

Pre-diabetes remission in lifestyle-mediated coaching of seafarers with newly diagnosed pre-diabetes

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Abstract

Introduction: Seafarers and fishers have inequity in health at work, with a higher risk of having metabolic syndrome. They are at increased risk of developing prediabetes, which can be reversed to normoglycemia based on the evidence from other industries. This study aims to educate and activate seafarers and fishermen with the support of coaches to reverse their prediabetes to stop the further development of diabetes type 2.

Methods: Random samples of seafarers and fishermen with newly diagnosed prediabetes and HbA1c levels ranging from 5.7%–6.4% from the maritime medical health examinations constitute the study population in a 16-week prediabetes coaching program. In addition to monthly Zoom meetings, they are asked to provide weekly reports via questionnaires on personal measurements and improvements in physical activity and diets.

Results: The preliminary data from 2 maritime clinics (n=405) show prevalences of prediabetes 18.8%, 36.4%, and 49.2% in the ages 20–29, 30–49, and 50+ years respectively, all p-values < 0.02. Analysis of the clinical data from the maritime health clinics and the questionnaires from the seafarers collected weekly will formulate the effect of the intervention. Summarizing data from various national prediabetes coaching fora will be the evidence base for remission of prediabetes.

Conclusion: A significant portion of seafarers have prediabetes with the potential to achieve remission of their pre-diabetes by eating healthy and being physically active. The goals are to lose at least 5%–7% of their starting weight, be accustomed to doing at least 150 min. of physical activity weekly, and follow a pre-diabetes-relevant dietary plan.

Keywords: Type 2 Diabetes Mellitus; Seafarers; Fishermen; Coaching; Remission. pre-diabetes

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Introduction

This proposed method combines biannual, mandatory clinical fit-for-duty health examinations for seafarers and fishermen from a public health perspective with a coach-based reversal of newly diagnosed prediabetes to a normal state. Prediabetes is a serious health condition in which blood sugar levels are higher than normal but not high enough to be diagnosed as Type 2 diabetes.

This pilot intervention trial supports seafarers and fishermen with prediabetes who want to learn how to prevent diabetes mellitus. The method applies not only to seafarers but also to prediabetes in all types of jobs,

especially in other transport areas with routine medical health examinations. Seafarers have a great inequity in health at work with a higher risk of being overweight, having metabolic syndrome, Type 2 diabetes mellitus, and hypertension, and a need for accurate early diagnosis and prevention¹⁻⁵.

The focus on early diagnosis of prediabetes seems to be a good choice for intervention based on the evidence that prediabetes mellitus can be reversed by nonpharmacological and pharmacological measures, which is the background for our proposed trial.⁶⁻⁷

Based on a systematic review, a limited number of studies of lifestyle interventions in the maritime setting exist, and they have all failed to demonstrate substantial health benefits for seafarers.¹⁰ This concurs with our observations that primary prevention of lifestyle diseases most often fails, while secondary prevention studies, for example, for Type 2 diabetes mellitus, have better success rates.¹¹ The research question, therefore, is whether it is possible to reverse a newfound prediabetes diagnosis by using health coaching, which is a method chosen in light of its positive results from the coaching prevention research of Type 2 diabetes mellitus in non-maritime areas.¹²⁻¹⁶ The aim is to educate and encourage seafarers to reverse their prediabetes through their efforts in a 16-week prediabetes coaching and learning program. Specifically, the goal is to evaluate the effect of weekly self-administered fasting glucometer and blood pressure measurements with learning and stepwise improved physical training and diet.

Methods

The universe of this research is the global population of seafarers and fishermen who undergo medical examinations every two years in a maritime medical clinic. The study population consists of random samples of seafarers in various countries with newly diagnosed

prediabetes with glycated hemoglobin (HbA1c) level of 39-47 mmol/L (5.7%-6.4%) who were not taking medication for Type 2 diabetes mellitus, were > 18 years of age, could read and write English or Spanish, and had mobile phone and internet access at home and on ships.

The applied values for the clinical diagnoses are presented in Table 1. For a pilot study, n= 10 seafarers with prediabetes will be selected from each maritime clinic in various countries. To estimate the size of the potential for remission of pre-diabetes, data from two maritime clinics is collected randomly for 6 months in 2023-24 with the results in Table 2.

