Lilian Monteiro Ferrari Viterbo

Modelo de gestão em saúde do trabalhador: desenvolvimento, validação e aplicação numa indústria do petróleo, Bahia, Brasil

Universidade Fernando Pessoa
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Tese apresentada a Universidade Fernando Pessoa como parte dos requisitos para obtenção do grau de Doutora em Ecologia e Saude Ambiental, sob a orientação da Prof.ª Doutora Maria Alzira Pimenta Dinis.

RESUMO

LILIAN MONTEIRO FERRARI VITERBO: Modelo de gestão em saúde do trabalhador: desenvolvimento, validação e aplicação numa indústria do petróleo, Bahia, Brasil

(Sob orientação da Prof.ª Doutora Maria Alzira Pimenta Dinis)

O campo da saúde do trabalhador (ST) visa analisar e intervir nas relações entre o trabalho, a saúde e o ambiente, a partir do processo laboral, incorporando o saber teórico dos profissionais da área ao saber prático dos trabalhadores. As ações devem estar vinculadas ao quotidiano vivenciado pelos indivíduos, considerando os riscos ambientais decorrentes de atividades antropogênicas, bem como os riscos ocupacionais que afetam a ST. Nesse contexto, o objetivo desta tese de doutoramento consiste em propor um modelo de gestão para serviços de ST, sob a ótica da gestão de risco, na indústria do petróleo no estado da Bahia, Brasil. A investigação contemplou avaliação retrospectiva (2006-2018) das informações disponíveis por meio de um banco de dados institucional e as análises foram realizadas como parte da avaliação epidemiológica periódica sobre os riscos à saúde, à segurança do trabalho e à saúde ambiental. Trata-se de um estudo que empreendeu a combinação de diversas estratégias metodológicas, capazes de abarcar a complexidade proposta da investigação-ação, tais como relato de experiência, desenvolvimento e validação de instrumento, índice e modelo, além de estudo longitudinal. A amostra contou com uma média de 1357 trabalhadores (MIN = 965; MAX = 1831). É importante enfatizar que esta é uma amostra de conveniência e que, a cada ano, a população do estudo variava em número e composição; no entanto, essa diferença não é estatisticamente significativa. Em todos os anos pesquisados,

prevaleceram, na amostra, trabalhadores do sexo masculino, casados, com média de 44,9 anos (MIN = 23; MAX = 73), em regime de trabalho administrativo, residentes na capital do estado da Bahia, Brasil e com o nível escolar médio. Recorreu-se ao SPSS versão 25.0 para a análise estatística dos dados, nomeadamente para análise estatística univariada e multivariada.

Ressaltam-se cinco pesquisas mais relevantes como principais resultados da tese, como a investigação-ação, intitulada *Interdisciplinarity: an Articulating Movement in the Field of Worker´s Health*, que demonstra os problemas experienciados na prática do campo estudado e ratifica a necessidade de um novo modelo de gestão em ST. Para isso, prosseguiu-se a elaboração e validação de um instrumento de abordagem interdisciplinar da ST, intitulado *Interdisciplinary Worker's Health Approach Instrument (IWHAI)*. Com a aplicação do IWHAI, foi possível desenvolver um índice capaz de avaliar o risco da ST, focado no desenvolvimento sustentável no local de trabalho, o *Worker's Health Risk Index (WHRI).* Com base nessas duas ferramentas, conceptualizou-se um novo e original modelo de assistência em ST, o *Workers' Healthcare Assistance Model (WHAM)*, que contempla a abordagem interdisciplinar, o gerenciamento de risco e a sustentabilidade econômica em busca da saúde integral e integrada, e que responde ao objetivo central da investigação. De forma a validar a eficácia da implementação dessa estratégia interdisciplinar, procedeu-se à realização de um estudo longitudinal retrospectivo, *Implementation of an Interdisciplinary Approach to Promote Workers Global Health Status in the Oil Industry, Brazil (2006–2015)*, que compara o antes e o depois, podendo constatar uma mudança de paradigma na ST. Os resultados deste estudo mostram que a abordagem interdisciplinar, com foco no gerenciamento de riscos individuais e coletivos, está associada à melhoria dos indicadores globais de saúde analisados. A avaliação do retorno sustentável do investimento (S-ROI) foi analisada e obteve-se um S-ROI de 85,5% para as variáveis estudadas, justificando o amplo sucesso da estratégica de investigação implementada no âmbito da indústria petrolífera em foco.

A diversidade e complexidade de temáticas abordadas ao longo desta investigação tornaram possível, para além das publicações centrais, desenvolver estudos

complementares com vistas a um aprofundamento dos resultados apresentados, demonstrando a relevância do tema desenvolvido na tese, assim como seu potencial inovador no campo da ST. O modelo de gestão em ST proposto revelou-se válido e robusto, assumindo-se como uma forma de intervenção em gestão de saúde, capaz de responder aos principais desafios que as empresas de grande porte enfrentam na contemporaneidade, melhorando o bem estar dos trabalhadores e aumentando a produtividade dos mesmos de forma sustentável, traduzindo-se ainda num conjunto de relevantes publicações científicas validadas por pares.

ABSTRACT

LILIAN MONTEIRO FERRARI VITERBO: Worker’s health management model: development, validation and application in an oil industry, Bahia, Brazil

(Supervised by Professor Maria Alzira Pimenta Dinis)

The field of workers' health (WH) aims to analyze and intervene in the relationships between work, health and the environment, based on the labor process, incorporating the theoretical knowledge of professionals in the field to the practical knowledge of workers. The actions must be linked to the daily life experienced by individuals, considering the environmental risks arising from anthropogenic activities, as well as the occupational risks that affect WH. In this context, the objective of this doctoral thesis is to propose a management model for WH services, from the perspective of risk management, in the oil industry in the state of Bahia, Brazil. The investigation included a retrospective assessment (2006-2018) of the information available through an institutional database and the analyzes were carried out as part of the periodic epidemiological assessment on the risks to health, work safety and environmental health. It is a study that undertook the combination of several methodological strategies, capable of encompassing the proposed complexity of action-research, such as report of experience, development and validation of instrument, index and model, in addition to a longitudinal study. The sample had an average of 1357 workers (MIN = 965; MAX = 1831). It is important to emphasize that this is a convenience sample and that, each year, the study population varied in number and composition; however, this difference is not

statistically significant. In all the years surveyed, male workers, married, with an average of 44.9 years (MIN = 23; MAX = 73), under administrative work, living in the state capital of Bahia, Brazil, prevailed in the sample. and the average school level. SPSS version 25.0 was used for the statistical analysis of the data, namely for univariate and multivariate statistical analysis.

Five most relevant researches stand out as the main results of the thesis, such as the action-research, entitled *Interdisciplinarity: an Articulating Movement in the Field of Worker´s Health*, which demonstrates the problems experienced in the practice of the studied field and confirms the need for a new management model in WH. For this, the elaboration and validation of an instrument of interdisciplinary approach of WH, entitled *Interdisciplinary Worker's Health Approach Instrument (IWHAI)*, continued. With the application of the IWHAI, it was possible to develop an index capable of assessing the risk of WH, focused on sustainable development in the workplace, the *Worker's Health Risk Index (WHRI)*. Based on these two tools, a new and original WH assistance model was conceptualized, the *Workers' Healthcare Assistance Model (WHAM)*, which contemplates the interdisciplinary approach, risk management and economic sustainability in search of integral and integrated health , and which responds to the central objective of the investigation. In order to validate the effectiveness of the implementation of this interdisciplinary strategy, a retrospective longitudinal study was carried out, *Implementation of an Interdisciplinary Approach to Promote Workers Global Health Status in the Oil Industry, Brazil (2006–2015)*, which compares the before and the after, being able to see a paradigm shift in the WH. The results of this study show that the interdisciplinary approach, with a focus on managing individual and collective risks, is associated with the improvement of the global health indicators analyzed. The evaluation of the sustainable return on investment (S-ROI) was analyzed and an S-ROI of 85.5% was obtained for the variables studied, justifying the broad success of the research strategy implemented within the scope of the oil industry in focus.

The diversity and complexity of themes addressed throughout this investigation made it possible, in addition to the central publications, to develop complementary studies with

a view to deepening the results presented, demonstrating the relevance of the theme developed in the thesis, as well as its innovative potential in the field of WH . The proposed WH management model proved to be valid and robust, assuming itself as a form of intervention in health management, capable of responding to the main challenges that large companies face today, improving the well-being of workers and increasing their productivity in a sustainable manner, resulting in a set of relevant scientific publications validated by peers.

RÉSUMÉ

LILIAN MONTEIRO FERRARI VITERBO: Modèle de gestion de la santé au travail: développement, validation et application dans une industrie pétrolière, Bahia, Brésil

(Supervisé par le professeur Maria Alzira Pimenta Dinis)

Le domaine de la santé des travailleurs (ST) vise à analyser et à intervenir dans les relations entre travail, santé et environnement, sur la base du processus de travail, en intégrant les connaissances théoriques des professionnels du domaine aux connaissances pratiques des travailleurs. Les actions doivent être liées à la vie quotidienne vécue par les individus, compte tenu des risques environnementaux liés aux activités anthropiques, ainsi que des risques professionnels qui affectent ST. Dans ce contexte, l'objectif de cette thèse de doctorat est de proposer un modèle de gestion des services ST, sous l'angle de la gestion des risques, dans l'industrie pétrolière de l'État de Bahia, au Brésil. L'enquête comprenait une évaluation rétrospective (2006-2018) des informations disponibles via une base de données institutionnelle et les analyses ont été effectuées dans le cadre de l'évaluation épidémiologique périodique des risques pour la santé, la sécurité au travail et la santé environnementale. Il s'agit d'une étude qui a entrepris la combinaison de plusieurs stratégies méthodologiques, capables d'englober la complexité proposée de la recherche-action, comme le rapport d'expérience, le développement et la validation de l'instrument, de l'indice et du modèle, en plus d'une étude longitudinale. L'échantillon comptait en moyenne 1357 travailleurs (MIN = 965;

MAX = 1831). Il est important de souligner qu'il s'agit d'un échantillon de convenance et que, chaque année, la population étudiée variait en nombre et en composition; cependant, cette différence n'est pas statistiquement significative. Dans toutes les années de l'enquête, les travailleurs de sexe masculin, mariés, avec une moyenne de 44,9 ans (MIN = 23; MAX = 73), sous travaux administratifs, vivant dans la capitale de l'État de Bahia, au Brésil, ont prévalu dans l'échantillon. et le niveau scolaire moyen. La version 25.0 de SPSS a été utilisée pour l'analyse statistique des données, notamment pour l'analyse statistique univariée et multivariée.

Cinq recherches les plus pertinentes se détachent comme les principaux résultats de la thèse, comme la recherche-action, intitulée *Interdisciplinarité: un Mouvement Articulé Dans le Domaine de la Santé des Travailleurs*, qui démontre les problèmes rencontrés dans la pratique du domaine étudié et confirme la nécessité d'un nouveau modèle de gestion à ST. Pour cela, l'élaboration et la validation d'un instrument d'approche interdisciplinaire des ST, intitulé *Instrument d'Approche Interdisciplinaire Pour la Santé des Travailleurs (IWHAI)*, s'est poursuivie. L'application de l'IWHAI a permis de développer un indice capable d'évaluer le risque de ST, axé sur le développement durable sur le lieu de travail, le *Worker's Health Risk Index (WHRI)*. Sur la base de ces deux outils, un nouveau et original modèle d'assistance ST a été conceptualisé, le *Workers 'Healthcare Assistance Model (WHAM)*, qui envisage l'approche interdisciplinaire, la gestion des risques et la durabilité économique à la recherche d'une santé intégrale et intégrée, et qui répond à l'objectif central de l'enquête. Afin de valider l'efficacité de la mise en œuvre de cette stratégie interdisciplinaire, une étude longitudinale rétrospective a été réalisée, *Mise en Œuvre d'une Approche Interdisciplinaire Pour Promouvoir l'État de Santé Mondial des Travailleurs Dans l'Industrie Pétrolière, Bahia, Brésil (2006-2015)*, qui compare les et l'après, être capable de voir un changement de paradigme dans le ST. Les résultats de cette étude montrent que l'approche interdisciplinaire, centrée sur la gestion des risques individuels et collectifs, est associée à l'amélioration des indicateurs de santé globale analysés. L'évaluation du retour sur investissement durable (S-ROI) a été analysée et un S-ROI de 85,5% a été obtenu pour les variables étudiées, justifiant le large succès de la stratégie de recherche mise en œuvre dans le cadre de l'industrie pétrolière en focus.

La diversité et la complexité des thèmes abordés tout au long de cette enquête ont permis, en plus des publications centrales, de développer des études complémentaires en vue d'approfondir les résultats présentés, démontrant la pertinence du thème développé dans la thèse, ainsi que son potentiel d'innovation dans le domaine des ST . Le modèle de gestion ST proposé s'est avéré valide et robuste, se supposant comme une forme d'intervention dans la gestion de la santé, capable de répondre aux principaux défis auxquels les grandes entreprises sont aujourd'hui confrontées, en améliorant le bien-être des travailleurs et augmenter leur productivité de manière durable, aboutissant à un ensemble de publications scientifiques pertinentes validées par des pairs.

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LISTA DE ABREVIATURAS

APR - **A**nálise **P**reliminar de **R**iscos

CGD - **C**arga **G**lobal de **D**oenças

DCNT - **D**oenças **C**rônicas **N**ão **T**ransmissíveis

DSS - **D**eterminantes **S**ociais da **S**aúde

FMEA - **A**nálise de **M**odos e **E**feitos de **F**alhas

FMECA - **A**nálise de **M**odos, **E**feitos e **C**riticidade de **F**alhas

FP-ENAS - **U**nidade de **I**nvestigação em **E**nergia, **A**mbiente e **S**aúde

HAZOP - **E**studo de **P**erigos e **O**perabilidade

IWHAI - ***I**nterdisciplinary **W**orker's **H**ealth **A**pproach **I**nstrument*

LOPA - **A**nálise de **C**amadas de **P**roteção

MAC - **M**odelo de **A**tenção **C**rônica

MARP - **M**odelo de **A**valiação de **R**isco **P**otencial

MAX - **M**áximo

MDSS - **M**odelo dos **D**eterminantes **S**ociais da **S**aúde

MIN - **M**ínimo

MPR - **M**odelo de **P**irâmide de **R**iscos

PIB - **P**roduto **I**nterno **B**ruto

ODS - **O**bjetivos do **D**esenvolvimento **S**ustentável

QRA - **A**nálise **Q**uantitativa de **R**iscos

SMS - **S**egurança, **M**eio **A**mbiente e **S**aúde

S-ROI - **A**valiação do **R**etorno **S**ustentável do **I**nvestimento

ST - **S**aúde do **T**rabalhador

UFP - **U**niversidade **F**ernando **P**essoa

WH - ***W**orker's **H**ealth*

WHO - ***W**orld **H**ealth **O**rganization*

WHAM - ***W**orkers' **H**ealthcare **A**ssistance **M**odel*

WHRI - ***W**orker's **H**ealth **R**isk **I**ndex*

INTRODUÇÃO

O presente tema de estudo insere-se no âmbito do programa de Doutoramento em Ecologia e Saúde Ambiental promovido pela Faculdade de Ciência e Tecnologia da Universidade Fernando Pessoa (UFP), enquadrado pela Unidade de Investigação em Energia, Ambiente e Saúde (FP-ENAS) da UFP, tendo este decorrido entre julho de 2017 e julho de 2020.

A Saúde do Trabalhador (ST) configura-se como um campo influente e com importante potencial para impactar positivamente na promoção e prevenção da saúde, no cuidado ecológico e ocupacional integral e integrado e na sustentabilidade econômica no contexto do trabalho. O propósito desta investigação surgiu do contato com a realidade e das percepções dos problemas práticos enfrentados na gestão em ST, em uma indústria de petróleo, com forte Política de Segurança, Meio Ambiente e Saúde (SMS) (Pretrobras, 2020). A melhoria contínua do desempenho em SMS é promovida em todos os níveis do campo em estudo, de modo a assegurar seu avanço nessas áreas, sendo os riscos inerentes às atividades operacionais constantemente identificados, avaliados e gerenciados, de modo a evitar a ocorrência de acidentes e/ou assegurar a minimização de seus efeitos (Machi Junior et al, 2014). A relevância desse tema na indústria em estudo pode ser evidenciada em seu plano estratégico, onde a redução da taxa de acidentes de trabalho (ambição de zero fatalidade) e os avanços financeiros são as métricas de topo (Petrobras, 2019). A gestão de risco nas áreas de segurança e meio ambiente é amplamente estudada cientificamente e com ações robustas implementadas. Contudo, no âmbito da saúde, identifica-se a ausência de um modelo que considere os fatores de riscos (ambientais, ocupacionais, comportamentais e metabólicos) e os fatores

pessoais de cada indivíduo, além de apresentar a influência desses riscos na ST. Na busca de uma resposta teórica ao problema prático da empresa e empenhado de grande motivação pessoal, destacam-se, como principais fundamentos teóricos utilizados na investigação, os Objetivos do Desenvolvimento Sustentável (ODS) (United Nations, 2015), os Determinantes Sociais da Saúde (DSS) (Graham & White, 2016; Kelly et al., 2007; Vidal, Oliveira, Pontes, Maia, & Ferraz, 2020; Vidal, Pontes, Barreira, Oliveira, & Maia, 2018), a interdisciplinaridade (Almeida, 2000), o cuidado ecológico e ocupacional (Lins et al., 2013), a Carga Global de Doenças (CGD) (Bloom et al., 2011; Forouzanfar et al., 2016; Malta et al., 2017), o gerenciamento de risco em saúde (Badri, Gbodossou, & Nadeau, 2012; A. S. Costa, **Viterbo**, Vidal, Dinis, & Simões, 2020; Gisela Marta Oliveira, Vidal, **Viterbo**, Costa, & Ferraz, 2020) e a sustentabilidade econômica no contexto do trabalho (Epstein, Elkington, & Leonard, 2008; **Viterbo**, Costa, Vidal, & Dinis, 2020b).

