is also involved, and the combination of these various factors considerably increases cardiovascular risk (24). Furthermore, analysis of muscle pain sensations showed that 60.21% of individuals suffer from muscle pain and 39.79% do not experience any pain. Studies have explained these results by the presence of metabolic, haemodynamic and musculoskeletal changes (25). In line with this finding, another study revealed that peripheral arterial occlusive disease (PAOD), or peripheral arterial disease, is a type of cardiovascular disease and is an atherosclerotic condition that manifests as obstruction (blockage) or stenosis (narrowing) of the lumen of the peripheral arteries, causing a decrease in blood flow to the lower limbs, including the muscles (26). However, it should be emphasised that atherosclerosis is a heterogeneous condition triggered by various pathophysiological mechanisms in the vascular wall and affects virtually all blood vessels in the body. The coronary vessels, carotid arteries and arteries of the lower limbs are the most affected (27). Another aspect of our results concerns the heart disease, the results show that 63.64% report having no disease, followed by 10.61% suffering from acute coronary syndrome, these results are consistent with those observed in a study in sub-Saharan Africa (Abidjan), which shows that among 3,152 patients hospitalised for cardiovascular disease, 13.5% had acute coronary syndrome, with 71.5% having acute coronary syndrome with ST segment elevation. In-hospital mortality: 10% (28). Furthermore, our data shows that 4.55% with left heart failure, this rate is low compared to the results of another study conducted between 2008 and 2014 at Mohammed V Hospital in Rabat, which shows that 63% have left-sided HF (29). Additionally, we noted that the prevalence of ischemic heart disease in our group was 3.03%. Following on from this observation, it is interesting to note that in 2021, 254 million people worldwide were living with ischaemic heart disease. Age-standardised rate (ASPR): 2,946.4 cases per 100,000 inhabitants (30). Furthermore, the prevalence of heart valve diseases in our sample is notably low, at 1.51%, aligning with another study that indicates a rarity of valvular heart disease at 3.6% (5). The most important aspect highlighted by our results is the assessment of cardiovascular disease risk, the results are divided into three categories: low CVR (≤ 9%), moderate CVR (10-29%), and high CVR (> 30%). We observe that almost half of individuals (40.91%) have a high cardiovascular risk. In contrast, 34.85% of individuals have a moderate risk and 24.24% have a low cardiovascular risk. These results are consistent with those observed in another study conducted in southern Morocco in 2023, which used the NHANES score to assess cardiovascular risk (CVR), which shows that among the 981 participants, the percentage of high RCV (> 20%) does not exceed 22,9%, the percentage of moderate RCV (10–20%) is 23,4%, and the percentage of low RCV (≤ 10%) is 53,7% (11). Our results show that the factors significantly associated with cardiovascular risk are: stress, smoking, and alcohol consumption. Our results are consistent with the findings of a study that consistently shows that smoking is a major risk factor for CV events (31), and another study that shows that psychosocial stress is associated with an increased

risk of cardiovascular events and mortality; the effect is independent of several sociodemographic factors (32). However, in our results, the association between cardiovascular risk and physical activity is not significant, which is consistent with the results of a meta-analysis showing a general protective effect of physical activity, but not all studies find a statistically significant association (33). The same applies to the association between cardiovascular risk and monthly income and diabetes, which are not significant, consistent with the results of a study conducted in 2019, which revealed that, overall, diabetes is an established CV risk factor, but depending on the population studied (glycemic control, treatments, sample size), its effect may lose significance after adjustment for other factors (34). The association between income and CVD is well documented in studies, but the effects vary depending on the country, period, and adjustments; some multivariate analyses show the effect of income to be attenuated or insignificant depending on the variables considered (35). This study had certain limitations: Data on stress, smoking, or eating habits may be underreported or exaggerated, and the lack of validated measurement tools to assess chronic stress or depression limits the interpretation of the role of psychological factors. Furthermore, the probability of contracting the five biomarkers (blood sugar, total cholesterol, HDL cholesterol, LDL cholesterol, and triglycerides) in the test kits provided to respondents. These markers are necessary to conduct the survey, and we collected approximately 189 samples, but they were unsuitable due to the absence of one of the biochemical markers, so we had to settle for working with only 90 samples.

Conclusion

Our study revealed the presence of cardiovascular risk in certain asymptomatic individuals, which requires specialist intervention. This is achieved by reducing modifiable risk factors in order to reduce the incidence of cardiovascular disease and protect individuals' health. Further research and approaches are needed for individuals under the age of 40 in order to increase the number of people targeted and better identify cardiovascular risk in more asymptomatic individuals. We must remain vigilant, and the general public must be made aware of the growing seriousness of the situation.

Conflict of Interest: Each author declares that he or she has no commercial associations (e.g., consultancies, stock ownership, equity interests, patent/licensing, arrangement etc-) that might pose a conflict of interest in connection with the submitted article.

Ethic Approval: This study was carried out with institutional authorization using previously collected data. No patient intervention has been carried out, and all data have been completely anonymized before analysis. According to local regulations, this kind of observational retrospective study does not require formal approval from an ethical committee. The study was carried out in accordance with the Helsinki Declaration's principles..

Authors Contribution: SEG: Conceptualization, Methodology / study design, Validation, Writing – review and editing, Resources; ML, SB, KY, LZ: Validation; RH: Data curation; BL, DF: Software, Investigation; MO: Supervision.

Declaration on the Use of AI: None.

Acknowledgements: We thank all the authors who participated in this work, and we thank the staff of the Zemouri provincial hospital of Kenitra for their collaboration.

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