Table 1: Blood glucose test values to decide who can be invited to participate

	HbA1c limits	Fasting glucose limits
Normal	≤ 39mmol/L (5,6%)	≤ 100mg/dl
Pre-diabetes	39-47 mmol/L (5,7%-6,4%)	100-125 mg/dl
Diabetes	≥ 48 mmol/L (6,5%)	≥ 126 mg/dl

Table 2: Prevalences of HbA1c in Maritime Medical Clinics, Latvia and Manila n=405; 2024*

HbA1c	-29	OR**	30-49	OR p-value	50+	OR p-value	Total	
Normal	0-5.6%	64	1.0	101	0.64 p<0.01	40	0.38 p<0.01	205
		80.0%		51.8%		30.8%		50.6%
Pre-diabetes	5.7-6.4	15	1.0	71	2.1 p<0.02	64	2.6 p<0.02	150
		18.8%		36.4%		49.2%		37.0%
Diabetes	6.5+	1	1.0	23	9.3 p<0.01	26	12.6 p<0.01	50
		1.3%		11.8%		20.0%		12.3%
Total		80		195		130		405

* Samples selected among the seafarers in the health examinations, irrespective of risk factors

** OR = Odds Ratios based on the proportions in the age group columns

The type of study and general design

The prediabetes remission coaching study is a multicenter, before-and-after study with 16 weeks using WhatsApp/mail personal health coaching for seafarers with newly diagnosed prediabetes through an educational, lifestyle, and behavioral approach.

The educational training is composed of small weekly readings and the completion of questionnaires, with goal settings based on coaches' advice to improve diet and physical exercise patterns. The information materials are based on online educational readings and videos for seafarers but are also used for other professions.

Laboratory tests

The maritime medical clinics perform the clinical and laboratory analyses in the maritime medical health examinations: weight, height, glycated hemoglobin (HbA1c), Total cholesterol (TC), High-density lipoproteins (HDL), Low-density lipoproteins (LDL) and Triglycerides (TG).

To be reported in Google Forms Data Scheme No.1. Laboratory tests are repeated after 16 weeks to evaluate the effects of the training. There will be small extra costs

for maritime medical clinics, as they are normally allowed to perform extra laboratory tests relevant to the seafarer's health. To evaluate the study's long-term effects, the tests should be repeated after 1 and 2 years as part of routine biannual medical examinations.

The primary goals are to educate, lose weight, and normalize blood sugar and blood pressure by gradually establishing more physical subgoals that can be a good means of motivation.¹⁷

Training methods

Coaching groups are established with the coordinators working together and coordinating with the maritime medical clinics. To previous surveys and a policy-related study of the needs and interests of further education for maritime medical doctors, the program is offered as a postgraduate educational program for the medical doctors to be updated for their advice to the seafarers.²⁰⁻²² A mixture of weekly mobile WhatsApp-based health coaching and Zoom meetings is used (Table 3). As a supplement, the seafarers can choose to include one of the numerous health apps on the market as part of their program.^{13,15,18,19}

Table 3. Schedule for the 16 weekly Seafarer/ Coach contacts and clinical visits*

Week No.	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	End
Clinical visit	Weekly WhatsApp contacts and monthly Zoom meetings															Clinical visit /GP	

(*) The first clinical visit is the first routine maritime medical health examination.

Content of the weekly learnings

The weekly learnings are: What is prediabetes and how to reverse it; Prevention by keeping physical fit; Prevention by healthy eating and keeping active; Blood pressure; Role of the workplace in the prevention; Mental health at sea; Overweight and obesity; Sleep, work, and diabetes; Healthy food; Healthy snacks; Drink type; Alcohol; Food fibers; Dental care; Lifestyle & social well-being; Evaluation, Knowledge test. ([Appendix 1 Link](#)).

Example, week 1:

Video 1 (5.12 min): What is prediabetes and how to reverse it?

<https://www.cedars-sinai.org/health-library/video-library/video-detail/p/prediabetes.html>

Video 2 (1.4 min) How to use the Glucometer?

<https://www.webmd.com/diabetes/video/video-how-to-check-your-blood-sugar>.

Reading: What you need to know:

Recommendations for the use and non-use of Metformin and the side-effects is included in the videos for week 2 and in the Discussion section.

Participants's feedbacks

Routine reporting schemes are weekly sent out by the coaches and completed by the seafarers on their goals in

physical activity and dietary patterns (Example LINK: [Seafarer's weekly report](#)) The coaches follow the development, educate, and motivate the seafarers to set progressive goals with an emphasis on social activity, diet and physical activity via monthly zoom meetings.