Em um cenário mundial em que as pessoas passam a maior parte do dia no trabalho, é importante tornar o contexto laboral seguro e propício à qualidade de vida e saúde, contemplando ainda o ambiente. Assim, instituições públicas e privadas devem desenvolver e implementar mecanismos e intervenções interdisciplinares na mesma direção (Task Force on Community Preventive Services, 2010), contribuindo para a implementação dos ODS ao nível micro. Entre os 17 objetivos, cinco deles estão diretamente relacionados às questões de saúde e ambiente de qualidade e trabalho/emprego dignos, como os ODS 2, 3, 6, 8 e 11, que, visam a garantir o acesso à saúde de qualidade e promover o bem-estar de todos, em todas as idades, contemplando a implementação de estratégias de crescimento econômico sustentável, emprego inclusivo e sustentável, pleno e produtivo e trabalho decente para todos, respectivamente (United Nations General Assembly, 2018). Compreendendo a condição de saúde como um estado complexo, multidimensional e dinâmico, os DSS são de fundamental importância para definição das estratégias de promoção e prevenção da saúde, visto que os fatores sociais, econômicos, culturais, ambientais e biológico/genéticos influenciam, afetam e/ou determinam a saúde da população de

diferentes formas (Arruda, Maia, & Alves, 2018; Carrapato, Correia, & Garcia, 2017; Oliveira et al., 2019; Vidal et al., 2020; Vidal et al., 2018).

A *World Health Organization* (WHO) sugere que a ação sobre fatores de risco tem o potencial de produzir melhorias sustentáveis na saúde das populações. Para gerenciamento do risco, duas abordagens principais se destacam: identificar pessoas de alto risco e conhecer o risco de toda a população, através de métodos objetivos, destacando aqueles que supostamente se beneficiariam das intervenções em saúde (World Health Organization, 2009). Muitas metodologias de análise de riscos industriais são utilizadas e mostram-se eficientes, especificamente nas áreas de segurança e meio ambiente, tais como Estudo de Perigos e Operabilidade (HAZOP) (Crawley & Tyler, 2015), Análise de Modos e Efeitos de Falhas (FMEA) (Lipol & Haq, 2011), Análise Preliminar de Riscos (APR) (Komljenovic, Groves, & Kecojevic, 2008), Análise de Modos, Efeitos e Criticidade de Falhas (FMECA) (Lipol & Haq, 2011), Modelagem de vulnerabilidade (Murray, 2013), Análise Quantitativa de Riscos (QRA) (Finney, 2005) e Análise de Camadas de Proteção (LOPA) (Summers, 2003), todas elas embasadas do conceito de risco probabilístico. No âmbito da saúde, em consonância com o mesmo enquadramento, o conceito de risco mais utilizado é o epidemiológico, que estima a probabilidade de ocorrência de eventos de saúde e doença associados a determinadas exposições (Navarro, 2009). Como modelo abstrato, o risco epidemiológico reduz a complexidade dos fenômenos que estuda, na medida em que visa a associar a causa e o efeito da doença, não sendo esta determinada por fatores unidimensionais (Mello, Carmo, Leite, Miguel, & Colares, 2014). Do ponto de vista teórico os seguintes conceitos foram priorizados, nomeadamente o risco social (Areosa, 2010), assim como a utilização do conceito de risco potencial, ou seja, o risco que se encontra no âmbito das possibilidades, anterior ao risco probabilístico que, através do Modelo de Avaliação de Risco Potencial, pode ser quantificável e representado por um formalismo matemático (Leite & Navarro, 2009). A junção desses saberes demonstrou um potencial avanço metodológico, capaz de tangibilizar aspectos abstratos dos principais fatores de riscos para a ST no contexto do trabalho.

Segundo a WHO, o impacto socioeconômico das doenças crônicas está aumentando e é considerado um problema para a saúde pública mundial. Além das mortes prematuras, as Doenças Crônicas Não Transmissíveis (DCNT) são responsáveis pela incapacidade no trabalho, pela renda familiar minorada e pela produtividade reduzida. No Brasil (Bloom et al., 2011), considerando mortes, absenteísmo e presenteísmo, o impacto das DCNT representou 5,4% do produto interno bruto (PIB) de 2015 ($ 129,8 bilhões). As projeções indicam que esse número chegará a 5,8% do PIB em 2030 ($ 184 bilhões). O estudo de Bloom et al (2011) revela que os custos econômicos relacionados à aposentadoria antecipada devem atingir 2,9% em 2030, em comparação com 2,4% em 2015. O indicador da WHO "Anos de vida perdidos por incapacidade" (Rasmussen, Sweeny, & Sheehan, 2015) mostrou o Brasil como o país com os maiores gastos em doenças crônicas, comparado aos outros 20 países no mesmo estudo. Em um cenário de significativo impacto econômico nos sistemas de saúde, a regulamentação da assistência à saúde aparece como uma forma de proporcionar eficiência econômica (Salgado, 2003) e pode ser entendida como um instrumento essencial para manter o equilíbrio dos mesmos (Vilarins, Shimizu, & Gutierrez, 2012). Destarte, a regulação é vista como um conjunto de ações que direcionam, ajustam, facilitam ou limitam determinados processos para alcançar resultados que podem estar relacionados ao atendimento das necessidades mais prementes de uma população (Schilling, Reis, & Moraes, 2006). Nesse sentido, a estratificação de risco dos usuários do sistema de saúde é um elemento central do gerenciamento da saúde de uma população. A estratificação da população em subpopulações leva à identificação de usuários com necessidades semelhantes, a fim de distribuir recursos específicos para cada grupo. Quando uma população não é estratificada por risco, o cuidado pode ser prestado àqueles com menor risco e/ou excesso de cuidado, ao invés daqueles com maior risco, resultando em atenção ineficaz e ineficiente (Mendes, 2015). O cuidar deve corresponder à realidade vivida pelas pessoas, sendo uma ferramenta imprescindível para traçar e delinear as intervenções de saúde. Tais intervenções devem ser capazes de detectar diferentes manifestações de risco, incluindo os riscos ambientais que surgem da destruição de ecossistemas, da contaminação crescente da atmosfera, do solo e da água, bem como do aquecimento global, resultantes das ações antropogênicas sobre o ambiente. Também os riscos

ocupacionais, decorrentes, sobretudo, das condições lesivas presentes nos ambientes de trabalho, que afetam a ST, dos seus familiares e de populações residentes nas áreas de influência das unidades produtivas. Nomeadamente, cuidado ecológico e ocupacional.

A ST traz um grande potencial de integração disciplinar no sentido de tentar organizar, de maneira mais compreensiva, fatores dificilmente alcançados pelas disciplinas isoladamente (Almeida, 2000). Ela visa a estudar e intervir nas relações entre o trabalho, a saúde e o ambiente, a partir do processo de trabalho, incorporando o saber teórico dos profissionais ao saber prático dos trabalhadores. Para implementação desses pressupostos, fez-se necessário um longo percurso para desenvolvimento dos profissionais, utilizando-se de bases epistemológicas como a filosofia do diálogo (Morgan & Guilherme, 2012), psicodinâmica do trabalho (Dashtipour & Vidaillet, 2017), perspectiva ergológica (Hennington, 2008), clínica da atividade (Clot, 2017) e clínica do trabalho (Bendassolli & Soboll, 2011). Todo esse arcabouço teórico possibilitou que a equipe de interdisciplinar envolvida no processo compreendesse a importância de cada área do saber que compõe a ST, além de ser capaz de integrar ainda profissionais da área de segurança, meio ambiente e trabalhadores no diálogo equilibrado sobre quais indicadores impactam na saúde e de que forma influenciam no risco individual e coletivo dos trabalhadores.

Por meio desse olhar, é possível observar que os pressupostos da ST - o protagonismo dos trabalhadores, a concepção ampliada da saúde para além dos fatores de risco tradicionais, a interdisciplinaridade e a ênfase em uma cultura real de promoção e prevenção da saúde - são aqueles que melhor atendem à tutela integral da saúde em sua matriz biopsicossocial. A articulação desses pressupostos, assim como a implementação prática desses na realidade dos serviços de ST têm sido um grande desafio para os profissionais da indústria do petróleo na Bahia, Brasil. Dessa forma, pergunta-se: como é possível atuar de forma interdisciplinar em ST? Como gerenciar os riscos individuais e coletivos em ST? Como intervir de forma efetiva, integral e integrada em ST?

O tema desta tese de doutoramento possui como objetivo principal desenvolver, validar e aplicar um modelo de gestão em ST, visando à prevenção e promoção da saúde, ao cuidado ecológico e ocupacional integral e integrado e à sustentabilidade econômica no contexto de trabalho. Para responder a este objetivo, estruturou-se um estudo, no período de 2006 a 2018, que empreendeu a combinação de diversas estratégias metodológicas capazes de abarcar a complexidade proposta da investigação-ação, tais como relato de experiência, desenvolvimento e validação de instrumento, índice e modelo, além de estudo longitudinal retrospectivo, que permitiu comparar os resultados de saúde e financeiros obtidos com a implantação do modelo ao longo de dez anos. Para a operacionalização do objetivo principal acima descrito, tornou-se necessária a construção de cinco objetivos secundários, conforme se descrevem:

Objetivo 1 – Desenvolvimento de investigação-ação, que buscou levantar os principais problemas encontrados para a prática integral e integrada da gestão em ST na indústria do petróleo, Bahia, Brasil.

Objetivo 2 – Desenvolvimento e validação de um instrumento de abordagem interdisciplinar da ST, com base num quadro teórico que integra as disciplinas da medicina, enfermagem, nutrição, educação física e odontologia, abarcando os fatores de riscos ambientais e ocupacionais, fatores de riscos comportamentais, fatores de riscos metabólicos e fatores pessoais, bem como os DSS, CGD e ODS;

Objetivo 3 – Desenvolvimento e validação de um índice que visa avaliar o risco a ST, com foco no desenvolvimento sustentável no local de trabalho. Essa abordagem pressupõe que a ST resulta de um conjunto de associações entre ambiente, saúde humana e relações de trabalho que, inter-relacionadas, contribuem para o estado geral de ST;

Objetivo 4 – Desenvolvimento, validação e aplicação de um modelo de gestão em ST, que contemple a abordagem interdisciplinar e o gerenciamento de risco, em busca da

saúde integral e integrada, considerando a promoção da saúde e sustentabilidade económica.

Objetivo 5 – Avaliação da eficácia do modelo implementado, através da descrição do comportamento de variáveis epidemiológicas de uma população de trabalhadores de uma indústria de petróleo na Bahia, Brasil, antes e depois da intervenção através de práticas de saúde interdisciplinares com foco na promoção da saúde.

Partindo do princípio de que a investigação-ação acompanha e molda este projeto e que cada objetivo atingido valida o anterior, acreditou-se ser pertinente a opção pela apresentação dos resultados através da compilação de produção científica validada por pares (artigos e capítulos), organizados em cinco capítulos apresentados nesta tese. O primeiro capítulo apresenta um relato de experiência, trazendo embasamento teórico relacionado ao tema em estudo, considerando possível a implementação da abordagem interdisciplinar no campo da ST. O segundo capítulo apresenta o *Interdisciplinary Worker's Health Approach Instrument* (IWHAI), instrumento capaz de viabilizar a coleta dos dados necessários para o mapeamento dos fatores de riscos em ST, a partir da abordagem interdisciplinar. O índice *Worker's Health Risk Index* (*WHRI)* é desenvolvido no capítulo três, onde é demonstrado como as informações colhidas através do IWHAI podem gerar um escore de risco individual e coletivo dos trabalhadores. Estes dois instrumentos seguiram o padrão científico recomendado para validação de instrumentos de recolha de dados com o objetivo de avaliar a sua confiabilidade e robustez (Sousa et al., 2015). O quarto capítulo propõe uma estrutura de ações sistematizadas e integradas para gestão em serviços de ST, voltada para a estratégia de promoção da saúde no ambiente de trabalho e considerando a sustentabilidade econômica, o *Workers' Healthcare Assistance Model* (WHAM), incorporando a utilização do IWHAI e *WHRI* em seu desenvolvimento. Por fim, no quinto capítulo analisa-se o comportamento de variáveis epidemiológicas de trabalhadores de uma indústria petrolífera da Bahia, Brasil, antes e após a

implementação de práticas interdisciplinares em avaliações de saúde ocupacional entre 2006 e 2015.

A Figura 1 apresenta o fluxo do processo de desenvolvimento de um modelo de gestão em ST, que surge da necessidade prática de responder aos problemas vivenciados na indústria do petróleo, Bahia, Brasil. Encontra-se embasado em referenciais teóricos abrangentes, que transcendem a lógica biológica do cuidado e ampliam a possibilidade de compreender a complexidade do campo de ST, demonstrando o potencial de utilização em outros contextos de trabalho.

Figura 1. Fluxo do processo de desenvolvimento de um modelo de gestão em saúde do trabalhador.

Com a aplicação do modelo apresentado na Figura 1, pretende-se implementar, no contexto estudado, uma nova atitude de cuidado por parte dos profissionais de saúde, denominada como cuidado ecológico e ocupacional integral e integrado, que impulsiona as ações em defesa do ambiente, no domicílio, no local de trabalho e em toda a parte, permeando os processos de relações, interações e associações entre os seres humanos e demais seres que integram a natureza. Sendo assim, as intervenções planejadas podem ser direcionadas à necessidade dos trabalhadores que buscam os serviços de saúde, aumentando as possibilidades de sucesso na implementação e manutenção de práticas preventivas efetivas e otimizadas, que gera sustentabilidade económica no contexto do trabalho.

Importa referir que a investigação desenvolvida conduziu, entre outros, à publicação de três artigos em revistas internacionais e dois capítulos de livros, entre diversas outras publicações científica relevantes, todos elaborados visando a responder aos objetivos secundários e apresentados na íntegra nos capítulos da tese. De forma complementar, foram anexadas publicações adicionais de estudos paralelos desenvolvidos no curso do doutoramento, os quais foram motivados pelos resultados encontrados nos trabalhos centrais. Vale a pena ressaltar que essas publicações adicionais não devem ser entendidas como dispensáveis, mas antes como auxiliadores de um entendimento mais alargado e profundo sobre temáticas que não foram o foco principal do doutoramento, mas que permitiram construir um conhecimento iterativo cientificamente alicerçado nas publicações desenvolvidas no decurso da elaboração da tese. Desta forma, a sua integração neste trabalho é determinante para entender o impacto inquestionável da validade e aplicação do modelo de gestão de saúde apresentado.

Em todas as etapas da pesquisa, foram seguidas as recomendações e diretrizes da Comissão de Ética e Pesquisa da Universidade Fernando Pessoa (Portugal), assim como a Resolução 466/2012, do Ministério da Saúde do Brasil, sobre aspectos éticos que regulam a pesquisa com seres humanos. Estas foram aprovadas pelo Comitê de Ética em Pesquisa da Escola Bahiana de Medicina e Saúde Pública da Bahia com o CAAE 84318218.2.0000.5544. Os dados pessoais foram restringidos e tratados para garantir o respeito à privacidade dos trabalhadores envolvidos.

CAPÍTULO I – INTERDISCIPLINARIDADE: UM MOVIMENTO ARTICULADOR NO CAMPO DA SAÚDE DO TRABALHADOR[1]

Este capítulo procurou responder ao primeiro objetivo secundário delineado da tese através do desenvolvimento de investigação-ação, que levantou os principais problemas encontrados para a prática integral e integrada da gestão em ST na indústria do petróleo, Bahia, Brasil.

Neste capítulo, a primeira autora participou na concepção, desenvolvimento da metodologia, da investigação-ação, da recolha e análise de dados e na escrita do manuscrito.

[1] **Viterbo, L. M. F.**, Costa, A. S., & Dinis, M. A. P. (2018). Interdisciplinarity: an articulating movement in the field of worker's health. In L. M. Viniegra, S. M. Chávez, E. M. Rodrigo, & (Coords.) (Eds.), La comunicación ante el ciudadano (pp. 323-334). Madrid, Espanha: Editorial GEDISA.

24. Interdisciplinarity: an articulating movement in the field of worker's health

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The field of worker's health aims to study and intervene in the work-health relationships from the work process, and incorporate the theoretical knowledge of technicians into the practical knowledge of workers. It is characterized by non-routine methods and techniques to the service organization model of health systems, where intervention and regulation of environmental and labor conditions is an object shared by non-traditional stakeholders, which makes it a complex field. The process of interdisciplinary work in health teams organizes in a more comprehensive way influential factors in the health of the people, hardly reached by the disciplines alone. The interdisciplinary practice in worker's health allows essential advances in the health/work relationship and consequently in the improvement of their health level.

1. Worker's health: a challenging course

Occupational Medicine emerged with the advent of the Industrial Revolution (Schilling, 1981), where exhaustive working hours, dangerous machines, accelerated rhythms and unhealthy environments were responsible for the sickness, mutilations and deaths of workers. Centred and based on the theory of

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unicausality, it sought to isolate specific risks and act on their consequences, medicalizing from signs and symptoms (Minayo-Gomez & Thedim-Costa, 1997). The industrial society described by Marx and Weber is characterized by socially produced wealth, its unequal distribution of goods and consequently by social, economic and geographical differences. The development of science and technology has generated high potential consequences for human health and the environment and can no longer account for the prediction and control of ecological, chemical, nuclear, genetic and economic risks (Beck, 2011). In this context of impotence of occupational medicine to intervene on the health problems resulting from the production processes, the dissatisfaction and questioning of workers and entrepreneurs increased with the progressive increase of the expenses due to the health problems, emphasizing the need for medical action aimed at workers by intervening on the environment based on the knowledge of other professionals (Mendes & Dias, 1991).

Thus, Occupational Health emerged from the theory of multicausality, where a set of risk factors was considered in the production of the disease, evaluated through the medical clinic and environmental and biological indicators of exposure and effect when considering multidisciplinary teams, with an emphasis on industrial hygiene (Minayo-Gomez & Thedim-Costa, 1997). In the twentieth century, technological advances influenced and changed social relationships, as new risks were brought into the society, and the latter began to demand, through social mobilizations, government interference in the regulation of health risk (Dourado & Navarro, 2009). Significant changes in materials (chemicals, radiation), people (demographics, skills), processes (assembly line, automation), laws (child labor, work hours, safety) and science and technologies (electrification, transportation, communications and computing) have altered the nature of work on several occasions (Felton, 1976). These transformations have broadened the opportunity for Occupational Health to develop value-added actions for workers and employers, as well as providing medical care for injuries and diseases in the workplace. Approaches have been improved for the prevention of occupational morbidity and mortality, as well as training, monitoring and control of exposure, risk assessment, screening, behavioral health and well-being interventions, disability management and thorough health and safety management systems (Sepulveda, 2013). However, the decontextualization of the reasons that were at the origin of the risk was limited to the interventions on specific measures, related to the most obvious risks. In a scenario of renewed social movements, in the late 1960s, marked by the questioning of the meaning of life, work in life and body use revealed the need for new responses to social policies, which consolidated essential changes in legislation, especially in safety and health (Mendes & Dias, 1991). The field of worker's health emerged from the mobilizations of workers in collective struggles for better living and working conditions, marked by resistance, achievement and a different approach to the health/work relationship, especially for the work process (Lacaz, 2007). It is strongly influenced by the Italian Worker Model (IWM) (Odd-

one, I., Marri, G., Gloria, S., Briante, G., Chiattella, M.R.E.A., & Re, 1986), whose fundamental principles are interdisciplinarity and the incorporation of worker's knowledge in health/illness at work studies (Mendes & Dias, 1991). The model aimed at confronting the worker's experience, i.e., the informal knowledge, and the technical knowledge, i.e., formal knowledge, the alliance of worker's leadership with health professionals, so that all stakeholders become co-authors of the research (Vincenti, 1999). Also, the IWM was a theoretical and methodological reference for the development of worker's health surveillance, based on the assumption that knowledge is required to intervene, emphasizing that information on working conditions must be validated with the participation of workers from their working places (Machado, 2006). The primary goals of worker's health is worker's health prevention and promotion, as well as more significant challenges to increasing the capacity to understand and analyze work (Alvarez, 2004).