Participants' activation, self-monitoring, and stepwise improvements

Based on the "patient activation model", it is challenging for prediabetes coaches to inspire seafarers to actively participate in the remission of their prediabetes.²³

Seafarer's weekly report (e.g., on Fridays-Saturdays) by completing Google Form 2 (Table 5-6) invited by the coach in addition to the questionnaires at the start and end of the 16 weeks will be used to assess changes in physical activity and dietary patterns to be discussed in the weekly contacts. The survey results and the patients' self-monitoring with portable glucometers, travel weight scales, pedometers, and blood pressure monitors and Google Forms 1-3 (Table 5-6) will serve as milestones to mark the stepwise improvements to support the seafarers' activity in the weekly contacts.^{24,25} Supplemental standard questionnaires on physical activity, food frequency, and stress level can be introduced to measure improvements over the 16 weeks (Table 5).

Requirements for effective prediabetes coaches.

Prediabetes coaches cannot replace maritime doctors and general practice doctors who have the legal responsibility to diagnose and treat persons with diabetes mellitus. Retired maritime officials, seafarers, seafarers' doctors, other health personnel in maritime health clinics, and researchers would be perfect prediabetes coaches because they are educated on the causes, treatments, and prevention of prediabetes and nutrition and activity-based lifestyle. The coaches will be well-educated to answer questions online and in monthly Zoom meetings. Master's coaching courses could be established for officials, seamen, fishermen, ship cooks, and staff from shipping companies to become qualified health coaches for seafarers. Certification for approved maritime prediabetes coaches should be based on specific training programs.

Procedures to Ensure Ethical Considerations

Confidentiality in the handling of personal data will be by the rules of the national data protection agencies and the General Data Protection Regulation (GDPR). No personally sensitive information will be included in the dataset given to the researchers and coaches; therefore, approval from the Ethics Committee is not necessary in European countries. All Google Forms data sheets ask for informed consent as the first question. In Denmark, the

project will be registered with the Danish Data Protection Agency. The specific rules for countries outside the EU, e.g. in Panama, will be followed. All data will be stored and destroyed after five years, under national regulations.

Analysis of the data

The clinical data is analyzed using SPSS version 28.0 based on the compiled data from Google Forms, coded into categorical data, and presented in the tables. The differences at the start and end of glycated hemoglobin (HbA1c), lipids, and weight before and after will provide an estimate of the effect on prediabetes remission coaching (Table 5-6). The weekly questionnaires on food and physical activities in Google Forms 2 together with Google Forms 7 (Table 5-6) will give an estimate of the change in knowledge and practical improvements in lifestyle. The overall results before and after the study course will provide a summary of the program's effects. This will be discussed to determine whether the program should be followed up for a longer time or if other changes should be made. The data quality and data safety procedures will be described and dealt with by the coaches to determine how to best check the data quality. ISO 27001 guidance on how to adopt data security will be addressed.

Table 4. Values for self-testing with glucometers finger-prick method on board the ship*

	Fasting	Postprandial 2 hours after meal
Normal	≤ 100 mg/dl (5.6 mmol/L)	≤ 140 mg/dl (7.7 mmol/L)
Prediabetes	100-125 mg/dl (5.6 to 6.9 mmol/L)	140-199 mg/dL (7.8-11.0 mmol/L)
Diabetes	≥ 126 mg/dl (6.7 mmol/L)	≥200 mg/dL (11.1 mmol/L)

* American Diabetes Association American Diabetes Association ADA <https://diabetes.org/about-diabetes/diagnosis>.

Table 5. Data reporting Forms

[Google Form 1](#): Maritime Medical (MM) Clinic data **at start and after 16 weeks** (or seafarers' own GP)

E-mail, name, Gen (m/f), Age, Work (Fishing, Merchant, Other)(position on board: officer/non-officer) Tobacco y/n, Taking diabetes medicine? Y/N, Taking blood pressure medicine? Y/N, Weight kg, Height cm, Diastolic and Systolic Blood pressure, Lab tests: A1C %, Total Cholesterol, LDH (low-density lipoprotein), HDL (high-density lipoprotein), TG Triglycerides. (Completed by the Coach based on information the MM clinic.)

[Google Form 2](#): Seafarer's weekly report (Fridays-Saturdays) invited by the coach

- Fasting finger prick blood sugar Glucometer mg/dl
- Weight (Kg)
- Blood pressure (mmHg)
- Did you base your meals on higher fiber starchy carbohydrates? Y/N
- Did you eat lots of fruit and vegetables? Y/N
- Did you cut down on saturated fat and sugar? Y/N
- Did you drink sufficient water, not to get thirsty? Y/N
- Did you get your breakfast every day? Y/N
- Did you get a total of 150 min **moderate** physical activity last week? Y/N
- Did you get **vigorous activity** with deep and rapid breathing as part of 150 min last week? Y/N

[Google Form 3](#): Seafarers' monthly report – the coach invites the seafarers to Zoom meetings and complete the Form