2. Interdisciplinarity in health: a possible and necessary approach

Discussions on interdisciplinarity began in the field of health between the 1970s and 1980s, in Latin America. Currently, some terms that attempt to reflect the idea of articulation between the various areas of knowledge coexist. Thus, the terms multidisciplinarity, pluridisciplinarity, interdisciplinarity and transdisciplinarity can be found in several publications with the same connotation, and are differentiated by the level of articulation between disciplines. In an attempt to differentiate them conceptually, Coimbra, Jr., Tucci, Hogan, & Navegantes (2000) suggest that multidisciplinarity would only conjure quantitative aspects, without a dialogue between its agents, and would be limited by the unidisciplinary view, as well as in multidisciplinarity. At another extreme, the transdisciplinary aims to transcend the interdisciplinary in the theoretical management of a theme or object, perhaps as an ideal of the search for knowledge. However, it remains to be seen whether transdisciplinarity is a feasible process as is interdisciplinarity, and to what extent and modality.

As have already commented, based on the position of Matos (2009), there are no specific disciplines from which the approach can be labeled as interdisciplinary. The complexity involved in an approach to understanding the object or problem to be apprehended is that it should define which disciplines may be called for this challenge. Thus, "No one must be afraid to be engulfed by the group in complex and interdisciplinary work. There is no such danger, for each one is there precisely to give his contribution and be enriched by the interfertilization of all" (Minayo, 2010, p. 442). Again, on the relationship between areas of knowledge, the very etymology of the word interdisciplinarity translates the linkage of one with another knowledge or of them among themselves in a spectrum of complementarity and complicity in a given reality. Thus, any knowledge, "as comprehensive as it may be, will al-

ways be partial, never fully expressing the truth of the known object, let alone its completeness, breadth and totality" (Coimbra, Jr., Tucci, Hogan, & Navegantes, 2000, p. 56). Besides, interdisciplinarity can be understood according to Vilela & Mendes (2003) as the dialogue that allows the enrichment of each discipline in method and perspective, linking scientific knowledge with world's complexity, since this world is not made of separate things, but of several realms.

Applying the discussions related to interdisciplinarity to the health sciences, it can be observed that the limitations experienced are more evident, especially given the need to understand the complexity of getting sick and living with a chronic condition. Some characteristics of these conditions, coupled with the specificities of health education step up this distance, such as the mechanistic view of the human body, the excessive valorization of the technological arsenal, the view of the disease from its biological expression neglecting its psychosocial realm and, consequently, exacerbating this reductionism with the dominance of unicausality as an explanation of the cause of illness (Cyrino, 2009). Some hindrances in the implementation of interdisciplinary approaches to health concern the expectation of the feasibility of cooperative practice among the teams. It is not a matter of assigning little importance to communication and interaction between professionals, but cooperation is not explained only as a result of a conscious process on the part of the subjects. One must consider the production of meaning by the subjects and the existence of unconscious forces that produce effects on the organizational life and, mainly, on their mutual relationships (Moraes, 2015). Now, how to implement interdisciplinarity in health care in practice?

> Health literature has few reports of interdisciplinary experiences developed in the field of healthcare practice. This fact makes one think both about the difficulties faced by interdisciplinarity to actually take place, and that professionals of the services are not accustomed to reporting their experiences, contributing to the articulation of theory-practice and the dissemination of successful experiences that promote the advancement of the perspective of interdisciplinary action (Matos, Pires, & Elvira, 2009, p. 339).

First and foremost, one must be careful not to consider interdisciplinarity as a reaction, a symptom of the current situation of knowledge. Instead, one must recognize it as an alternative way to the excessive specialization and individualization of sciences, deviating from the reality of knowing much about the part, denying the need to know the whole or most of it. "In this context, the effort to integrate interdisciplinarity is shown as the most appropriate remedy for cancerization or the general pathology of knowledge" (Vilela & Mendes, 2003, p. 527). Reaffirming the initial considerations about the feasibility of its application, Fazenda (2002, p. 11) shows that the first condition of implementing interdisciplinarity is the development of sensitivity. Also, it is necessary to hone skills in the "art of understanding and ex-

pecting, a development towards creation and imagination". The theoretical foundations of interdisciplinarity as a strategy of action must be operationalized since refinements and new looks on the theory emerge in the field of action.

3. The practice of interdisciplinarity in worker's health

Seeking to know and intervene in labor relationships and in the health-disease process, where the worker is a coauthor, the worker's health strategies developed in the period 2006-2015 are presented below, in an oil industry, in Bahia, Brazil, evidencing actions in different health models, where Occupational Health is the dominant model in the period 2006-2010, and Worker's health is the dominant model in the period 2011-2015. Due to the very characteristic of the interdisciplinary approach and the environments in which it is currently being discussed, considering experiences of materialization, the theme does not seem to be close to many health services. In practice, what is seen is the grouping of several disciplines or professionals in health services to diversify the provision of services, with a persistent vision of the parts. In fact, the health work market by specialties seems to favor this type of professional behavior, limiting to few exceptions the existence and persistence of services that transcend the rationale of multidisciplinarity.

3.1. Interdisciplinary in Worker's health Services: Approaches to practice

This work intends to show the path of a worker's health service seeking interdisciplinary care. Many steps have been experienced from the practical experimentation of a series of theoretical references, including health work process management models, all of which are used for this learning and construction. Thus, although the business setting is not a fertile ground for alternative models to traditional scientific management, it is necessary to criticize the quality of the products that can be generated by multidisciplinary teams gathered by virtue of the existence of vertically-implanted health programs, who propose to intervene in the primary health problems of this population of workers. Thus, the implementation of these work models compromises the production of meanings by the health workers, since they only prescribe the performance of tasks without margins to the contextualization. The organizations that provide service in the field of health have increasingly demanded new lenses to face their management issues. The workers who work there, in turn, also draw attention to their dramas, the recognition of their knowledge, underpinning the complex, contradictory and conflicting framework of labor relationships (Psicologia, 2016).

Considering that it is necessary to introduce new creative stimuli with a view to increasing the perception of the complexity involved in the world of work and its influence on the health status of the working population, matters of interest to service are addressed by a "management collegiate body" that added both technical knowledge of the areas involved in customer service and management knowledge to facilitate actions to tackle the most frequent issues faced in the daily routine of services. This management collegiate body worked in a shared decision space, focused on the autonomy and leadership of the various stakeholders involved, seeking productivity and commitment to care (Campos, 1998). These innovations in management were intended to result in effective changes in the traditional ways of scientific organization, such as rigidity, low level of communication, alienation of workers and insensitivity to users' needs (Cecílio, 2010). It is believed that this initiative was the first step towards the service's interdisciplinarity since the group already exercised this approach as a strategy for the understanding and resolution of daily routine problems. Also, it appropriated critical principles of semi-autonomous management (Avila & Pereira, 2007), and among them, the principle of "aggregation". This principle draws near the interdisciplinary approach in that it considers that a system (team) becomes more than a set of parts or people gathering. Skills and competencies not exercised by their members emerge from these groups. Besides the aggregation, the exercise of autonomy, cooperation and self-organization makes the service coordination effort focused on the creation or maintenance of the conditions conducive to the development of the desired autonomous performance. However, as a limitation of this management model, it should be pointed out that even considering the spectrum of possibilities of using their technical skills and autonomy, management collegiate bodies are often traversed by administrative service demands, which competes with the need for this body to address issues related to care management, hindering the implementation of more regular quality assessment instruments. Also, the health coordinator represents the company and leadership of the service in the management collegiate body, insofar as it is the one that signals the limits of the team's decision-making autonomy, working as a "guardian" of corporate norms, rules and policies. In any case, this experience proved to be productive and contributory to the implementation of other interdisciplinary practices insofar as it trained, within the intended approach, part of the team that later would be responsible for the dissemination of the practices learned and exercised in the collegiate body for care professionals.

Thus, broadening the theme "Management Collegiate Body", it was possible to see the participation of service users (industrial workers) as influencers of the decision-making process in health, previously restricted to this collegiate body. This model included management, health workers and service users, consolidating democratic work management as a deliberative space for negotiation and agreement with the contribution of these stakeholders (Cecílio, 2010). Since these are health worker services, specific aspects of the dramas experienced in this field of knowledge and by these

stakeholders guided health planning, and the primary challenge was to find possible answers to the pressing confrontations considering the action of the forces that moved man-work relationships, such as economic hurdles, technological/organizational alternatives and the various situational plans that condition/enable the necessary changes (Minayo-Gomez & Thedim-Costa, 1997). As an innovative initiative in the industry, this health service held planning meetings that included the participation of worker's representatives, the Internal Accident Prevention Commission (CIPA) and the union. Recognizing that it is not a necessarily peaceful debate, considering the conflicts naturally imposed by the man-work relationship, the methodology used for this approximation was based on the theoretical reference of Ergology of French philosopher Yves Schwartz, 1996. Ergology argues that the understanding of human work requires attention on realms such as values and uses of self, through research on concepts quite different from those used by the functionalist perspective. One of these concepts concerns the possibilities of choices made daily in work situations, always traversed by different values. This model of understanding of the human condition at work would produce significant developments in the concepts of work management, knowledge formation and subjectivity (Psicologia, 2016). Also, there was a need to exercise a broader view of the worker's health field for professionals with no specific training in this area, such as physical education and nutrition. Another concept to be strengthened is the idea that knowledge about health and work is not exclusive to academics. This knowledge must be built on the worker's practical knowledge. In the ergologic perspective, the disciplinary border is crossed by the invitation to the dialogue of the different areas of scientific knowledge. The different disciplines are interested in work in its multiple realms (Schwartz, 2000). After this stage, considering health professionals able to dialogue with workers as their equal could already be seen as a significant upgrade in the quality of the service. However, the most necessary and challenging development concerned the transfer of expertise developed in the collegiate body regarding interdisciplinarity for the service staff. The care model by discipline made each profession exercise its knowledge by protecting it from others, hampering dialogue and exchange of experiences and information required to understand the whole.

The Instruction to the Double, a method formulated by Yvar Odone in 1970 and reviewed by Yves Clot, 2007 (Batista & Rabelo, 2013) proved feasible for a diverse group of professionals to observe and know how each one of them developed their approaches individually with users through simulated and filmed consultations. Subsequently, the videos were watched and discussed by the entire team. The intention was to highlight the commonalities between the consultations and the gaps for understanding the real needs of the users. At this point, it should be pointed out that the method was not intended to be used to transform labor situations. Instead, it aimed to share the methods of individual approaches to make them complementary and non-overlapping. The use of the method is subject to other purposes that do not necessarily involve the objectives of this original methodological orienta-

tion, such as the use for data collection. In these cases, it is not expected to have sufficient elaboration to transform their craft (Batista & Rabelo, 2013). The adaptation of the method provided a better insight into the whole for each of the disciplines on the occupational assessment of workers, their purposes and objectives. Relevant aspects not investigated by any of the disciplines were also raised, and redundant aspects were redistributed among the professionals. For better interprofessional understanding, the teams started to work on the care systematization model, based on the most commonly used taxonomies in their respective areas in the World Health Organization's Family of International Classifications (World Health organization, 2012) and others. All these procedures contributed to the maturation and appreciation of the interdisciplinary practice as an essential method of care to this population and culminated in the interdisciplinary discussions of the cases, as described below.

The interdisciplinary meeting to discuss the attendances held on the day was established as a routine practice. The professionals talked about methods and their impressions, what was grasped by their experience and was between the lines of users' statements. The diagnoses could then be reformulated, contributing to the elaboration of more effective intervention plans that could draw closer to the reality experienced by the users. It is important to emphasize that in the interdisciplinary interaction, there may be a more significant exposure of the professional limitations and potentialities, and this interaction may also reveal the conflicts and latent power relationships / correlations in the teams. This question poses one of the challenges of interdisciplinarity and is one of the impediments to its implementation (Costa, 2007).

3.2. The implementation of interdisciplinary interventions and health indicators

In the first period from 2006 to 2010, the workers visited the occupational health service annually for expert medical and dental care and, between 2011 and 2015, evaluations with nurses, nutritionists and physical educators were included, all of whom were committed to developing the interdisciplinary practice through the individual approach in the visits and collective approach through the health and environmental campaigns.

From the organization of the interdisciplinary team, interventions were implemented aiming to revive the human side of the work and its protective capacity of injuries to worker's health, besides the accidents and diseases (Lacaz, 2007). Diagnoses of working and health conditions involved workers to elect priorities to eliminate the determinants and constraints of health issues (Sato, 1996). Health programs were designed, aiming at interdisciplinary practice, in a perspective of building actions that benefited the community, requiring health professionals to coexist with different areas of knowledge, which increased insights on the other (Nancarrow et al., 2013). The main

Year	*Number of workers*	*Smokers (%)*	*Altered triglycerides (%)*	*Periodontal disease (%)*	*Physically active (%)*
2006	1,752	8.62	24.89	10.04	18.89
2007	1,754	7.92	25.37	8.33	20.30
2008	1,810	7.46	24.70	10.14	22.82
2009	1,797	6.96	25.49	11.41	23.98
2010	1,800	6.56	21.67	11.07	23.61
2011	1,794	6.13	21.63	9.28	25.92
2012	1,812	4.91	19.48	7.94	31.24
2013	1,787	4.70	19.03	6.58	33.07
2014	1,594	3.70	19.07	6.55	32.75
2015	1,460	3.90	19.25	4.45	35.62

programs implemented were: The Tobacco Control Program, the Healthy Food Program, the Worker's Dentistry Program and the Physical Activity Promotion Program. The longitudinal retrospective study of the 2006-2015 period facilitated the analysis of health indicators, as shown in Table 1. Concerning data analysis, the IBM® SPSS® Statistics vs.24.0 was used, considering a level of significance of 0.05 for all situations of statistical inference.

Table 1. Prevalence data of smokers with altered triglycerides with periodontal disease and physically active, Salvador, Bahia, Brazil, from 2006 to 2015.

Worker's health has a high potential for disciplinary integration to try to sort more comprehensively factors that are difficult to achieve by the disciplines alone (Severo & Seminotti, 2010). From the analysis in Table 1, a statistically significant decline in the data related to the number of smokers, workers with altered triglycerides and the rate of periodontal disease, as well as an increased number of physically active workers, could be observed. The results analyzed suggest that an interdisciplinary and integrated approach to worker's health, with activities directed to the needs of the population, may be associated with the improved health indicators evaluated. The essential issue is the understanding that exists of what is work and the type of dialogue that is established in the actions with the workers, either in the risk and disease prevention approach or the perspective of health promotion. It is necessary to stimulate a shared daily movement process towards health, where health professionals and workers build together.

4. Conclusion

Health services that regularly and systematically use the interdisciplinary approach in health assessments and interventions of their workers are sometimes scarce. Thus, the results discussed evidenced the need for worker's health teams to plan and implement the evaluations and procedures, following a systematic and interdisciplinary model by reference. This text does not aim to determine steps for the implementation of interdisciplinary practices, but it presents in what way an attempt to insert other theoretical references and other social stakeholders in the experience of health workers as challenges emerged, was intended. These references transcend the biological rationale of care and extend the possibility of understanding the complexity that emerges from the users seeking what health services can provide, increasing the odds of success in implementing and maintaining such practices in these services. It is necessary to make advances in the proposed paths by worker's health in the scope of studies and actions so that more consistent results are achieved and consolidated from a scientific and practical viewpoint.

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CAPÍTULO II – DESENVOLVIMENTO E VALIDAÇÃO DE UM INSTRUMENTO DE ABORDAGEM INTERDISCIPLINAR EM SAÚDE DO TRABALHADOR[2]

Este capítulo procurou responder ao segundo objetivo secundário delineado para o desenvolvimento da tese. Ele apresenta todo o processo de desenvolvimento e validação do IWHAI, que busca responder à questão levantada sobre como é possível atuar de forma interdisciplinar em ST, considerando os fatores ambientais e ocupacionais, fatores comportamentais, fatores pessoais e metabólicos.

Neste artigo, a primeira autora participou na conceptualização, desenvolvimento da metodologia, da validação, da investigação, da recolha e análise de dados e na escrita do manuscrito.

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Development and Validation of an Interdisciplinary Worker's Health Approach Instrument (IWHAI)

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Abstract: The present study aimed to develop and validate an Interdisciplinary Worker's Health Approach Instrument (IWHAI). The development stage comprised a group of 10 professionals, including physicians, nurses, nutritionists, dentists and physical educators, as well as a judges' committee, composed by 19 recognized experts in the area of worker's health (WH). For the validation of the IWHAI, the Spearman's correlation coefficient (r_s) was calculated, the factor analysis to the instrument was applied, and the Cronbach's alpha (α) and the Intraclass correlation coefficient (*ICC*) were calculated. The IWHAI was structured in five dimensions, integrating 43 health indicators, on a scale of 0–4, totalling 215 sub-indices with closed response coding. The instrument was validated with a Kappa coefficient (KAPPA) (k), with excellent agreement for all attributes, i.e., $k = 0.88$ for applicability, $k = 0.80$ for clarity and $k = 0.82$ for relevance. $p > 0.05$ results reveal moderate to strong positive correlations between some variables, i.e., pests, vectors and air quality/drinking water quality ($r_s = 0.69$). A total of 14 components of the factor analysis, explaining 62.6% of the data variance, were extracted. α value is considered moderate to high, $\alpha = 0.61$, the *ICC* value also being considered moderate to high, with *ICC* = 0.61. The IWHAI is considered validated, constituting a technological innovation for an interdisciplinary approach in the field of WH, enabling the prevention and integral promotion of health.