Optional assessments of differences from start to end in 16 weeks

[Google Form 4](#): IPAQ-International Physical Activity Test, for the seafarers, week 5 and 15

[Google Form 5](#): FFQ Food Frequency Questionnaire for the seafarers, week 4 and 14

[Google forms 6](#): STRESS Test for the seafarers, week 2 and 12

[Google forms 7](#): Knowledge test for seafarers, week 1 and 16

Table 6: Procedures to be done by the Mar Med Clinics, the Seafarers, and the Coaches

A. Establish local coaching groups nearby the maritime medical clinics	
The first to be done is to establish coaching groups in the areas of the maritime medical clinics. Define the requirements to be prediabetes coaches. Coaching Statutes . Based on this, future coaches are invited, and the group meets to make the formalities of education, organization, and financial issues in the working together with the maritime medical clinics. The coaches cannot replace the maritime medical doctors, only be trainers, coaches and for every medical question, ask the seafarers doctors or the GP.	
B. To be done by the maritime medical clinics at start	
<ol style="list-style-type: none"> 1. The medical clinic does the usual lab analysis including weight, height, HbA1c, total cholesterol, LDL, HDL, and TG the coach will add the data to (Google Form 1) 2. The Clinic selects one or more possible participants who complies with the including criteria. 3. The clinic Informs the seafarer that the clinical diagnosis is pre-diabetes, that can be reversed by joining an education and activity coaching program. 4. The seafarer is invited to participate in the coaching in 16 weeks and to meet the coach 	
C. The first meeting with the seafarers and the coaches	
<ol style="list-style-type: none"> 1. Inform the seafarer on the objectives and the content of the program (Table 4-5) 2. Assure personal access to Wifi, mobile phone and laptop, home and onboard the next 4 months 3. Inform on how to complete the Google Forms (a day of the week, e.g. every Saturday) 4. Agreement on the start and end day of the program 5. Buy and bring on board: Glucometer,^[78] Blood pressure monitor^[79] Digital Mini Travel Scale, pedometer. 6. Exchange contacts: e-mail, mobile, WhatsApp,Wifi, time zones and travel plans. 7. Discuss and make agreement on the seafarer's payment for the coaching (sign a contract) 8. Coaching contract template 	
D. To be done every week by the seafarers and the coaches	
To be done by the Seafarers:	<p>Make the Glucometer fasting test, your blood pressure and weight on or two fixed days in the week, e.g. on Fridays and Saturdays.</p> <p>Complete the questions and add the Glucometer result, Blood pressure and the weight, results to the Google Form 2 on a fixed day every week e.g. Saturdays/Sundays.</p> <p>Study the learning materials for the week (Table 6).</p>
To be done by the Coaches:	<p>Stay orientated on the seafarers results and the goals in the Google Forms and talks.</p> <p>Send weekly WhatsApp messages with inspiring comments to the seafarers.</p> <p>Recommend weekly videos and readings, and invite for discussions and help to use the advices.</p>
E. To be done by the seafarers after 16 weeks, and after 1 and 2 years	
Laboratory tests	Get the lab analysis done in the MMClinic or own GP (or private laboratory) including A1c, Total cholesterol, LDL, HDL, TG (Google Form 1)

Results

Routine clinical data from the maritime health clinics and the data from the seafarers' weekly responses form the basis for the evaluation of the effect of the intervention to create the most effective programs.

Based on the clinical data, the maritime medical doctors will select one or more possible participants who meet the inclusion criteria: glycated hemoglobin (HbA1c) level of 39-47 mmol/L (5.7%-6.4%) and not taking medication for Type 2 diabetes mellitus. The clinic will inform the selected seafarer(s) that the clinical diagnosis is prediabetes, which can be normalized through an adequate exercise program and by maintaining a low-calorie diet to lose weight with the help of a coaching program. Seafarers within the inclusion criteria are invited to take part in the 16 weeks of coaching.

The prediabetes prevalences in the first part of the program (n=405) are quite high: 18%, 36%, and 49% in the age groups up to 29, 30-49, and 50+ years of age respectively with a significant potential for pre-diabetes remission intervention (Table 2). Odds ratios for prediabetes proportions in the 30-49 and the 50+ years age groups compared with the lowest age groups are 2.1 (p<0.02) and 2.6 (p<0.02) respectively. The corresponding Odds Ratios for diabetes mellitus type 2 in the middle and the oldest age groups respectively are 9.3 (p<0.01) and 12.6 (p<0.01) compared with the lowest age groups.

Discussion

The proposal for coaching-based prediabetes remission is pioneering a new area of maritime health research, supplementing mainly descriptive studies until now. With this proposal, the pieces around the prediabetes trilogy project are falling into place by presenting a research tool that fits together with the two previous studies: 1) Abandon the ‘diabetic control’ urine dipstick method that could not identify prediabetes and valuable information for early prevention was lost and 2) the proposal to introduce a permanent screening for prediabetes by the use of glycated hemoglobin (HbA1c) test for all seafarers.^{26,27}

Theoretical Framework

The research question, therefore, is whether it is possible to reverse a newfound prediabetes diagnosis by using health coaching, which is a method chosen in light of its positive results from the coaching prevention research of Type 2 diabetes mellitus in non-maritime areas.

The evidence-based hypothesis is that prediabetes can return to normal through the use of coaching prevention in non-maritime areas, which remains unevaluated among seafarers and fishermen. For example, Toro-Ramos, et al. conducted an intervention study among patients with prediabetes, in a coach-guided diabetes prevention program and a control group with no specific attention. The intervention group had a significant reduction in glycated hemoglobin levels compared with the control group.¹² Almutairi et al., found that seven of 10 randomized controlled intervention studies among type 2 diabetes patients using patient activation with coaching, demonstrated a significant effect compared to the control groups.¹³

Sherifali et al. conducted a controlled health coaching study using either usual diabetes education or diabetes education plus diabetes health coaching. The health coaching group showed significantly better results than the usual diabetes education.¹⁴ Jefferson et al. described how health coaching via telephone to urban youth succeeded in reducing the risk for diabetes type 2.¹⁵ The Health Belief Model has been widely used in prediabetes programs, e.g., the English Diabetes Prevention Program is effective in improving key cardiovascular risk factors, including excess body weight, and serum lipid level.^{28,29}

In these examples prediabetes and diabetes type 2 are included. The difference is that we include the prevalence of prediabetes, indicating the size of the target group, which is absent in other studies.

Educational strategy

To control their improvements on board, we propose the use of portable blood glucose meters regularly. New portable glucometers are being introduced commercially

with good validity.^{30,31} While most patients do not know that prediabetes can be reversed by their efforts, this calls for education of the seafarers on how they can do this effectively.³² Education gives people the tools they need to make it more likely that they can access quality healthcare.³³ The ship’s complement is a hierarchal structure that consists of the master, two department heads, the chief mate, and the chief engineer.³⁴ We primarily want to invite the leaders on board expecting that many of them will succeed in reversing the prediabetes condition to normal. Furthermore, they have a position in which they can propose changes on board to facilitate prediabetes reversion for the entire crew. For this reason, they will be invited to become new coaches for seafarers after they have passed a health coach educational training course.

Prediabetes health coaching methods to be developed

Several studies have demonstrated the potential to implement a personalized, digital health intervention to treat and manage Type 2 diabetes mellitus through a lifestyle and behavioral approach to improve clinical outcomes.³⁵⁻³⁷

The digital data-driven health coaching method has been reported to provide similar benefits to in-person or telephone-based health coaching.³⁸ Using these nonpersonal methods offers the potential to treat large numbers of seafarers and fishermen in diverse geographic locations.

Furthermore, group-based education interventions are more effective than usual care, waiting list control, and individual education in improving clinical, lifestyle, and psychosocial outcomes in patients with Type 2 diabetes mellitus.^{34,39} With approximately 1.5 million seafarers and millions of fishermen globally receiving health examinations every other year, there is a need for a huge cost-effective prediabetes remission program.

Combined medical treatment and lifestyle modification

Metformin, sold under the brand name of Glucophage (N, N-dimethylbiguanide), is the first-line medication for treating Type 2 diabetes mellitus, particularly in overweight individuals. Metformin is included in the ship’s medicine chest and is useful for acute pharmacological treatment, but not long-term prediabetes prevention.^{39,40} The effects of drug interventions are limited to the duration of their use and do not permanently change the basic pathophysiology of insulin resistance or β -cell dysfunction.⁴¹ Lifestyle modification (LM) and medications (weight loss and insulin-sensitizing agents) successfully reduced the incidence of Type 2 diabetes mellitus, whereas medication effects were short-lived. The LM interventions were sustained for several years;

however, their effects declined with time, suggesting that interventions to preserve effects are needed.⁴²

Strengths and Weaknesses

It is a strength to start with the youngest seafarers at the maritime schools and the first employments on the ships. The youngest seafarers can bring new perspectives of thinking of health prevention to the maritime industry and help to attract the young seafarers for work at sea. It is a strength to use the method of early diagnostics of prediabetes to identify risk elements of health that is not else seen by the maritime medical doctors and the seafarers.