Keywords: worker's health (WH); interdisciplinary approach; questionnaire; instrument validation

1. Introduction

The 2030 Agenda for Sustainable Development, adopted by all United Nations Member States in 2015 [1] establishes 17 Sustainable Development Goals (SDGs) and defines integrated and indivisible goals balancing the three dimensions of sustainable development, i.e., economic, social and environmental. SDGs 3 and 8 relate to the health and labour aspects, aiming to ensure a healthy life and to promote the well-being for all, including the promotion of sustainable economic growth, inclusive and sustainable, full and productive employment and decent work for all, respectively [2,3]. The European Union (EU) Strategic Framework on Health and Safety at Work 2014–2020 [4–6] identifies important challenges and objectives including improvements in health and safety rules, prevention of occupational diseases and issues related to the aging of the workforce. Risk prevention and the promotion of safer and healthier conditions in the workplace are essential not only to improve the quality of employment and working conditions, but also to promote competitiveness [7]. Keeping

workers healthy has a direct and quantifiable positive impact on productivity, contributing to the improvement and sustainability of social security systems [8,9].

As a disciplinary and professional field, the worker's health (WH) covers the areas of medicine and engineering [10], which also incorporates epidemiology, administration, demography, statistics, ecology, toxicology, sociology, ergonomics and economics in the field of knowledge, comprising interdisciplinary theoretical practices [11,12]. In an extended perspective, the object of WH is the understanding of the health and disease process of human groups in their relation to work [13] and its potentiality is conditioned to the articulation between the two planes, i.e., health and disease [14]. WH involves distinct theoretical and operational fields around complex problems, thus being a privileged space for the formation of teams committed to interdisciplinary studies [15–17]. Environmental and sanitary situations are an example since they jointly involve the biological and physical environment, production, social organization, economy and culture in its interaction with human bodies and ecosystems, which may result in characteristics of greater health or vulnerability to risks [18]. Fragmented analysis of any of these variables, as performed by common science or even by multidisciplinary studies, would lead to major analytical and ethical problems involving limited intervention proposals [11,19]. WH surveillance is permeated by multiple, and sometimes conflicting, interests, in a permanent mechanism of transformation of the work process [20] and seeks to intervene in an interdisciplinary way in working conditions that negatively affect health, causing accidents or illness [11,16,21]. These actions must be linked to the daily life experienced by individuals, considering the environmental risks resulting from anthropogenic activities, as well as occupational hazards, mainly due to damaging conditions present in the work environments, affecting the health of workers, of their families and of populations living in the areas of influence of the productive units [22]. The associations between the environment as a whole and human health are very complex [23,24]. Intra-institutional articulation is the greatest obstacle to be overcome in the area of WH, as well as the need to improve the interface of the interdisciplinary team with proposals for interventions aiming to address ecological and occupational care [15].

A number of instruments have been developed to assess WH with the main objective of improving working conditions and promoting health and well-being in the workplace [25]. Examples are Health and Work Survey (INSAT) [26], Medical surveillance of exposures to occupational risks (SUMER) [27], Evolution and Workplace Health Relations (EVREST) [28] and the Basic questionnaire and methodological criteria for Surveys on Working Conditions, Employment, and Health in Latin America and the Caribbean (CTESLAC) [29]. In particular, the study by Yueng-Hsiang et al. [30] is a very important contribution to the development and validation of questionnaires applied in the WH and safety fields.

Prior studies [4,31–35] prioritize the analysis of working conditions in order to identify the risks related to work that impact on the health and well-being of individuals. It is of fundamental importance that other aspects of social determinants of health are included in these kinds of surveys, such as the social conditions in which people live and work [36]. Including these aspects would enable the development of health strategies to be more directed to the needs of the population. The potential of this systematized articulation based on intersectoral and interdisciplinary intervention as an action to transform work towards health promotion is broad, thus constituting an embryo of transformation in the WH theoretical–practical model.

The present study aimed to develop an Interdisciplinary Worker's Health Approach Instrument (IWHAI) (Table S1) based on a theoretical framework involving the disciplines of medicine, nursing, nutrition, physical education and dentistry, as well as based on aspects related to social determinants of health [36–38], global disease burden [39–41], environmental aspects [23], SDGs [1] and, in particular, the working conditions affecting the health of the individual.

2. Materials and Methods

2.1. Study Design

This study is based on a strong methodological component, carried out from September 2017 to July 2018, in the WH service in the oil extraction and production industry in Bahia, Brazil. The study involved 10 health experts for the development of the IWHAI and its guidance manual. For the content validation, a judges' committee comprising 19 recognized specialists in the area of WH, with at least five years of experience in an interdisciplinary approach, was also involved. A database comprised of a quota sample ($p > 0.05$), for 965 workers from a larger work population of 1275 subjects was chosen (Table 1).

Table 1. Population and sample characterization.

Sociodemographic Data	Population *n* (%)	Sample *n* (%)	*p*
Sex			
Male	1117 (87.6)	884 (91.6)	
Female	158 (12.4)	81 (8.4)	
Age Group			
≤29	50 (3.9)	44 (4.6)	> 0.05
30–39	350 (27.5)	261 (27.0)	
40–49	245 (19.2)	209 (21.7)	
50–59	556 (43.6)	410 (42.5)	
≥60	74 (5.8)	41 (4.2)	
Total	1275	965	

Figure 1 Detailed the Interdisciplinary Worker's Health Approach Instrument (IWHAI) development and validation process.

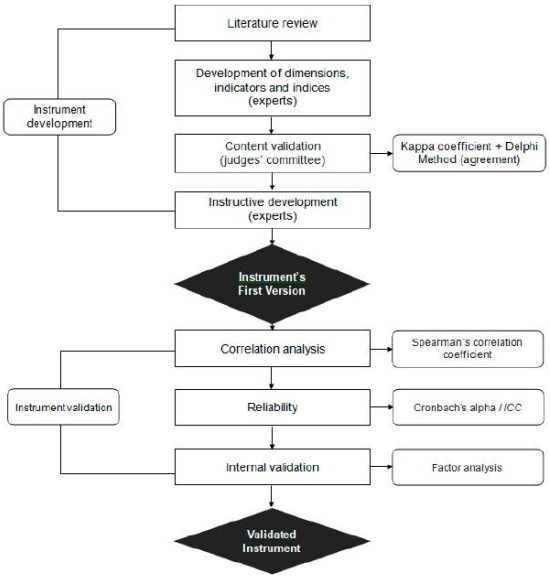

Figure 1. Interdisciplinary Worker's Health Approach Instrument (IWHAI) development and validation process.

2.2. IWHAI Development

The IWHAI development stage included a group of 10 WH experts, representing 20% of each profession, i.e., physicians, nurses, nutritionists, dentists and physical educators, all with more than five years of experience in the WH area. The literature review enabled the analysis of previously referenced instruments, as well as the theoretical framework for the development of a new instrument. IWHAI is methodologically based on the Quantitative Instrument for Sanitary Inspection (QISI) [42], both in terms of the process of developing and structuring the instrument, as well as in what relates the concept of potential risk. In its final version, IWHAI was structured with five dimensions, composed of 43 indicators, on a scale of 0–4, totalling 215 sub-indices with closed response coding. Each indicator was associated with an interval scale of 0–4, where zero represents non-existent or inadequate risk control and four represents optimal risk control, with the following graduation: 0—non-existent or inadequate; 1—tolerable; 2—reasonable; 3—good and 4—optimum. IWHAI proposes multidisciplinary assessments, encompassing an interdisciplinary approach. For each technical area, i.e., medicine, nursing, nutrition, dentistry and physical education, the main indicators of risk control for WH were defined. Finally, to reduce the subjectivity of the evaluator, the coding of closed answers for each sub-index of the scale was developed, with five possibilities for each indicator. Assessments comprised seven eight-hour meetings with professionals from each technical area and five meetings with the interdisciplinary team. For the classification of the indicators as critical and non-critical, a panel was developed with professionals, with each member giving an opinion about the indicator in question, thus obtaining a final group consensus. Of these indicators, 56.0% were classified as critical. At the basis of the IWHAI development, the need to establish a guidance manual that is able to assist health professionals in the task of filling each indicator was identified.

2.3. IWHAI Validation

To validate IWHAI content, a recognized 19 WH experts' panel, i.e., judges' committee, with minimum experience of five years in an interdisciplinary approach, was set up. A similar methodology, including statistical analysis, was used in other validation studies [43,44]. The first version of the IWHAI was presented to the group along with the spreadsheet for content evaluation, regarding the attributes of applicability, clarity and relevance, using a Likert scale. For each dimension, indicator and sub-index set, an eight-character code was created to organize the database generated in this step. Kappa coefficient (KAPPA) [43,45] was applied to analyse the results, considering $k > 0.80–1.00$, excellent agreement; $k > 0.60–0.79$, good agreement; $k > 0.40–0.59$, moderate agreement; $k > 0.20–0.39$, weak agreement and $k > 0–0.19$, no agreement. All results were accepted with KAPPA above 0.60, i.e., revealing good agreement. Following the Delphi method [46–48], already used in other health instrument development and validation studies, the 10 experts developing the draft instrument met again to review the judges' recommendations. These were accepted and resulted in the exclusion of three indicators ("Chemical waste", "Health waste" and "Bottled water") and the inclusion of five indicators (Pests and vectors", "Quality of air", "Quality of drinking water", "Work-related absenteeism" and "Work accident").

2.4. Data Analysis

The procedures chosen to perform the validation of IWHAI were based on studies, namely those of Yueng-Hsiang et al. [30], Viterbo et al. [42] and Oliveira et al. [49]. After the selection of the dimensions and their respective indicators, the analysis of the relationship between variables was performed using IBM® SPSS® Statistics for Windows v.25.0 (IBM, Armonk, NY, USA) [50]. Spearman's correlation coefficient (r_s) was used in order to assess the correlation between ordinal variables. This test is indicated for non-parametric analyses, i.e., when there is no normal distribution or when the variables are not continuously quantitative, as is the case of the scale used in the sub-index. This test quantifies the relationships between the variables and their behaviour, either if linear or non-linear,

positive or negative. For the validation of the construct, factor analysis was performed, i.e., analysis of the principal components of the correlations between variables. This technique assumes that the intercorrelations between the items can be explained by a smaller set of factors, representing relations between sets of interrelated variables. Through this analysis, the internal validity of the instrument was made, aiming to explain the variance of the results. This explanation was based on the independent components formed by a set of uncorrelated variables emerging from the transformation of correlated variables, obtained from the original variables. Several tests were used to assess the suitability of the respondent data for factor analysis. The Kaiser-Meyer-Olkin measure of sampling adequacy (KMO) test, measuring the data quality for the factor analysis, and the Bartlett's test of sphericity, were used to verify if there is a relationship between the variables and if the matrix of correlations in the population is an identity matrix.

2.5. Ethical Approval

In all stages of the study, the recommendations and guidelines of Resolution 466/2012 [51] of the Brazilian Ministry of Health on ethical aspects regulating research with human beings, were followed. The study was approved by the Research Ethics Committee of the Bahiana School of Medicine and Public Health and CAAE no. 84318218.2.0000.5544. Before participating in the study, all subjects gave their informed consent for inclusion.

3. Results

In the validation stage of the IWHAI, men, aged between 51 and 60 years, with an administrative work regime, residing in the capital state (Salvador, Bahia, Brazil) and with a high school education, prevailed. The definition of the IWHAI dimensions and their respective indicators, as described in Section 2.2 is presented in Table 2.

Table 2. IWHAI dimensions and indicators.

Dimensions	Indicators
Medicine	* Altered blood pressure
	* Altered glycemia
	* Arterial hypertension
	* Diabetes mellitus
	* Dyslipidemia
	* Musculoskeletal pathology
	* Psychiatric pathology
	* Stress level and symptoms
	* Tobacco use
Nursing	Air quality
	Drinking water quality
	* Ergonomic risks—physical aspects
	Ergonomic risks—organizational aspects
	* Exposure to environmental risks (physical, chemical and biological
	Family relationships
	Pests and vectors
	* Self-care level
	Social aspects—leisure
	Work accident
	* Work environment health conditions agents)
	Work-related absenteeism

Table 2. *Cont.*

Dimensions	Indicators
Nutrition	* Alcohol use Altered triglycerides Bodyweight condition Energy balance intake Fibre intake Level of food knowledge * Saturated lipids intake * Simple carbohydrate intake * Sodium mineral intake
Dentistry	Bruxism * Caries Oral hygiene quality * Oral lesion on soft or hard tissues * Periodontal condition * Periodontal disease
Physical Education	Abdominal strength level Cardiorespiratory fitness * Contemplation stage for physical activity practice * Feeling of pain Flexibility level Manual gripping force Physical activity level

Note: * Critical indicators.

The dimension, indicator and sub-index set form an IWHAI verification item. Table 3 shows an example of a "Nutrition" dimension verification item.

Table 3. Example of IWHAI nutrition verification item.

Dimension	Indicator	Indices	
Nutrition	Alcohol use	0	Frequent heavy drinker (drinks 1 time or more per week and consumes 5 or more doses per occasion, once a week or more)
		1	Frequent drinker (drinks once a week or more and may or may not consume 5 or more doses at least once a week, but more than once a year)
		2	Less frequent drinker (drinks 1 to 3 times a month and may or not drink 5 doses or more at least once a year)
		3	Non-frequent drinker (drinks less than once a month, but at least once a year and does not drink 5 or more doses at one time)
		4	Abstemious (drinks less than once a year or has never drunk in life)

The IWHAI verification items were assessed for applicability, clarity and relevance. Using the KAPPA, the results show that the instrument has a high inter-observer agreement, as shown in Table 4.

Table 4. IWHAI inter-observer Kappa coefficient.

Dimensions	Rated Items	Applicability		Clarity		Relevance	
		n_1 (%)	k	n_2 (%)	k	n_3 (%)	k
Medicine	171	72	0.80	90	0.76	90	0.76
Nursing	285	73	0.86	81	0.78	79	0.78
Nutrition	171	71	0.79	89	0.71	90	0.71
Dentistry	114	90	1.00	84	0.93	90	1.00
Physical Education	133	86	0.95	90	0.83	90	0.83
Mean			0.88		0.80		0.82
(%)		78		87		88	

Note: Total of rated items = number of items of each dimension x number of judges' committee; n_1 = percentage of items with the agreement in the high applicability criterion; n_2 = percentage of items with the agreement in the high clarity criterion; n_3 = percentage of items with the agreement in the important relevance criterion.

The applicability attribute obtained 78% of the "I fully agree" option in the judges' committee response. The clarity was evaluated as high, obtaining 87% of the answers. The relevance attribute corresponded to 88% of the answers in the "Important" option. The IWHAI was considered with validated content and excellent agreement for all attributes, presenting $k = 0.88$ for applicability, $k = 0.80$ for clarity and $k = 0.82$ for relevance, as shown in Table 4. The "Pests and vectors", "Quality of air", "Quality of drinking water", "Work-related absenteeism" and "Work accident" indicators were not evaluated by the judges' committee, since they were included by suggestion from the same experts, later accepted using the Delphi method.

Table 5 presents the p values, with only the correlations considered statistically significant at the 0.01 level to be shown. The analysis of Table 5 shows that the strongest positive relationships are between "Air quality" and "Pests and vectors" ($r_s = 0.69$, $p < 0.01$), between "Physical activity level" and "Contemplation stage for physical activity practice" ($r_s = 0.78$, $p < 0.01$), between "Oral hygiene quality" and "Periodontal condition" ($r_s = 0.79$, $p < 0.01$), as well as between "Bodyweight" condition and "Energy balance intake" ($r_s = 0.59$, $p < 0.01$). These are the variables in which the behaviour of both varies in the same direction, either increasing or decreasing.

Table 5. Most significant Spearman's correlation coefficients among variables under study.

Indicators	Pests and Vectors	Physical Activity Level	Contemplation Stage for Physical Activity Practice	Saturated Lipids Intake	Level of Food Knowledge	Body Weight Condition	Altered Triglycerides	Altered Blood Pressure	Abdominal Strength Level	Oral Hygiene Quality	Arterial Hypertension
Air quality	0.69 **										
Contemplation stage for physical activity practice		0.78 **									
Self-care level		0.40 **	0.34 **								
Sodium mineral intake				0.23 **							
Body weight condition					0.30 **						
Altered triglycerides					0.31 **						
Altered blood pressure					0.31 **	0.33 **					
Energy balance intake					0.59 **	0.59 **	0.37 **	0.37 *			
Flexibility level									0.39 **		
Periodontal condition										0.79 **	
Arterial hypertension								0.33 **			
Diabetes mellitus											0.35 **

* significant at 0.05 level; ** significant at 0.01 level.

The factor analysis presented in Table 6 reveals the adequacy of the sample through the means of the Kaiser–Meyer–Olkin measure of sampling adequacy (KMO) [52,53] (0.66 > 0.5) and through Bartlett's test [54] (x^2 = 5252.03; $p < 0.001$). The factor loads are above 0.30, varying between 0.32 and 0.91, indicating a high level of validity of the selected items. Of the 43 indicators integrating the instrument, 14 components were extracted, which together account for about 62.6% of the total variance. All communalities have values above 0.40, showing the great proportion of variability of each variable that is explained by the factors. The measure of sample adequacy values suggests that the "Caries" indicator should be excluded from the factor analysis. Regarding the internal consistency of the IWHAI, it is observed in Table 6 that the global Cronbach's alpha (α) is 0.61 and considered moderate/high [45,55,56]. With regard to the reproducibility of the instrument, the value of the intraclass correlation coefficient (*ICC*) is reasonable (0.61; 95% Confidence Interval = 0.562–0.652, $p < 0.001$).

Table 6. Factor load and communality of the indicators under study.