Among the weaknesses is that the interest of participation among the maritime medical doctors and the seafarers seems to be rather low maybe because good results so far are missing. Further, as the seafarers do not all have free access to the internet at sea, they cannot be in contact and give respond to the weekly learnings and the questionnaire forms.

Conclusions

Remission of prediabetes is expected for a significant part of the seafarers. We are looking forward to collaborating and conducting large-scale remissions of prediabetes with all the stakeholders given the strong global need for these programs. However, the learning part of the program alone is available for the education of maritime medical doctors and seafarers.

Highlights

What Is Already Known?

Seafarers and fishers have a great inequity in health at work with a higher risk of being overweight, having metabolic syndrome, Type 2 diabetes mellitus and hypertension. Prediabetes mellitus is a serious health condition in which blood sugar levels are higher than normal but not high enough to be diagnosed as Type 2 diabetes. Prediabetes can be reversed by life-style mediated measures, but not yet seen in seafarering.

What Does This Study Add?

20%-50% of the seafarers have prediabetes, which increases with age. The pre-diabetes remission study is pioneering in maritime health research. The seafarers assess their activity, diet, weight, and finger-prick blood sugar, weekly. Education is done through texts and videos weekly and online talks monthly. The method is useful for seafarers and fishermen and for other transport workers.

Consent For Publication

We declare consent for publication.

Ethical consideration

This study was conducted with secondary data. For this reason, it is not a study that requires an ethics committee. Additionally, no ethical violations were made throughout the study.

Conflict of Interest

None declared

Funding

None declared

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Contributions of Authors

OCJ, FG, and NDM: Conceptualization and writing of the original draft, critical revision, and final approval of the submitted version. OCJ, EH, FG, and NDM: Writing of the original draft, critical revision of the submitted version. OCJ and NDM: Writing of the original draft, critical revision, and final approval of the submitted version.