Component: %	Factor load														C*	(α) **
	I	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII	XIII	XIV		
Food Behaviour: 7.2																
Energy balance intake	0.82														0.76	0.57
Level of food knowledge	0.58														0.58	0.59
Bodyweight condition	0.73														0.67	0.59
Altered triglycerides	0.47														0.52	0.58
Altered blood pressure	0.53														0.47	0.59
Altered glycemia	0.64														0.55	0.61
Environmental Factors: 6.0																
Pests and vectors		0.77													0.62	0.62
Air quality		0.91													0.85	0.61
Drinking water quality		0.55													0.57	0.62
Oral Health:5.4																
Oral hygiene quality			0.86												0.82	0.58
Periodontal condition			0.90												0.85	0.59
Periodontal disease			0.50												0.60	0.60
Bruxism			0.80												0.61	0.58
Personal Factors: 5.0																
Diabetes mellitus				0.68											0.59	0.60
Arterial hypertension				0.67											0.58	0.59
Physical Activity: 4.9																
Physical activity level					0.85										0.77	0.59
Contemplation stage for physical activity practice					0.86										0.77	0.60
Physical aptitude: 4.8																
Cardiorespiratory fitness						0.48									0.57	0.60
Abdominal strength level						0.73									0.61	0.61
Flexibility level						0.67									0.59	0.61
Manual gripping force						0.59									0.62	0.61
Musculoskeletal Factors: 4.6																
Feeling of pain							0.82								0.71	0.61
Musculoskeletal pathology							0.82								0.71	0.61

Table 6. *Cont.*

Component: %	Factor load														C*	(α) **
	I	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII	XIII	XIV		
Behavioural Factors: 4.5																
Simple carbohydrate intake								0.75							0.63	0.60
Fibre intake								0.67							0.61	0.61
Self-care level								0.48							0.62	0.59
Mental Disorder and Working Conditions: 4.0																
Psychiatric pathology									0.46						0.53	0.61
Work environment health conditions									0.55						0.46	0.62
Stress level and symptoms									0.66						0.64	0.62
Consumption: 3.9																
Alcohol use										0.67					0.59	0.60
Dyslipidemia										0.40					0.59	0.61
Intake Levels: 3.8																
Saturated lipids intake											0.57				0.62	0.61
Sodium mineral intake											0.59				0.57	0.61
Organizational and Social Factors: 3.6																
Ergonomic risks—organizational aspects												0.47			0.69	0.61
Social aspects—leisure												0.68			0.73	0.61
Work accident												0.53			0.60	0.61
Family relationships												0.80			0.68	0.61
Work-related absenteeism												0.82			0.72	0.61
Occupational Risks: 2.5																
Exposure to environmental risks (physical, chemical and biological agents)													0.61		0.48	0.61
Ergonomic risks—physical aspects													0.46		0.59	0.62
Drugs and Injuries: 2.4																
Tobacco use														0.77	0.66	0.61
Oral lesion on soft or hard tissues														0.32	0.58	0.61

Note: Extraction method: Principal components. Varimax rotation with Keiser normalization. Extraction criterion: Eigenvalues higher than one. Total variance explained by extracted components: 62.6%; KMO = 0.66; Bartlett's test: $x^2 = 5252.03$, $p < 0.001$; * Communalities; ** Cronbach's alpha (α) if item is removed; Global Cronbach's alpha (α): $\alpha = 0.61$; *ICC* = 0.61%—95% Confidence Interval = 0.562–0.652, $p < 0.001$.

4. Discussion

The current socio-economic context of the world demands from the companies the implementation of actions aimed at the improvement of living and working conditions, as well as the development of strategies for the promotion of WH, impacting in the reduction of absenteeism and medical expenses. For this, it is necessary to systematically monitor the population and implement programs aimed at reducing the potential risks of health, environment and work triad.

Similar studies resulting from the application of instruments, such as INSAT [25,26], SUMER [27], EVREST [28] and CTESLAC [29], focus on aspects related to working conditions. Other tools make it possible to calculate the epidemiological risk of each individual, such as the Framingham score [57] and the QRISK3 [58] calculator for estimating 10-year risk for myocardial infarction and stroke. The IWHAI works with the interdisciplinary approach and with the potential risk, which considers the possibility of occurrence of a health problem, without necessarily describing the health aggravation and the probability of occurrence. It is a concept expressing the value judgment about potential exposure to a possible risk [59], a clear advance in guaranteeing the prevention and integral promotion in the WH field.

The sample (Table 1) does not differ from the population at sex and age groups ($p > 0.05$), thus allowing for more robust analyses and conclusions. The results of the KAPPA (Table 4) show a consistent validity of the content, ranging in the applicability attribute between 0.79 and 1.00, in the clarity attribute between 0.71 and 0.93 and in the relevance attribute between 0.71 and 1.00. These values are much higher when compared to the reliability measurement of the Brazilian version of the Health and Work Survey INSAT-BR [60] (Brazilian adaptation) which showed KAPPA values ranging from 0.36 to 0.63, with a mean of 0.49. The results of the KAPPA in IWHAI are close to those of the QISI which, although developed for application in sanitary inspection in large food and nutrition services in Brazil, shows excellent agreement for the clarity ($k = 0.82$) and relevance ($k = 0.92$) attributes and good agreement for the applicability attribute ($k = 0.78$).

Regarding the correlations, there is an important association between the quality of the environment and the probability of occurrence of pests and vectors [23], as well as the close connection between oral hygiene and the oral health condition itself, as identified in past studies [61,62]. Additionally, the level of food knowledge is strongly associated with the level and quality of energy balance intake [7], with WH impacts and workers' productivity impacts in general.

The 14 components extracted from the factor analysis (Table 6) are able to explain 62.6% of the phenomenon under study, i.e., the interdisciplinary approach in WH. This is a very satisfactory result since the dimension evaluated is abstract and influenced by several sub-dimensions. The results of the factorial analysis and the Cronbach's alpha found in IWHAI are similar to the validation study by Yueng-Hsiang et al. [30], in which six components were extracted, able of explaining 47.9% of the data variance.

In this sense, the Food behaviour component (Table 6) stands out in the strong explanation of data variability (7.2%), revealing its importance in the interdisciplinary approach and in the workers' own health [63]. The interrelation among the variables that integrate this component is visible because the level of food knowledge is directly related to the food intake, which in turn leads to changes in the individuals' body condition and in their health condition, namely in altered blood pressure and altered glycemia. The environmental factors component emerges immediately afterward, with 6.0% explanation of the data variance. At this level it is important to emphasize the importance of a safe environment for the health of the worker that positively conditions the same, contributing to its promotion, rather than to its aggravation. Air quality is fundamental as it can lead to serious respiratory diseases, such as asthma, chronic pulmonary obstructive disease and lung cancer, as stated by Barreira et al. and the World Health Organization [64–66]. Water quality is also important because it is a direct transmission vector of diseases for the individual [67,68]. When these two indicators are bad, they can lead to the emergence of pests and vectors, which are highly negative for human and environmental health, as highlighted by Nazri et al. [69].

5. Conclusions

The development of the IWHAI enabled the collection of data by specialized teams using a single instrument that includes the health, environment and work triad. It also integrates the social determinants of health, as well as the risk factors studied as the main important ones for the global burden of disease. IWHAI content validation revealed excellent agreement for all attributes, with k = 0.88 for applicability, k = 0.80 for clarity and k = 0.82 for relevance. The reliability of the instrument is moderate/high (α = 0.61). Despite the indication to exclude the "Caries" indicator from the factor analysis, the authors decided to keep it in the instrument because of the importance it has in the WH assessment. The IWHAI development and validation demonstrates the possibility of applying an interdisciplinary approach in the WH field, with a focused performance of professionals of distinct specialties, as well as a mapping of intersectoral interventions, as an action to transform work towards health prevention and integral promotion. IWHAI application is thus found to be valid, robust and reliable.

5.1. Strengths and Limitations

The IWHAI is considered with validated content, being an innovation for the WH interdisciplinary approach in different labour contexts. Another important IWHAI expected contribution is the reduction of WH costs, considering that IWHAI acts simultaneously in disease prevention and health maintenance.

Although IWHAI is valid and reproducible, two main limitations must be considered, the need to maintain an interdisciplinary team able to respond to the various dimensions of the instrument and the existence of minimal environmental and health monitoring.

5.2. Future Applications

It is very important that new applications of the IWHAI be carried out so that its reproducibility is validated in other labour contexts. The validity of an instrument is also based on its availability and application by the scientific community. For this reason, the IWHAI is available as supplementary material and its application is free, provided that due credits are made to the IWHAI authors through the necessary citation of this article.

Supplementary Materials: The following are available online at http://www.mdpi.com/1660-4601/16/15/2803/s1, Table S1: Interdisciplinary Worker's Health Approach Instrument—IWHAI.

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CAPÍTULO III – AVALIAÇÃO DE RISCO À SAÚDE NA INDÚSTRIA DO PETRÓLEO NA BAHIA, BRASIL: UM ÍNDICE DE RISCO À SAÚDE DO TRABALHADOR[3]

Este capítulo apresenta as etapas de desenvolvimento de um índice *WHRI* capaz de responder ao terceiro objetivo secundário delineado para o desenvolvimento da tese, que trata do gerenciamento dos riscos individuais e coletivos em ST.

No capítulo, a primeira autora participou na conceptualização, desenvolvimento da metodologia, da validação, da investigação, da recolha e análise de dados e na escrita do manuscrito.

[3] **Viterbo, L. M. F.,** Dinis, M. A. P., Vidal, D. G., Costa, A. S., Oliveira, P. V. G., do Nascimento, J. G., & Simões, H. (2020). Health Risk Assessment in Oil Industry in Bahia, Brazil: The Worker's Health Risk Index (*WHRI*). In P. M. Arezes, J. S. Baptista, M. P. Barroso, P. Carneiro, P. Cordeiro, N. Costa, … G. Perestrelo (Eds.), Occupational and Environmental Safety and Health II. Studies in Systems, Decision and Control (pp. 311–321).

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Health Risk Assessment in Oil Industry in Bahia, Brazil: The Worker's Health Risk Index (*WHRI*)

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Abstract The objective of this study was to assess the worker's health (WH) risk, focused on sustainable development in a work context and based on the development and application of the Worker's Health Risk Index (*WHRI*) in the oil extraction and production industry in Bahia, Brazil. The sample, obtained by quota sampling, comprised 965 participants. The development stage integrates the Interdisciplinary Workers Health Approach Instrument (IWHAI) application to collect worker's data, the analysis of the relationships between the indicators, the risk ranges definition, the *WHRI* formulas elaboration, the *WHRI* final application and its discriminant validity. Three risk ranges were defined: "Low", "Moderate" and "High". *WHRI* revealed the ability to identify differences between the population studied, according to sex, age group and education level. The results indicate that 74% of the participants are in the "Low", 21% in the "Moderate" and 5% in the "High" risk ranges. High-risk workers are also those with diabetes mellitus, triglycerides, altered glycemia and hypertension, poor oral hygiene and periodontal condition, smoking, less physically active (all with $p < 0.05$), and higher levels of abstentionism. *WHRI* major contribution is to make available a useful tool for the identification of WH risk, contributing to define clearer health promotion, prevention and intervention policies in the context of WH.

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Keywords Occupational health · Worker's health risk index · Sustainable working conditions

1 Introduction

Risk prevention and the promotion of safer and healthier conditions in the workplace are essential not only to improve the quality of employment and working conditions, but also to promote competitiveness [1]. Healthy workers have a direct and quantifiable positive impact on productivity, contributing to improve the sustainability of social security systems [2, 3]. Risk stratification of health system users is a central element of the health management of a population. An important model for the organization of care regulation is the Risk Pyramid Model (RPM), which operationalizes the risk stratification of non-acute chronic conditions and defining intervention strategies for self-care and in professional care. Although RPM is a relevant model for stratifying populations in risk ranges, their theoretical frameworks do not describe the methodology that determines their classes.

In line with the need for risk stratification and with the intention of covering a lack of availability of health and sustainability indicators within the work context, this study proposes the Worker's Health Risk Index (*WHRI*), which aims to assess the Worker's Health (WH) risk, focusing on sustainable development in the workplace. This approach assumes that the WH results from a set of associations between environment, human health and working relationships, which, interrelated, contribute to the general health status of the working population. For this reason, and in an interdisciplinary perspective, the development of an index such as *WHRI* is considered relevant, enabling the prevention and integral promotion of health in the collective work environment.

2 Materials and Methods

2.1 Study Design

The research is based on a strong methodological component, carried out in the period of August to October 2018, in the worker's occupational health service in the oil extraction and production industry in Bahia, Brazil. The study involved 10 specialists, all active in the WH field, with a minimum of five years of interdisciplinary experience, and three data science experts. Data were collected during the annual occupational assessment of the subjects, in appropriate offices, by professionals of medicine, nursing, nutrition, dentistry and physical education, with large experience in the specific area of work. All calls were performed in an integrated, single shift and lasted an average of 40 min with each professional.

The Interdisciplinary Worker's Health Approach Instrument (IWHAI) [4], previously validated, was used for data collection purposes. Data were treated to standardize variable names, as well as a randomly generated code was created to ensure anonymity of study participants. To assess the *WHRI*'s ability to identify differences/associations between participants by sex, age group and educational level, the Chi-square test was applied ($\alpha = 5\%$). In all stages of the study, the recommendations and guidelines of Resolution 466/2012 of the Brazilian Ministry of Health on ethical aspects regulating research with human beings were followed. The study was approved by the Research Ethics Committee of the Bahiana School of Medicine and Public Health and CAAE no. 84318218.2.0000.5544. Before participating in the study, all subjects gave their informed consent for inclusion.

2.2 *Sample*

The *WHRI* was applied to a sample of 965 workers, where men (91.6%), aged 50–59 years (43.6%) and with a complete secondary level (60.4%), prevailed. The sample does not differ from the population in terms of the distribution of the percentages by sex ($p > 0.05$) and age group ($p > 0.05$), contributing to a more robust analysis, and also allowing to infer the results found for the population (see Table 1).

2.3 WHRI *Indicators Selection*

Based on the literature review, 6 dimensions, 44 indicators and 220 sub-indices, integrating the IWHAI [4], were included. The "Personal factor" dimension, corresponding to the "Age group" indicator and the respective sub-indices, were added to the *IWHAI*, and the calculations were performed by the data scientists. For the definition of the variables, aspects related to social determinants were considered, i.e., health [5], global disease burden [6, 7], environmental aspects [8], SDGs [9] and, in particular, working conditions affecting the health of the individual.

Table 1 Population and sample characterization

		Population *N* (%)	Sample *n* (%)	*p*
Sex	Male	1117 (87.6)	884 (91.6)	> 0.05
	Female	158 (12.4)	81 (8.4)	
Age	≤ 29	50 (3.9)	44 (4.6)	
	30 a 39	350 (27.5)	261 (27.0)	
	40 a 49	245 (19.2)	209 (21.7)	
	50 a 59	556 (43.6)	410 (42.5)	
	≥ 60	74 (5.8)	41 (4.2)	
	Total	1275	965	

WHRI was coded in closed responses with an interval scale of 0 to 4, where zero represents non-existent or inadequate risk control and four represents optimal risk control, with the following graduation: 0—non-existent or inadequate; 1—tolerable; 2—reasonable; 3—good and 4—excellent. The 3 data science experts defined the parameters' values to be applied in all *WHRI* development steps, as detailed in Table 2.

As Table 2 shows, the first parameter refers to the Dimension Weight (*W*), comprising an integer number, ranging from 0 to 5. The highest value, i.e., $W = 5$, characterizes the dimension whose indicators have a major impact on the interdisciplinary assessment, corresponding to the medicine dimension. The second parameter corresponds to the criticality for each indicator, which was defined by the Critical Sub-index (*Ci*), ranging from 0 to 2. The third parameter is the Associated Indicator (*Ai*), establishing the association between indicators. As an example, there is Feeling of pain indicator, which has *Ci* at level 2, so the indicator will be considered critical whenever one of the sub-indices 0, 1 or 2 is chosen, with no difference between these scores. Feeling of pain is associated with Musculoskeletal pathology and Ergonomic risks—physical aspects indicators, which means that they are influenced by them, which can be either positive or negative.

2.4 WHRI *Calculations*

The development of the *WHRI* calculation was mainly based in the model of calculation of the potential risk, by Leite and Dourado [10] and Navarro [11]. The Multidisciplinary Risk (*Mr*) is the value calculated from a weighted average of the sub-indices filled in the indicators of each dimension, added by a factor calculated from the number of risk associations that each indicator had with other dimensions, or with the dimension itself. The worker will have a *Mr* score for 5 dimensions, i.e., medicine, nursing, physical education, nutrition and dentistry and to calculate it, all *WHRI* indicators must be filled. The *Mr* calculation is shown in Eq. 1.

$$Mr = \left\{ \frac{\left[\frac{\log(W+1)}{(W+Q)}\right]}{(W+I)} \right\} + \left\{ R + \left[A \times \left(\frac{0.05}{T} \right) \right] \right\} \quad (1)$$

where W is the dimension weight, Q is the number of dimensions integrating disciplinary care, I is the number of indicators by dimension, R is the reference value, detailed below, A is the number of indicators with sub-index ranging from 0 to 2, i.e., *Ai,* associated with some dimension indicator, considering all the dimensions assessed for a particular individual and T is the number of total associations between indicators of all dimensions. 0.05 is a constant responsible for a bigger data detail of the negative weights of the associated indicators. $R = 0.95$, when there is at least one indicator in the dimension whose sub-index is less than or

Table 2 *WHRI* dimensions, indicators and associated indicators

W	Code	Indicator	*Ci*	*Ai*						
				I01	I02	I03	I04	I05	I06	I07
(0)	G01	Age group								
A(1)	O02	Oral hygiene quality								
	O03	Periodontal condition	0							
	O04	Periodontal disease	1	O02	M06					
	O05	Caries	0	N02						
	O06	Oral lesion on soft or hard tissues	0	M06	N06					
	O07	Bruxism		M09						
B (2)	N01	Energy balance intake		P01						
	N02	Simple carbohydrate intake	0							
	N03	Saturated lipids intake	0							
	N04	Sodium mineral intake	0							
	N05	Fibre intake								
	N06	Alcohol use	0	E05	E06					
	N07	Level of food knowledge								
	N08	Body weight condition								
	N09	Altered triglycerides	0	N06						
C (3)	P01	Physical activity level		E06	E07					
	P02	Contemplation for physical activity	1							
	P03	Feeling of pain	2	M07	E02					
	P04	Cardiorespiratory fitness								
	P05	Abdominal strength level								
	P06	Flexibility level								
	P07	Manual gripping force								
D (4)	E01	Environmental hazards exposure	1							
	E02	Ergonomic risks—physical	1							
	E03	Ergonomic risks—organizational								
	E04	Work environment health conditions	0							
	E05	Family relationships								
	E06	Social aspects—leisure								
	E07	Self-care level	1	E05						
	E08	Pests and vectors		E04						
	E09	Drinking water Quality		E04						
	E10	Air quality		E04						
	E11	Work accident		E01	E02					
	E12	Work-related absenteeism		P03						

(continued)

Table 2 (continued)

W	Code	Indicator	*Ci*	*Ai*						
				I01	I02	I03	I04	I05	I06	I07
E(5)	M01	Dyslipidemia	0	N03	N09					
	M02	Diabetes mellitus	2	N02	P01	E05	E07	M04	M06	O06
	M03	Altered glycemia	1	N02	P01	E05	E07			
	M04	Arterial hypertension	0	N04	P01	E05	E07			
	M05	Altered blood pressure	1	N04	P01	E05	E07			
	M06	Use of tobacco	1							
	M07	Musculoskeletal pathology	0							
	M08	Psychiatric pathology	1							
	M09	Stress level and symptoms	0	N06						

Note W—Dimension weight; *Ci*—Critical sub-index; *Ai*—Associated indicator; A—Dentistry; B—Nutrition; C—Physical education; D—Nursing; E—Medicine

equal to the value defined as critical (see Table 2, critical sub-index (*Ci*)), 0.95 is a constant that limits the maximum that the *Mr* can reach before the *Ai*. In all other cases, $R = 0.95 - M/4.3$, where *M* is the sub-indices arithmetic mean, and 4.3 is a constant responsible for increasing the *WHRI*'s accuracy, increasing its probability of identity.

The *WHRI* is calculated from the *Mr* mean (Eq. 1) of the worker, according to Eq. 2. Each worker will have a specific *WHRI* score, and the same result will not be possible for more than one individual.

$$WHRI = \frac{\left\{0.95 - \left(\frac{Is}{3.3}\right)\right\} + \sum Mr}{Q + 1} \tag{2}$$

where *Is* is the indicator corresponding to the subject's age group (see Table 3), *Mr* is the multidisciplinary risk and *Q* is the number of dimensions integrating disciplinary care, 0.95 is a constant that limits the maximum that the *Mr* can reach before the *Ai* and the difference between 4.3, constant from Eq. 1 and 1, i.e., equal to 3.3, is another constant responsible for making the sum of *Mr* proportional to the calculation of the age dimension.

Table 3 Indicator assigned to the subject's age group

Age group	*Is*
$As \geq 60$	0
$50 \leq As < 60$	1
$40 \leq As < 50$	2
$30 \leq As < 40$	3
$As < 30$	4

Note As—age of the subject; *Is*—indicator corresponding to the subject's age group

For the calculation of the value of *Mr* it is necessary to extract the values of *W*, *I*, *M*, *A*, *R*, *Q*, and *T* of each dimension, already defined in Eq. 1. To complete the *WHRI* calculation it is necessary to extract the values of *Is*, *Q* and $\sum Mr$, as defined in Eq. 2. In order to transform the data generated from the *WHRI* calculations into information supporting decision making in the WH field, specialists and data experts met to define three distinct risk ranges: Low risk ($WHRI < 0.530$); Moderate risk ($0.530 \leq WHRI < 0.662$); and High risk ($WHRI \geq 0.662$).

As a theoretical basis for the definition of the risk range, models by the Leeds Department of Health [12] and Porter and collaborators [13], that stratify the population by risk levels, were used. The following classifications were considered: Low-risk values vary from 0.007 to a defined value of 0.529. Individuals who have these *WHRI* values are considered to be at low WH risk, particularly behavioural risks [14], and with needs for interventions related to health promotion actions [15]; Moderate-risk values vary between the lower limits of 0.530 and the higher limits of 0.661. Individuals with these *WHRI* values are considered to be at moderate WH risk, specifically in terms of biopsychosocial and environmental risks [16], and with needs for interventions related to health prevention actions [17]; High-risk values are above the acceptability limit of 0.662. Individuals who present these *WHRI* values are considered to be at high WH risk and need interventions related to complex health care actions [18].

2.5 WHRI *Validity*

Because *WHRI* was based in *IWHAI*, already validated and published [4], *WHRI* is considered as validated. At this stage, the aim was to the test the discriminant validity by assessing the *WHRI* significant differences of workers' groups according to an fundamental shared characteristic, i.e., risk ranges. *Kruskal–Wallis* test was used for comparing the sub-indices medians of the three risk ranges, also allowing to verify if the WHRI is able to identify differences between the risk ranges.

3 Results and Discussion

The *WHRI* risk range distribution was compared by sex, age group and education level of the sample, according to Table 4.

5.1% of the workers were classified as high-risk, 20.6% as moderate-risk and 74.3% as low-risk. The results (Table 4) indicate a heterogeneous distribution of workers across the three risk ranges. In the high-risk range there are predominantly male workers ($p < 0.05$), aged 50 or older ($p < 0.05$) and with complete or incomplete intermediate education levels ($p < 0.05$). These risk factors were also identified by Niccoli and Partridge [19] and Dhingra and Vasan [20]. In line with these results, an education level below the university degree, is also a risk factor ($p < 0.01$).

Table 4 *WHRI* risk range comparison by sample sociodemographic characteristics

Variables		Low-risk	Moderate-risk	High-risk	*p*
		n (%)	*n* (%)	*n* (%)	
Sex	Male	644 (72.9)	191 (21.6)	49 (5.5)	0.002
	Female	73 (90.1)	8 (9.9)	0 (0.0)	
Age	≤29	44 (100)	0 (0.0)	0 (0.0)	0.000
	30 a 39	247 (94.6)	13 (5.0)	1 (0.0)	
	40 a 49	173 (82.8)	33 (15.8)	3 (1.4)	
	50 a 59	233 (56.8)	143 (34.9)	34 (8.3)	
	≥ 60	20 (48.8)	10 (24.4)	11 (26.8)	
Education	Incomplete intermediate level	29 (51.8)	19 (33.9)	8 (14.3)	0.002
	Complete intermediate level	438 (75.3)	116 (19.9)	28 (4.8)	
	Incomplete higher level	28 (84.8)	4 (12.1)	1 (3.0)	
	Complete higher level	124 (78.5)	28 (17.7)	6 (3.8)	
	Complete higher level with postgraduate degree	32 (84.2)	6 (15.8)	0 (0.0)	

Table 5 presents the prevalence of the sub-indices of indicators by risk range. To each indicator, the most prevalent sub-index by risk range and the percentage of workers in that condition is presented.

According to Table 5, most of the indicators, i.e., all those indicated in bold, identify significant differences between the three risk ranges. In the dimension of medicine, nursing, physical and dental activity, the most significant differences are observed ($p < 0.05$), suggesting that workers with higher levels of diabetes mellitus altered triglycerides, glycemia, blood pressure and use of tobacco, are found in the high-risk range. Workers in the high-risk range are also those with poorer oral hygiene and periodontal condition, and are the least physically active (all with $p < 0.05$). For these reasons, these are also the workers with the highest levels of workplace absenteeism ($p < 0.05$). In Table 5, it is possible to identify which indicators are simultaneously poorest by risk range. In the high-risk range are workers with worse levels on critical health indicators, particularly those related to the medical field, such as glycemia, blood pressure and diabetes, which, associated with sedentary lifestyles and consumption of harmful substances, such as tobacco and alcohol, lead to the development of chronic conditions severely affecting their health and productivity at work, as already mentioned by Farhud [21] in a previous study. Associated with the consumption of tobacco, alcohol, diabetes, and foods rich in sugar are also severe periodontal conditions, as already identified by Llambés and colleagues [22].

Table 5 Sub-indices prevalence (%) by risk range

	Indicator	Risk Ranges			*p*
		Low	Medium	High	
Dentistry	Oral hygiene quality	4 (36.9)	2 (44.7)	2 (61.2)	**0.001**
	Periodontal condition	4 (41.2)	1 (41.2)	1 (57.1)	**0.001**
	Periodontal disease	3 (55.6)	2 (50.0)	2 (42.9)	0.126
	Caries	1 (46.1)	1 (63.6)	1 (60.0)	**0.001**
	Oral lesion on soft or hard tissues	4 (100)	4 (100)	1 (100)	0.480
	Bruxism	2 (54.2)	3 (47.3)	2 (60.0)	0.335
Nutrition	Energy balance intake	3 (54.0)	2 (48.7)	2 (53.1)	**0.001**
	Simple carbohydrate intake	3 (78.1)	3 (68.3)	3 (65.3)	**0.001**
	Saturated lipids intake	3 (93.6)	3 (91.0)	3 (87.8)	0.201
	Sodium mineral intake	3 (98.5)	3 (98.0)	3 (100)	0.902
	Fibre intake	3 (69.8)	3 (57.3)	3 (61.2)	**0.002**
	Alcohol use	3 (57.9)	3 (51.3)	3 (38.8)	**0.003**
	Level of food knowledge	3 (59.5)	2 (56.3)	2 (57.1)	**0.001**
	Body weight condition	2 (47.3)	2 (45.7)	2 (49.0)	**0.002**
	Altered triglycerides	3 (67.9)	3 (43.4)	1 (40.8)	**0.001**
Physical education	Physical activity level	3 (44.8)	0 (40.2)	0 (65.3)	**0.001**
	Contemplation stage for physical activity	3 (73.9)	3 (58.3)	1 (32.7)	**0.001**
	Feeling of pain	4 (93.4)	4 (67.9)	4 (79.6)	**0.002**
	Cardiorespiratory fitness	3 (60.1)	3 (63.1)	3 (77.1)	**0.001**
	Abdominal strength level	4 (35.6)	0 (33.5)	0 (28.1)	**0.001**
	Flexibility level	0 (27.9)	0 (43.7)	0 (46.2)	**0.001**
	Manual gripping force	3 (66.7)	3 (65.5)	3 (63.0)	**0.003**
Nursing	Ergonomic risks—physical aspects	3 (81.7)	3 (68.9)	3 (63.3)	**0.001**
	Ergonomic risks organizational aspects	3 (94.9)	3 (94.9)	3 (91.8)	0.956
	Work environment health conditions	3 (85.1)	3 (81.1)	3 (89.8)	0.259
	Family relationships	3 (98.2)	3 (96.4)	3 (87.8)	**0.001**
	Social aspects—leisure	3 (97.5)	3 (96.4)	3 (100)	**0.019**
	Self-care level	3 (54.0)	2 (55.1)	2 (55.1)	**0.001**
	Pests and vectors	2 (52.2)	1 (55.8)	1 (62.5)	**0.031**
	Drinking water Quality	0 (52.0)	0 (54.8)	0 (60.4)	0.733
	Air quality	3 (862.5)	3 (55.3)	3 (55.1)	0.147
	Work accident	4 (99.6)	4 (100)	4 (100)	0.595
	Work-related absenteeism	4 (48.7)	2 (32.7)	2 (32.7)	**0.001**

(continued)

Table 5 (continued)

	Indicator	Risk Ranges			*p*
		Low	Medium	High	
Medicine	Dyslipidemia	3 (37.2)	4 (33.7)	4 (30.6)	0.082
	Diabetes mellitus	4 (46.7)	2 (50.0)	2 (33.3)	**0.002**
	Altered glycemia	4 (80.9)	4 (72.4)	4 (80.0)	**0.002**
	Arterial hypertension	3 (84.6)	3 (74.3)	3 (37.5)	**0.001**
	Altered blood pressure	4 (50.7)	3 (37.2)	2 (49.0)	**0.001**
	Use of tobacco	4 (75.0)	4 (44.5)	2 (47.1)	**0.001**
	Musculoskeletal pathology	4 (49.3)	2 (39.4)	2 (56.3)	**0.001**
	Psychiatric pathology	4 (47.9)	4 (60.0)	3 (52.1)	0.165
	Stress level and symptoms	4 (91.9)	4 (85.7)	4 (87.5)	**0.021**

Note 0—non-existent or inadequate; 1—tolerable; 2—reasonable; 3—good and 4—excellent

4 Conclusions

WHRI application in the WH context allowed its validity in identifying the share of workers in the three "low", "moderate" and "high" risk ranges. The *WHRI* robustness is visible in the ability to identify differences among worker's sociodemographic characteristics ($p < 0.001$), helping to define health policies in the workplace that promote overall WH, also contributing to the increase of worker's productivity. It was verified that the sex, age and education influence the WH risk, being higher in men, over 50 years old and with low educational level ($p < 0.001$). The fact that 74% of workers are in the "low" risk range, does not mean that they should be considered as free to develop disease, and, consequently, it is crucial to monitor WH. This result is of fundamental importance for the oil industry studied, as oil production in old fields such as Bahia, Brazil, is declining, leading to an economic scenario of business resource constraints.

The application of a tool as *WHRI* enables the definition of risk management strategies aimed at the better use of economic resources to match care resources in different situations. In future studies, it would be important to analyze the association of *WHRI* with health assessment results, and the correlations between risk ranges and worker's conditions in the workplace.

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CAPÍTULO IV – MODELO DE ASSISTÊNCIA À SAÚDE DO TRABALHADOR: DESENVOLVIMENTO, VALIDAÇÃO E AVALIAÇÃO DO RETORNO SUSTENTÁVEL DO INVESTIMENTO[4]

Este capítulo procurou responder ao quarto objetivo secundário delineado para o desenvolvimento da tese. Ele apresenta todo o processo de desenvolvimento e validação do WHAM, que busca responder à questão levantada sobre que modelo de atenção em ST é pode atuar de forma interdisciplinar, capaz de gerenciar riscos e ser economicamente sustentável.

No artigo, a primeira autora participou na conceptualização, desenvolvimento da metodologia, da validação, da investigação, da recolha e análise de dados e na escrita do manuscrito.

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Article

Workers' Healthcare Assistance Model (WHAM): Development, Validation, and Assessment of Sustainable Return on Investment (S-ROI)

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Abstract: The present study aimed to present and validate the Worker´s Healthcare Assistance Model (WHAM), which includes an interdisciplinary approach to health risk management in search of integral and integrated health, considering economic sustainability. Through the integration of distinct methodological strategies, WHAM was developed in the period from 2011 to 2018, in a workers' occupational health centre in the oil industry in Bahia, Brazil. The study included a sample of 965 workers, 91.7% of which were men, with a mean age of 44.9 years (age ranged from 23 to 73 years). The Kendall rank correlation coefficient and hierarchical multiple regression analysis were used for the validation of WHAM. The assessment of sustainable return on investment (S-ROI) was made using the WELLCAST ROI™ decision support tool, covering workers with heart disease and diabetes. WHAM can be considered an innovative healthcare model, as there is no available comparative model. WHAM is considered robust, with 86% health risk explanatory capacity and with an 85.5% S-ROI. It can be concluded that WHAM is a model capable of enhancing the level of workers' health in companies, reducing costs for employers and improving the quality of life within the organization.

Keywords: Workers' Healthcare Assistance Model (WHAM); patient-centred care; integrated care; interdisciplinary; sustainable return on investment (S-ROI); economic sustainability; WELLCAST ROI™

1. Introduction

More than ever, life, as we know, will never be the same. The world is currently experiencing the coronavirus pandemic (COVID-19) [1], an unforeseeable health development that is affecting the entire global population, and consequently healthcare assistance models across the globe. There is now an urgent need to look at human health through the "one health" lens [2], to design and implement programs, policies, legislation, and research in a cooperative manner among all sectors of society to achieve better public health outcomes.

In addition to the recognition of the success of the current healthcare models in the relief of pain and the treatment of multiple pathologies, several criticisms are gaining support, pointing out the limitations relating to the attention to patient health. These issues include approaches that take an undifferentiated view of the individual, which is focused exclusively on the part of the body that is sick; the focus on the curative actions of diseases, injuries, and damages; the advancement of medicalization; and the generalization of hospital care using technology. In the past, if a medical doctor was seen as a

figure possessing the knowledge necessary to cure the patient, nowadays that figure is seen as one part of a team, with the patient being the final decision-maker in their health outcomes.

The World Health Organization has chosen to strengthen people-centred care and integrated health services as priority strategies to transform health services to meet the health challenges of the 21st century [3]. This favours the emergence of integrated care models, which are seen as possible solutions to the growing demand for improvement in the patient experience, especially in patients with chronic conditions.

Considering economic sustainability in the search for integral and integrated health, this study aims to present and validate a model of workers' healthcare, the Workers´ Healthcare Assistance Model (WHAM), which embraces an interdisciplinary approach towards health risk management.

In light of the literature review, the following three research hypotheses were formulated:

Hypotheses (H1). *WHAM promotes integral and integrated care;*

Hypotheses (H2). *WHAM is robust and has greater explanatory capacity for workers' health risks;*

Hypotheses (H3). *WHAM is economically sustainable and provides a significant return on investment.*

2. Literature Review

A review of the literature in the field of occupational health highlights discussions relating to "assistance models", a term that varies based on the conceptualization, which can include "assistance modalities or technological models" [4,5]; "ways to promote health" [6]; "assistance models" [4,6,7]; "technical, techno-assistance, and technical assistance models" [4,8]; "modes of intervention" [7]; "attention models" [9–11]; and "care models". The result of this diversity of terms is the already identified difficulty in conceptualizing assistance models. Healthcare assistance models are understood as technological combinations with different purposes, which are used to solve problems and meet needs within a given context and population and in a given territory (individuals, groups, or communities), to organize health services or to intervene in situations, depending on the epidemiological profile and investigation of health problems and risks [12]. These logical systems organize the functioning of care networks, articulating the relationships between network components and health interventions. In turn, these are defined according to the prevailing view of health, demographic and epidemiological situations, and social determinants of health at a given time and in a given society and place [13].

According to Campos [5,6], the conceptualization of an assistance model, technological model, or assistance modality must go beyond mere organizational and technical design, showing a new way of producing assistance actions anchored in the organization of the state.

According to Silva [14], biomedicine has become the hegemonic model in the provision of health services in Brazil and other countries around the world, influenced by accumulated knowledge and the paradigm of science. In this process, the daily requirements in the health sector stand out, such as the relationships between people; the involvement and co-responsibility of managers, health professionals, and patients in healthcare; as well as the bond, reception, and humanization of healthcare assistance practices [15]. From a technological point of view, there is a predominance of the use of the so-called "hard technologies" (equipment), to the detriment of light technologies (professional-patient relationships) [8,16]. Thus, diagnostic tests are a priority, but patients are not necessarily considered in terms of their suffering. This approach has been the target of criticism at the international level, starting from the 1970s and gaining greater importance in the second half of the 1980s [11,17]. In terms of the biomedical model, there is a certain neglect of the importance of the determinants of the health–disease process; that is, the focus on the disease and not on the elements that contribute to health promotion, underestimating that cultural, ethical, and social aspects condition lifestyles and that these are also determinants in the same process [13,14,18].

Merhy [8] contributes to the debate about the need to change the hegemonic assistance model, arguing that it is necessary to impact the core of care. In this sense, it is necessary to invest in relational-type light technologies, focusing on the needs of users and reversing the investment in hard

or light-hard technologies, which can be translated into standards, equipment, and materials. Thus, light technologies are used and combined with people and resources to achieve certain objectives, which are gathered in an organized manner and consolidated as essential elements of health services [19].