List of abbreviations

HbA1c: Glycolated hemoglobin

TC: Total cholesterol

HDL-C: High-density lipoprotein-cholesterol

LDL-C: Low-density lipoprotein-cholesterol

TG: Triglyceride

OR: Odds Ratios

GDPR: General Data Protection Regulation

EU: European Union

ISO 27001: International Information Security Standard

Appendix (LINK): Contents of the 16 Weeks Coaching

References

1. Nittari G. et al. Overweight among seafarers working on board merchant ships. *BMC Public Health*. 2019 Dec;19(1):45. [doi:10.1186/s12889-018-6377-6](https://doi.org/10.1186/s12889-018-6377-6)
2. Oldenburg M. et al. Coronary risks among seafarers aboard German-flagged ships. *Int Arch Occup Environ Health*. 2008 May;81(6):735–41. [doi:10.1007/s00420-007-0261-5](https://doi.org/10.1007/s00420-007-0261-5)
3. Tu M, Jepsen JR. Hypertension among Danish seafarers. *Int Marit Health*. 2016;67(4):196–204.
4. Herttua K, Ahrenfeldt LJ, Paljarvi T. Risk of major chronic diseases in transport, rescue and security industries: a longitudinal register-based study. *Occup Environ Med*. 2022 Mar;79(3):162–8. [doi:10.1136/oemed-2021-107764](https://doi.org/10.1136/oemed-2021-107764)
5. Kaerlev L, et al. Hospital contacts for chronic diseases among danish seafarers and fishermen: a population-based cohort study. *Scand J Public Health*. 2007;35(5):481–9. [doi:10.1080/14034940701267385](https://doi.org/10.1080/14034940701267385)
6. American College of Cardiology [Internet]. [cited 2022 Feb 7]. New Guidance on Blood Pressure Management in Low-Risk Adults with Stage 1 Hypertension. Available from: <https://www.acc.org/latest-in-cardiology>
7. Alderman MH. Non-pharmacological treatment of hypertension. *The Lancet*. 1994 Jul 30;344(8918):307–11. [doi:10.1016/s0140-6736\(94\)91343-9](https://doi.org/10.1016/s0140-6736(94)91343-9)
8. Baygi F, et al. Healthy nutrition for seafarers during and after COVID-19 pandemic. *Int Marit Health*. 2022;73(1):56–7. [doi:10.5603/IMH.2022.0008](https://doi.org/10.5603/IMH.2022.0008)
9. Taylor R, Al-Mrabeh A, Sattar N. Understanding the mechanisms of reversal of type 2 diabetes. *The Lancet Diabetes & Endocrinology*. 2019 Sep 1;7(9):726–36. [doi:10.1016/S2213-8587\(19\)30076-2](https://doi.org/10.1016/S2213-8587(19)30076-2)
10. Baygi F et al. Lifestyle interventions in the maritime settings: a systematic review. *Environ Health Prev Med*. 2020;25:10. [doi:10.1186/s12199-020-00848-7](https://doi.org/10.1186/s12199-020-00848-7)
11. Jensen OC et al. Strategies for Prevention of Non-communicable Diseases in Seafarers and Fishermen: Lessons Learned. *International Journal of Community & Family Medicine*. 2018 Sep 10;3. [doi:10.15344/2456-3498/2018/142](https://doi.org/10.15344/2456-3498/2018/142)
12. HealthCheck360. Pre-Diabetes Coaching Program [Internet]. [cited 2023 Nov 13]. Available from: <https://www.healthcheck360.com/prediabetes-program>
13. Almutairi N, Hosseinzadeh H, Gopaldasani V. The effectiveness of patient activation intervention on type 2 diabetes mellitus glycemic control and self-management behaviors: A systematic review of RCTs. *Prim Care Diabetes*. 2020 Feb;14(1):12–20. [doi:10.1016/j.pcd.2019.08.009](https://doi.org/10.1016/j.pcd.2019.08.009)
14. Sherifali D et al. The Diabetes Health Coaching Randomized Controlled Trial: Rationale, Design and Baseline Characteristics of Adults Living With Type 2 Diabetes. *Canadian Journal of Diabetes*. 2019 Oct 1;43(7):477–82. [doi:10.1016/j.cjcd.2018.10.004](https://doi.org/10.1016/j.cjcd.2018.10.004)
15. Jefferson V et al. Coping skills training in a telephone health coaching program for youth at risk for type 2 diabetes. *J Pediatr Health Care*. 2011;25(3):153–61. [doi:10.1016/j.pedhc.2009.12.003](https://doi.org/10.1016/j.pedhc.2009.12.003)
16. Hallberg SJ et al. Effectiveness and Safety of a Novel Care Model for the Management of Type 2 Diabetes at 1 Year: An Open-Label, Non-Randomized, Controlled Study. *Diabetes Ther*. 2018 Apr;9(2):583–612. [doi:10.1007/s13300-018-0373-9](https://doi.org/10.1007/s13300-018-0373-9)
17. Mifsud JL et al. Motivational interviewing to support modifiable risk factor change in individuals at increased risk of cardiovascular disease: A systematic review and meta-analysis. *PLoS One*. 2020;15(11):e0241193. [doi:10.1371/journal.pone.0241193](https://doi.org/10.1371/journal.pone.0241193)
18. Gupta K et al. Evaluating the Usability of mHealth Applications on Type 2 Diabetes Mellitus Using Various MCDM Methods. *Healthcare*. 2022 Jan;10(1):4. [doi:10.3390/healthcare10010004](https://doi.org/10.3390/healthcare10010004)
19. Sneha S et al. Health Internet Technology for Chronic Conditions: Review of Diabetes Management Apps. *JMIR Diabetes*. 2021 Aug 31;6(3):e17431. [doi:10.2196/17431](https://doi.org/10.2196/17431)
20. Jensen, OC., George Charalambous, and Debbie Andrioti. “Perceived Training Needs of Maritime Doctors and General Practitioners.” *International Journal of Travel Medicine and Global Health* 6, no. 4 (December 1, 2018): 154–60. <https://doi.org/10.15171/ijtmgh.2018.28>.
21. Bygvraa, DA et al. Maritime Doctors’ Skills and Competencies: A Review for Policy Analysis.” *Maritime Technology and Research* 2, no. 1 (January 1, 2020): 40–51. <https://doi.org/10.33175/mtr.2020.206375>.
22. Andrioti, Despena et al. “Do Danish Maritime Doctors Value Continuous Education Initiatives?” *Health Economics & Outcome Research: Open Access* 03 (January 1, 2017). <https://doi.org/10.4172/2471-268X/1000137>.

23. Hibbard JH. et al. Development of the Patient Activation Measure (PAM): conceptualizing and measuring activation in patients and consumers. *Health Serv Res.* 2004 Aug;39(4 Pt 1):1005–26. doi:10.1111/j.1475-6773.2004.00269.x
24. Obesity Action Coalition [Internet]. [cited 2024 Mar 25]. Self-Monitoring - The Way to Successful Weight Management. Available from: <https://www.obesityaction.org/resources/self-monitoring-the-way-to-successful-weight-management/>
25. Pleus S. et al. Self-Monitoring of Blood Glucose as an Integral Part in the Management of People with Type 2 Diabetes Mellitus. *Diabetes Ther.* 2022 May;13(5):829–46. doi:10.1007/s13300-022-01254-8
26. Jensen OC et al. Early diagnosis of T2DM using high sensitive tests in the mandatory medical examinations for fishers, seafarers and other transport workers. *Primary Care Diabetes.* 2022 Feb;16(1):211–3. doi:10.1016/j.pcd.2021.12.018
27. Jensen OC et al. Screening for type 2 diabetes and hypertension in seafarers' medical examinations. *Int Marit Health.* :9. doi:10.5603/IMH.2022.0010
28. Jensen OC, et al. Rethinking the use of urine dipstick for early diagnosis of Type 2 diabetes mellitus. *Diabetes Research and Clinical Practice.* 2022 Jan;109222. doi:10.1016/j.diabres.2022.109222
29. Galaviz KI. et al. Interventions for Reversing Prediabetes: A Systematic Review and Meta-Analysis. *American Journal of Preventive Medicine.* 2022 Apr 1;62(4):614–25. doi:10.1016/j.amepre.2021.10.020
30. Castaño López MÁ et al. Fernández de Liger Serrano JL, Robles Rodríguez JL, Márquez Márquez T. Validation of a glucose meter at an intensive care unit. *Endocrinol Nutr.* 2012 Jan 1;59(1):28–34. doi:10.1016/j.endonu.2011.08.003
31. Chandra Prabhakar M, Halder P. Reliability and accuracy of bedside capillary blood glucose measurement by glucometers compared to venous blood glucose in critically ill patients: A facility based cross-sectional study. *Clinical Nutrition ESPEN.* 2024 Apr 1;60:24–30. doi:10.1016/j.clnesp.2024.01.008
32. American Medical Association [Internet]. 2021 [cited 2023 Dec 22]. What doctors wish patients knew about a prediabetes diagnosis. Available from: <https://www.ama-assn.org/delivering-care/diabetes/what-doctors-wish-patients-knew-about-prediabetes-diagnosis>
33. Amelia R. et al. Educational Model and Prevention on Prediabetes: A Systematic Review. *Curr Diabetes Rev.* 2023 Oct 10; doi:10.2174/0115733998275518231006074504
34. Four Stripes: Understanding the Hierarchy on Ships - The MARE Report [Internet]. [cited 2024 Jan 31]. Available from: <https://marereport.namma.org/index.php/2021/05/28/fo-ur-stripes-understanding-hierarchy/>
35. What Is Behavioral Coaching? Explaining Key Concepts & More [Internet]. [cited 2023 Dec 28]. Available from: <https://www.a-plancoaching.com/blog/behavioral-coaching/>
36. Meyer, Hilary. “What Is Best Practice in Online Coaching?” *International Journal of Evidence Based Coaching and Mentoring*, no. S17 (2023): 77–90. <https://doi.org/10.24384/srgt-nk21>.
37. Azelton KR, Crowley AP, Vence N, Underwood K, Morris G, Kelly J, et al. Digital Health Coaching for Type 2 Diabetes: Randomized Controlled Trial of Healthy at Home. *Front Digit Health.* 2021 Nov 25;3:764735. doi:10.3389/fdgh.2021.764735
38. Gershkowitz BD, Hillert CJ, Crotty BH. Digital coaching strategies to facilitate behavioral change in type 2 diabetes: a systematic review. *The Journal of Clinical Endocrinology & Metabolism.* 2021;106(4):e1513–20. doi:10.1210/clinem/dgaa850
39. Odgers-Jewell K. et al. Effectiveness of group-based self-management education for individuals with Type 2 diabetes: a systematic review with meta-analyses and meta-regression. *Diabet Med.* 2017 Aug;34(8):1027–39. doi:10.1111/dme.13340
40. Mousavi SS, et al. Comparing the effectiveness of metformin with lifestyle modification for the primary prevention of type II diabetes: a systematic review and meta-analysis. *BMC Endocrine Disorders.* 2023 Sep 18;23(1):198. doi:10.1186/s12902-023-01445-9
41. de Hoogh IM et al. The Effect of a Lifestyle Intervention on Type 2 Diabetes Pathophysiology and Remission: The Stevenshof Pilot Study. *Nutrients.* 2021 Jun 25;13(7):2193. doi:10.3390/nu13072193
42. Haw JS et al. Long-term Sustainability of Diabetes Prevention Approaches: A Systematic Review and Meta-analysis of Randomized Clinical Trials. *JAMA Intern Med.* 2017 Dec 1;177(12):1808–17. doi:10.1001/jamainternmed.2017.6040
43. Wegovy® Flextouch® - information for healthcare professionals - Medicin.dk [Internet]. [cited 2024 Feb 1]. Available from: <https://pro.medicin.dk/Medicin/Praeparater/10247>