Regardless of the scope, health services are always complex. The processes are standardized by regulatory bodies, service providers, and class representatives, among others. They have highly specialized and qualified workers who, belonging to different class councils, have interests that do not always converge [20]. Team composition characteristics in health services must be highlighted, recognizing these team members as the main actors responsible for the implementation of technologies aligned to a healthcare assistance model. Faria [21] draws attention to the fact that actions performed in a given place to deal with a certain problem may not apply to other situations, considering the historical-political context that influences a situation. Therefore, the use of healthcare assistance models invariably requires the selection of certain constructs that support them. Thus, they can be used in an alternative or adapted way, as long as they enable the achievement of similar results. To incorporate new health needs, healthcare assistance models can be considered to have influenced the organization of care models, being more focused on specific populations, such as the chronically ill. A comprehensive care model defines how health services are offered, providing the best care and service practices for a person or population group as they evolve through a condition, injury, or event, aiming for people to receive the right care, at the right time, by the right team, and in the right place [22].

The field of occupational health is a fertile environment for the development of interdisciplinary practices [23–26], as it encompasses knowledge from different disciplines, requiring constant and complex interactions between professionals in the fields of epidemiology, the environment, engineering, and healthcare, among others. The framing of occupational health in a biomedical healthcare assistance model favours the development of disjointed and ineffective interventions regarding the needs presented by workers, while the biopsychosocial model is often used in their work environments. According to Annadale [27], the biomedical healthcare assistance model only focuses on the physical processes, i.e., the pathology, biochemistry, and physiology of a disease, neglecting the roles of social factors or individual subjectivity.

In this context, it is necessary to discuss a model of assistance in occupational health that is capable of reviewing the central characteristics of the biomedical healthcare assistance model, including: (i) organization of practices focused on the identification of signs and symptoms and the treatment of diseases, with health promotion not being a priority; (ii) assistance is organized based on individual spontaneous demand, with an emphasis on specialization and the use of hard technologies; (iii) the work is developed in a fragmented, hierarchical manner and with inequality across different professional categories; (iv) difficulty in implementing the integrated care due to the lack of understanding of the individual as a multidimensional human being, as well as the lack of communication and integration between the services involved; (v) health planning is seldom used as a management tool; (vi) the training of health professionals is specialized, based on the hegemony of scientific knowledge; and (vii) themes such as interdisciplinary, people-centered care, attachment, and welcoming are not prioritized. Another aspect of great relevance in the current global context of scarcity of resources, particularly in the current context of COVID-19, is the prioritization of investments ineffective, integral, and integrated interventions, which can be achieved through a model that contemplates the management of occupational health risks, considering the social health determinants [28,29], global disease burden [30], environmental aspects [31,32], sustainable development goals [33,34] and in particular, working conditions that affect an individual's health [35].

In the current context, the effectiveness of a healthcare assistance model must include economic sustainability in addition to health gains, to know how much the company has earned due to investments made in a certain area, with the sustainable return on investment (S-ROI) being a very important metric for this assessment. Measuring the S-ROI [36–38] of preventive programs is not an easy task, due to the large number of variables that influence this calculation. The main variable is patient health, which can improve or worsen unpredictably. Analyzing the S-ROI in preventive programs

identifies the financial impact a program generates concerning the amount invested, which must be considered in the long term. Disease prevention actions bring future returns, mainly to the reduction of healthcare assistance costs. If the individual participates in preventive programs, the probability of developing diseases or discovering them in advanced stages decreases. Over the past 20 years, several studies [39–47] have addressed this issue and there is growing evidence that workplace programs can generate acceptable financial returns for employers investing in them. A study of Johnson and Johnson employees [39] showed a difference in the increase in the average annual costs of internment between workers involved and not involved in lifestyle improvement programs and changes in the workplace, representing $43 and $76, respectively, thus representing a considerable increase in percentage terms. The study by Munir et al. [45] aimed to conduct a cost-benefit analysis of the stand more at work (SMArT) workplace intervention, designed to reduce sitting time. A net saving of $2.18813 (95% CI; $−4.3804; $4.8143) per employee was found as a result of productivity increase. Peik and others [46] applied the Research and Development (RAND) Europe model, a program designed to expand access to up to 40 evidence-based clinical preventive services for all employees and eligible family members, as part of a unique global health initiative at the country level to estimate the return on investment over a five-year timeframe. The study concluded that this program generates a global return of $4.28–$11.88 (after investment cost). Gao and co-workers [47] assessed the economic performance of a workplace-delivered intervention to reduce sitting time among desk-based workers. The incremental cost-efficacy ratios ranged from $6.28/minute reduction in workplace sitting time to $8.45/minute reduction in overall sitting time. The intervention was cost-effective over the lifetime of the cohort when scaled up to the national workforce, and provides important evidence for policy-makers and workplaces regarding the allocation of resources to reduce workplace sitting.

3. Materials and Methods

3.1. Study Design

The present study was carried out from 2011 to 2018, in a workers' occupational healthcare centre in the oil industry in Bahia, Brazil. It involved the integration of distinct methodological strategies for the development of WHAM, such as the development of a conceptual model, action research, statistical validation, and S-ROI analysis. The study involved two experts who had been working in the field of occupational health for fifteen years, with an emphasis on ergonomics and health management, an interdisciplinary approach, and a database composed of a population group and sample of workers, numbering 1275 and 965 individuals, respectively (Table 1).

Table 1. Population and sample characterization.

	Population *n* (%)	Sample *n* (%)	Difference (%)	*p*
Sex				
Male	1117 (87.6)	884 (91.6)	4.0	
Female	158 (12.4)	81 (8.4)	−4.0	
Age Group			0.7	
≤29	50 (3.9)	44 (4.6)	−0.5	>0.05
30 a 39	350 (27.5)	261 (27.0)	2.5	
40 a 49	245 (19.2)	209 (21.7)	−1.1	
50 a 59	556 (43.6)	410 (42.5)	−1.6	
≥60	74 (5.8)	41 (4.2)	4.0	
Total	1275	965		

3.2. Data Analyses

Data analyses were carried out using SPSS version 25 for Windows (IBM Corporation, New York, NY, USA). Diagnostics and intervention prevalence were presented as absolute and relative frequencies. Correlations among modifiable health risk factors and health outcomes were performed through the

Kendall rank correlation coefficient. Correlations among health indicators and the interdisciplinary risk coefficients were also performed using the Kendall rank correlation coefficient. Hierarchical multiple regression analysis was used to calculate the independent contributions of occupational medicine interdisciplinary, dentistry interdisciplinary, physical education interdisciplinary, nursing interdisciplinary, and nutrition interdisciplinary risk coefficients, to provide an estimate of incremental variance accounting for the Workers' Health Risk Index (*WHRI*) [48]. This index had already been published, resulting from the classification of workers into three risk ranges—"low", "moderate", and "high". The Durbin–Watson test was applied to detect the presence of autocorrelation at lag 1 in the residuals (prediction errors), through which the hierarchical multiple regression analysis multicollinearity was verified. To lead the application of the WHAM, the "Guidelines for Implementing the Workers' Healthcare Assistance Model (WHAM)" were developed, which are presented in the Supplementary Materials (Word S1).

3.3. Model Development

The "Workers' Healthcare Assistance Model" is understood as the organization of the conditions necessary to carry out a person-centred care process, about the method, staff, and instruments. The term "process" used in the context of healthcare makes it possible to identify, understand, describe, explain, and predict the needs of a person, family, or community at a given moment in the health and disease process, demanding professional care by health specialists. Therefore, WHAM presupposes a set of actions, through certain means of action, regulated by a course of thinking; that is, through a conception of workers' health, WHAM's origin and its potential to transform itself or to be transformed.

To compose the WHAM, the Interdisciplinary Workers' Health Approach Instrument (IWHAI) [49], a tool that had already been published, was used as a data collection instrument, aiming to collect data from 43 health indicators. To map the diagnoses, the health taxonomies were used, while the *WHRI* [48] was used to prioritize the health risks of the workers. Figure 1 shows the main stages of integrating the WHAM.

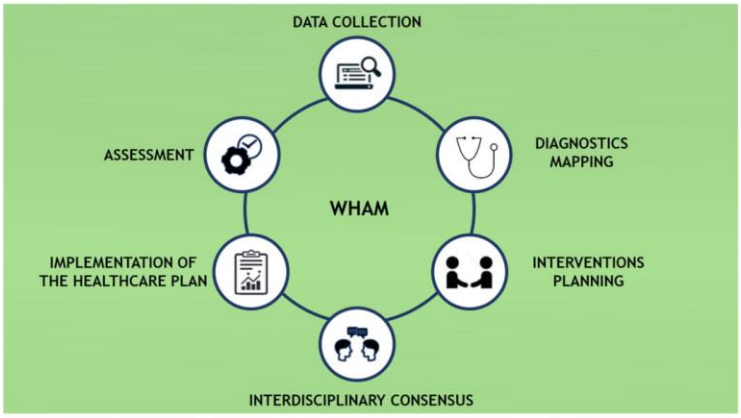

Figure 1. Phases in the Workers' Healthcare Assistance Model (WHAM).

3.3.1. Data Collection

The data collection stage aimed to identify health problems, as well as the efficient and targeted recording of the workers' needs in its broadest sense. For this, the IWHAI [49] was chosen. It allows structured data collection, covering the disciplines of medicine, dentistry, nursing, nutrition, and physical education, as well as environmental, occupational, behavioural, personal, and metabolic

factors. It is composed of in 5 dimensions with 43 indicators, totalling 215 sub-indexes with closed response coding, where zero represents non-existent or inadequate control of risk and four represents optimal control of risk, arranged in the following scale: 0 = non-existent or inadequate; 1 = tolerable; 2 = reasonable; 3 = good; 4 = excellent.

3.3.2. Diagnostics Mapping

For the diagnostics mapping stage, it was necessary to define taxonomies that encompass the complexity of the workers' health field, especially those related to the health, environment, and work triad. The following codes were used for medical, dental, nursing, nutritional, and physical education factors: (i) International Classification of Diseases (ICD 11) [50]; International Classification of Nursing Practice (CIPE®) [51,52]; International Dietetics and Nutritional Terminology (IDNT) [53]; and the International Classification of Functioning, Disability, and Health (ICF) [54].

3.3.3. Intervention Planning

For the intervention design stage, it was necessary to define classifications that encompass proposals for interventions, which include ecological and occupational care. For each mapped diagnosis, an intervention must be associated. During the attendance of the worker, priority is given to diagnoses for health indicators that are classified as control or health conditions: 0 = non-existent or inadequate; 1 = poor; 2 = reasonable.

3.3.4. Interdisciplinary Consensus

This consists of a discussion amongst the interdisciplinary health team to validate the perceptions [55] raised by professionals in each area during the attendance of workers, sharing the diagnoses and interventions proposed by each discipline. The IWHAI [49] was used as a guiding instrument for data collection. For support of the team decisions regarding the hierarchy of priority interventions, the *WHRI* [48] was used, allowing multidisciplinary (by dimension) and interdisciplinary (association of all dimensions) risk classifications. The classifications comprise three ranges: "low", "moderate", and "high". Since 64% of the sample age is above 40 years and the gender proportion of male to female is very high, the effects of these factors were controlled in this step by the *WHRI* [48] assessment. As the workers' ages increase, the risk indicator also increases; the same happens for male and female workers for some sex-related diseases, such as the higher susceptibility by men to develop cardiovascular diseases and alcohol abuse. For this reason, when *WHRI* [48] is applied, each worker will have two risk indicators influencing the indicators of health behaviours and outcomes: a risk indicator related to the workers' age, whereby the older the worker, the higher their risk indicator; and another risk related to their sex, whereby female or male gender will have different impacts on health behaviours and outcomes. The final *WHRI* [48] score is mediated by the workers' age and sex.

The *WHRI* [48] dimension that has the greatest weight in the interdisciplinary context is designated as the worker case manager (WCM) and will assume technical responsibility concerning care management.

3.3.5. Implementation of the Healthcare Plan

The care plan (CP) is an interdisciplinary document, composed of relevant IWHAI indicators with their respective diagnoses and associated interventions, in addition to the definitions of the implementation and deadline. For the implementation of the CP, the WCM must bring together the interdisciplinary intervention team (IIT), ratify the CP, and proceed with the treatment of the proposed actions through interdisciplinary assistance, group work, and collective and environmental interventions. After validation of the CP by the IIT, the workers are involved in discussing the CP and implementing it at the individual level.

3.3.6. Assessment

The assessment stage deals with the follow-up and monitoring of the workers to the effectiveness of the implemented health interventions. For this, it is necessary to systematically reassess the *WHRI* [48]. The attendance took place in a single period (shift) by each member of the interdisciplinary team, with an average time of 40 min for each consultation and a total time of 3.5 h for each worker in the health service.

3.4. WHAM Validation

To validate the WHAM, the data collected in 2018 were used in a representative sample of the population of 965 workers, where attendance by the interdisciplinary team occurred at the same time. Through statistical tests, the intention was to identify the prevalent diagnoses and interventions, how the modifiable factors are related to health outcomes in this sample, and the impact each dimension has on the *WHRI* [48], i.e., if the joint use of these dimensions contributes to greater robustness and explanatory capacity of the WHAM.

3.5. Assessment of Sustainable Return on Investment (S-ROI)

To assess the cost-benefit (*CB*) relationship of implementing WHAM, interventions directed at workers with coronary heart disease (CHD) and diabetes in the period ranging from 2011 to 2018 were analyzed. The effectiveness of the intervention was based on the results of epidemiological studies over this period. Brazilian national data were used to estimate the average annual benefits of preventing direct medical costs for diseases.

The analytical tool WELLCAST ROI™ [56], developed to justify the approval of disease prevention and management programs, was used to calculate the S-ROI. For this, the following steps were taken: (i) determine the incidence of the pre-program disease; (ii) determine all costs associated with the disease, either medical costs (for CHD patients, the Framingham model [57] was used to calculate incidence pre and post-program for a period of 10 years, assuming changes in Low-density lipoprotein (LDL) cholesterol, and systolic and diastolic pressure risk factors; for patients with diabetes mellitus, the reduction in the progression of diabetes comorbidities over 10 years was calculated, based on the reduction of glycemia, considering the retinopathy, kidney disease, neuropathy, and microangiopathy comorbidities) or economic costs (monthly salary data, loss of daily productivity, medical inflation rate, among other rates estimated by WELLCAST ROI™); (iii) define the program and its cost; (iv) determine the effectiveness of the program in reducing costs; (v) subtract post-program costs from pre-program costs to determine reductions; and (vi) apply the concepts of net present value (*NPV*), internal rate of return (*IRR*), and *CB* to determine the S-ROI.

3.6. Ethical Approval

In all stages of the study, the recommendations and guidelines of Resolution 466/2012 [58] of the Brazilian Ministry of Health on ethical aspects regulating research with human beings, approved by the Research Ethics Committee of the Bahia School of Medicine and Public Health and Certificate of Presentation for Ethical Consideration (CAAE) 84318218.2.0000.5544, were followed. All subjects gave their informed consent for inclusion before participating in the study.

4. Results

The prevalent diagnoses and their respective interventions by dimension are presented in detail in Table 2.

Table 2. Diagnosis and intervention prevalence by dimension.

Dimension	Indicator (Assessment Number)	Prevalent Diagnostics	*n* (%)	Prevalent Intervention	*n* (%)
Physical Education	Physical Activity Level (527)	General Physical Resistance—Sedentary	140 (26.6)	Guide and Clarify the Frequency and Duration of Activities Performed to Increase the Level of Physical Activity	290 (55.1)
	Contemplation Stage for Physical Activity Practice (322)	Serious Difficulty in Making Decisions—Contemplation	96 (29.8)	Encourage Thinking about Starting a Physical Activity Program, Warning about the Harm of Physical Inactivity	273 (84.8)
	Feeling of Pain (71)	Moderate Pain	34 (47.9)	Guide to Work Physiotherapy	35 (49.3)
	Cardiorespiratory Fitness (135)	Regular Aerobic Capacity	103 (76.3)	Recommend Specific Physical Activity	89 (66.4)
	Abdominal Strength Level (222)	General Physical Resistance—Regularly Active	58 (26.1)	Stimulate and Guide for Resistance Exercise	134 (60.4)
	Flexibility Level (386)	Mobility of Several Joints—Weak Moderate Disability	85 (22.0)	Encourage and Guide for Flexibility Exercise	273 (70.7)
	Manual Gripping Force (121)	General Physical Resistance—Regularly Active	32 (26.4)	Stimulate and Guide for Resistance Exercise	93 (77.5)
Nursing	Ergonomic Risks—Physical Aspects (193)	Impaired Ergonomic Condition	148 (76.7)	Promote Ergonomic Comfort	191 (99.0)
	Ergonomic Risks—Organizational Aspects (46)	Stress due to Change or Transfer of Environment	16 (34.8)	Obtain Data on Ability to Manage Stress	19 (42.2)
	Work Environment Health Conditions (140)	Impaired Health Surveillance	133 (95.0)	Inspect the Workplace	100 (71.4)
	Family Relationships (25)	Impaired Family Process	9 (36.0)	Support Family Coping Process	12 (48.0)
	Social Aspects—Leisure (14)	Impaired Ability to Perform Leisure Activities	14 (100.0)	Implement Leisure and Fun Activities for Workers and Family Members	7 (50.0)
	Self-Care Level (585)	Health-Seeking Behavior	165 (28.2)	Reinforce Positive Behavior	106 (18.1)
Medicine	Tobacco Use (22)	Tobacco Use	16 (72.7)	Encourage Health-Seeking Behavior	21 (95.5)
	Stress Level and Symptoms (64)	Symptoms and Signs Related to Emotional State	13 (20.3)	Encourage Health-Seeking Behavior	38 (59.4)
	Dyslipidemia (515)	Pure hypercholesterolemia	179 (34.8)	Encourage Health-Seeking Behavior	362 (70.4)
	Diabetes Mellitus (68)	Non-insulin-dependent	53 (77.9)	Guide to Specialist	42 (61.8)
	Systemic Arterial Hypertension (94)	Primary Essential Hypertension	82 (87.2)	Encourage Health-Seeking Behavior	51 (54.3)
	Musculoskeletal Pathology (111)	Low Back Pain	21 (18.9)	Encourage Health-Seeking Behavior	69 (62.2)
	Psychiatric Pathology (10)	Generalized Anxiety	2 (20.0)	Encourage Health-Seeking Behavior	7 (77.8)
	Altered Glycemia (93)	Increased Blood Glucose	62 (66.7)	Guide to Specialist	50 (53.8)
	Altered Blood Pressure (220)	Primary Essential Hypertension	111 (50.5)	Guide to Specialist	96 (43.6)

Table 2. *Cont.*

Dimension	Indicator (Assessment Number)	Prevalent Diagnostics	*n* (%)	Prevalent Intervention	*n* (%)
Nutrition	Energy Balance Intake (339)	Excessive Estimated Energy Intake	239 (70.5)	Adequate Macronutrients	296 (87.6)
	Simple Carbohydrate Intake (148)	Excessive Carbohydrate Intake	74 (50.0)	Adequate Macronutrients	83 (56.5)
	Saturated Lipids Intake (47)	Lipid Type Intake in Disagreement with Needs	30 (63.8)	Adequate Macronutrients	17 (36.2)
	Sodium Mineral Intake (3)	Excessive Oral Intake	2 (66.7)	Instruct Knowledge Related to Nutrition	2 (66.7)
	Fibre Intake (240)	Inadequate Fiber Intake	224 (93.3)	Adequate Macronutrients	92 (38.8)
	Alcohol Consumption (196)	Excessive Alcohol Intake	194 (99.0)	Guide on Alcohol Consumption	147 (75.4)
	Level of Food Knowledge (289)	Limited Adherence to Nutrition Recommendations	48 (16.6)	Promote Continued Food and Nutrition Education	245 (84.8)
	Body Weight Condition (596)	Overweight—Obesity	312 (52.3)	Modify the Distribution, Type, or Amount of Food Nutrients Within Meals or over Time	469 (78.8)
	Altered Triglycerides (268)	Change in Laboratory Values Related to Nutrition	189 (70.5)	Modify the Distribution, Type, or Amount of Food Nutrients Within Meals or over Time	227 (85.0)
Dentistry	Oral Hygiene Quality (803)	Adequate Oral Hygiene	438 (54.5)	Prophylaxis, Topical Application of Fluoride, and Guidance on Correct Oral Hygiene	420 (52.0)
	Periodontal Condition (378)	Supragingival Tartar	223 (59.0)	Supragingival Tartarectomy, Prophylaxis, Topical Application of Fluoride, and Guidance on Brushing Technique and Wire Use	260 (67.0)
	Bruxism (34)	Other Somatoform Disorders Related to Stressful Events—Bruxism	33 (97.1)	Guide to Specialist	13 (35.1)
	Periodontal Disease (27)	Chronic Periodontitis	18 (66.7)	Guide to Periodontist Treatment	17 (60.7)
	Caries (84)	Dentin Caries	50 (59.5)	Guide to Restorative Treatment with External Dentist	62 (72.9)
	Oral Lesion on Soft or Hard Tissue (3)	Leukoplakia and Other Disorders of the Oral Epithelium, Including the Tongue	1 (33.3)	Guide to Specialist	2 (66.7)

In the physical education dimension, the most prevalent diagnosis is "regular aerobic capacity" (76.3 %), with the most prevalent intervention being "encourage thinking about starting a physical activity program, warning about the harm of physical inactivity" (84.8 %). In the field of nursing, the "impaired ability to perform leisure activities" (100.0 %) stands out as the most prevalent diagnosis, followed by the need to "promote ergonomic comfort" (99.0 %) as the most necessary intervention. In the field of medicine, "primary essential hypertension" emerges as the diagnosis with the highest prevalence among workers (87.2 %), preceded by "encourage health-seeking behaviour" (95.5 %) as the intervention with the greatest application within this sample. At the nutritional level, "excessive

alcohol intake" is the most prevalent (99.0 %), with the intervention with the greatest application focusing on the need for "adequate macronutrients" (87.6 %). Finally, in the field of dentistry, the most prevalent diagnosis is identified as "other somatoform disorders related to stressful events—bruxism" (97.1 %), with the predominant intervention being "guide to restorative treatment with external dentist" (72.9 %).

Table 3 shows the statistically significant correlations between modifiable health behaviours and health outcomes.

Table 3. Significant ($p < 0.05$) correlations among modifiable health behaviours and health outcomes.

	Health Outcomes							
Modifiable Health Behaviors	1	2	3	4	5	6	7	8
Altered Blood Glucose	0.65		0.25			0.14		0.45
Stress Level and Symptoms								
Altered Blood Pressure	0.21					0.21	0.18	
Alcohol Consumption		0.09				0.13		
Social Aspects - Leisure								
Self-Care Level		0.08				0.25		
Family Relationships								
Body Weight Conditions		0.06	0.15			0.23		
Energy Balance Intake	0.48	0.07	0.21		0.36	0.32	0.17	0.44
Simple Carbohydrate Intake			0.16			0.25		0.33
Saturated Lipids Intake		0.11						
Sodium Mineral Intake						0.07		
Fibre Intake						0.06		
Tobacco Use								
Level of Food Knowledge	0.46	0.11	0.25			0.28	0.18	0.31
Oral Hygiene Quality			0.14			0.12	0.30	0.58
Cardiorespiratory Fitness						0.08		
Contemplation Stage for Physical Activity			0.31			0.09		
Handgrip Strength			0.15					
Physical Activity Level			0.29			0.10		
Abdominal Strength Level			0.18			0.12		
Feeling of Pain				0.40				
Flexibility Level			0.19			0.12		
Bruxism					1.00	0.27		
Periodontal Condition						0.10	0.26	0.76

Note: 1—Diabetes mellitus; 2—Dyslipidemia; 3—Arterial hypertension; 4—Musculoskeletal pathology; 5—Triglycerides; 6—Caries; 7—Periodontal disease.

Moderate correlations in Table 3 ($\tau b \geq 0.30$) are identified as follows: between diabetes mellitus and altered blood glucose ($\tau b = 0.65$), energy balance intake ($\tau b = 0.48$), and the level of food knowledge ($\tau b = 0.46$); between arterial hypertension and the contemplation stage for physical activity ($\tau b = 0.31$); between the musculoskeletal pathology and the feeling of pain ($\tau b = 0.40$); between psychiatric pathology and energy balance intake ($\tau b = 0.36$); between triglycerides and energy balance intake ($\tau b = 0.32$); between caries and oral hygiene quality ($\tau b = 0.30$); between periodontal disease and periodontal condition ($\tau b = 0.76$), oral hygiene quality ($\tau b = 0.58$), level of food knowledge ($\tau b = 0.31$), altered blood glucose ($\tau b = 0.45$), energy balance intake ($\tau b = 0.44$), and simple carbohydrate intake ($\tau b = 0.33$).

The results are shown in Table 4 show which indicators are most correlated with each coefficient of each dimension of interdisciplinary risk.

Table 4. Correlations among health indicators and the interdisciplinary risk coefficients.

Indicators	Multidisciplinary Risk Coefficient				
	Physical Education	Nursing	Medicine	Nutrition	Dentistry
Physical Activity Level	−0.57 *				
Contemplation Stage for Physical Activity Practice	−0.59 *				
Feeling of Pain	−0.31 *				
Cardiorespiratory Fitness	−0.32 *				
Abdominal Strength Level	−0.47 *				
Flexibility Level	−0.41 *				
Manual Gripping Force	−0.22*				
Ergonomic Risks—Physical Aspects		−0.44 *			
Ergonomic Risks—Organizational Aspects		−0.13 *			
Work Environment Health Conditions		−0.26 *			
Family Relationships		−0.16 *			
Social Aspects—Leisure		−0.03			
Self-Care Level		−0.07 *			
Tobacco Use			−0.52 *		
Stress Level and Symptoms			−0.22 *		
Dyslipidemia			−0.39 *		
Diabetes Mellitus			−0.60 *		
Systemic Arterial Hypertension			−0.49 *		
Musculoskeletal Pathology			−0.37 *		
Psychiatric Pathology			−0.28		
Altered Glycemia			−0.25 *		
Altered Blood Pressure			−0.42 *		
Energy Balance Intake				−0.37 *	
Simple Carbohydrate Intake				−0.11 *	
Saturated Lipids Intake				−0.13 *	
Sodium Mineral Intake				−0.04	
Fibre Intake				−0.25 *	
Alcohol Consumption				−0.45 *	
Level of Food Knowledge				−0.18 *	
Body Weight Condition				−0.47 *	
Altered Triglycerides				−0.43 *	
Oral Hygiene Quality					−0.55 *
Periodontal Condition					−0.66 *
Bruxism					−0.34 *
Periodontal Disease					−0.54 *
Caries					−0.37 *
Oral Lesion on Soft or Hard Tissues					−0.82 *

Notes: * significant correlations ($p < 0.05$).

The values presented in Table 4 make it clear which indicators are most correlated with multidisciplinary risk; the worse an indicator is, the more the risk increases. Thus, in the field of physical education, it appears that the indicator of the contemplation stage for physical activity is the one that is most strongly correlated ($\tau b = 0.59$). In nursing, the physical aspects of ergonomic risks have the most significant correlation ($\tau b = 0.44$). In the field of medicine, diabetes mellitus is the most disturbing indicator ($\tau b = 0.60$). In nutrition, alcohol consumption presents the strongest correlation ($\tau b = 0.45$). Finally, the highest correlation of all is for oral lesion on soft or hard tissue, which is the most significant indicator in the field of dentistry ($\tau b = 0.82$).

Hierarchical regression analysis was applied to understand whether the variables or dimensions under analysis explain a statistically significant amount of the variance of the dependent variable to be tested—in this case, the *WHRI* [48] (Table 5). A comparison of stages is made by gradually adding each independent variable in each stage, to understand if the combination of the dimensions explains more than considering them separately.

Table 5. Hierarchical multiple regression analysis scheme.

Predictor Dimensions	Step 1		Step 2		Step 3		Step 4		Step 5	
	B	*t*	*B*	*t*	*B*	*t*	*B*	*t*	*B*	*t*
Medicine	0.272	22.28	0.285	24.57	0.234	26.61	0.216	30.91	0.205	35.03
Dentistry			0.223	18.66	0.209	21.01	0.195	24.66	0.166	29.35
Physical Education					0.179	20.81	0.169	24.93	0.179	29.82
Nutrition							0.174	24.06	0.194	29.45
Nursing									0.168	20.76
R		0.58		0.72		0.82		0.89		0.93
R^2		0.34		0.52		0.67		0.79		0.86
$R^2{}_a$		0.34		0.51		0.66		0.79		0.86

Notes: B = unstandardized beta; t = t-test statistic; R = multiple correlation coefficient; R^2 = R Square; $R^2{}_a$ = Adjusted R Square; R =Step 1: Constant = 0.370, F = 496.6, $p < 0.001$; Step 2: Constant = 0.300, F = 511.7 $p < 0.001$; Step 3: Constant = 0.231, F = 638.5 $p < 0.001$; Step 4: Constant = 0.101, F = 911.1, $p < 0.001$; Step 5: Constant = 0.035, F = 1141.3 $p < 0.001$. Durbin–Watson = 1.506. All predictors are significant at 0.05 level. No multicollinearity was identified.

It can be observed that as the dimensions under analysis are added, the model becomes more robust and has greater explanatory capacity for the dependent *WHRI* [48] variable. Thus, when comparing the first stage (step 1) with the last stage (step 5), an increase of 52% in the explained variance of the *WHRI* is observed with the 5 analyzed dimensions, showing values of 34% ($R^2 = 0.34$) and 86% ($R^2 = 0.86$), respectively. Medicine is the dimension with the most significant impact on the model ($B = 0.205$; $t = 35.03$; $p < 0.05$) and nursing has the least impact on the model ($B = 0.168$; $t = 20.76$; $p < 0.05$). The model's final expression is as follows:

$$\begin{aligned} WHRI \;=\; & 0.035 + (0.205 \times Medicine) + (0.194 \times Nutrition) \\ & + (0.179 \times Physical\ Education) + (0.168 \times Nursing) + (0.166 \\ & \times Dentistry) \end{aligned} \quad (1)$$

After analyzing the robustness of WHAM, its economic sustainability was assessed using the WELLCAST ROI™ tool. For the analyzed time period and based on the *NPV* of USD 23,363.29/per worker, the *IRR* of 85.5%, and the *CB* of 1.85:1, the S-ROI was determined, suggesting that WHAM is economically sustainable.

5. Discussion

Given its complexity, the field of healthcare requires the mobilization of specialists from different areas, with the aim of promoting comprehensive and integrated care for workers. Based on an approach aimed at changing behaviors and adopting healthier lifestyles, going beyond the mere medicalization or treatment of diseases, the interdisciplinary care on which the WHAM model is based resulted in the data presented in Table 2. In view of the most prevalent diagnoses identified for each of the integrated dimensions, an intervention was generated that promotes worker autonomy and the maintenance of healthy lifestyles and behaviors, such as physical activity, healthy eating, non-consumption of alcohol and tobacco, good oral hygiene, balanced social and environmental relations, and decent work habits [55]. At this level, hypertension or diabetes mellitus diagnosis is highlighted, suggesting healthy behaviors or healthier eating habits interventions. As Eng and collaborators [59] state, the workplace is a key space for guidance around healthy behaviors and the reduction of non-communicable diseases (NCDs), such as diabetes mellitus and arterial hypertension. Viterbo and co-authors [23] report that long-term interdisciplinary practice has had very positive and significant effects on reducing NCDs. Hochart and Lang [60] also mention in their study that the implementation of a comprehensive care program in the workplace with the aim of modifying health risk behaviors resulted in a decrease in workers in the high and medium risk ranges and in the maintenance of health for those that were in the low risk range. The same is true for the issue of oral health, a problem that is related to other serious

diseases [61,62], and which is solved through the implementation of regular programs for the adoption of oral hygiene behavior among workers, as reported by Viterbo and collaborators [63]. Supporting these results, and in order to reinforce the importance of an integral look at workers' health, Table 3 presents the results between the behaviors (modifiable factors) and the results for workers' health. An overview of these results makes the connections between behaviors and health outcomes even more evident, as well as between the results themselves. In this case, an individual look at a worker would not allow one to understand them as a whole, contributing to fragmentation. Certain associations exemplify this idea, namely between the level of food knowledge and the type of food, identified by the energy balance intake, altered blood glucose, and diabetes mellitus. A similar relationship was identified in a review by Sami and co-authors [64], in which guidance towards healthier eating practices reduced the level of diabetes and prevented associated complications. The study by Holynska and colleagues [65] showed that the level of food knowledge is effectively related to nutrient intake, as this study also demonstrated. In line with this, Breen et al. [66] argued that the level of food knowledge enhances the choice of food, thus optimizing the quality of life of people with diabetes.

Table 4 shows the results of the indicators that are most correlated with the risk of each analyzed dimension, making it possible to identify those that contribute most to the increased risk in that dimension. The strongest correlation belongs to the field of dentistry, more specifically for oral lesions increasing the health risk of these workers. According to Warnakulasuriya et al. [67], conducting screening programs using valid visual inspection method to detect potentially malignant oral disorders within a workplace is not only feasible, but also effective. In terms of physical activity, the indicator that has the strongest correlation is that of the contemplation stage for physical activity; that is, the predisposition to start a physical activity. In the review by Jirathananuwat and Pongpirul [68], the 48 studies analyzed demonstrated that the workplace can play an important role in promoting regular physical activity among workers. Ergonomic risks in the workplace are, in this context, assumed to be the most correlated with risk in the field of nursing. This has been documented in several studies, namely by Skovlund et al. [69] and Welch et al. [70]. Since workers spend long hours of their day at the workplace, an additional concern regarding workplace ergonomics must be considered, as correct adaptation will result not only in promoting the well-being of workers, but also in reducing medical costs for employers, as reported by Munir et al. [45], Gao et al. [47], and Welch et al. [70]. In terms of pathologies, diabetes mellitus is the indicator that most contributes to risk in the dimension of medicine. In the reviews by Hafez [71] and Gan [72], the workplace is an important space for effective reduction of diabetes mellitus.

Implications for Workplace

Some of the results in this study will have a direct implication in the workplace context, thus a more detailed specific analysis is necessary. The results regarding the WHAM robustness (Table 5) make it clear that the combination of technical and scientific knowledge in the work context results in a better understanding of the workers' global health. This result makes it possible to effectively verify that the interdisciplinary approach translates into gains in health, and that it must be adopted as a matrix in all work contexts, particularly those referring to a higher exposure risk and greater number of employees, as already identified in the studies by Viterbo et al. [23], Clark et al. [73], and Costa et al. [74].

Considering that health promotion and prevention actions can influence the health habits and behaviors of workers, they can also reduce health costs. The literature review [38,75–77] suggests that programs based on behavior change theory and using personalized communication and individualized counselling for high-risk individuals are likely to produce a positive return on the amount invested in these programs. The assessment of S-ROI in the specific model under investigation (WHAM) corroborates other studies carried out in the workplace [41,44,45,47], showing positive financial results and reinforcing the advantages of applying WHAM, which in addition to directing investment in health strategies that are proven to be a priority, enables the optimization of financial resources, resulting in

an S-ROI of 85.5% for interdisciplinary, integral, and integrated interventions for the community of workers with a high risk level.

6. Conclusions

The search for a healthcare model for workers that is oriented towards integrated care, expanded health needs, economic sustainability, and which overcomes the problems arising from the hegemony of the biomedicine paradigm, such as the excessive use of technologies and focus on curative actions of diseases, is one of the great challenges of the Brazilian health system today. This scenario is strongly present in Brazilian scientific production and is reflected in national and international policies through legislation and public initiative.

The results obtained with the practical application of WHAM in the oil industry in Bahia, Brazil, demonstrated the potential of the model, where the articulated and hierarchical management of the various indicators of workers' health makes it possible to direct practices aimed at the cause and not at the effect or symptom. At the individual level, the model presented an interdisciplinary diagnosis of the health conditions of each worker, correlating the modifiable health factors and their respective impacts. The presentation of information to individuals promoted autonomy and empowered workers to change behaviors that negatively interfere with health conditions. At the collective level, the application of the model demonstrated the correlation between health indicators and interdisciplinary risk in the studied context, encouraging the creation of strategies aimed at the most critical conditions, as well as the design of preventive interventions. The robustness of the model highlights this same potential, in addition to the related optimization of financial resources of 85.5% for interdisciplinary interventions.

The absence of a similar model in occupational health is a limitation of this study since comparative analyses in the context of this work are not possible. The application of WHAM in different healthcare contexts is suggested in future studies, as well as carrying out analyses of the model's effectiveness by comparing the population's epidemiological results and studying the S-ROI.

The different theoretical contributions to the theme of this study, as well as the results found, lead to the understanding that WHAM can be considered as a model capable of encompassing the complexity of the field of occupational health, considering the interdisciplinary approach, risk management, and comprehensive and integrated care, in addition to accounting for economic sustainability for companies investing in healthcare.

Supplementary Materials: The following are available online at http://www.mdpi.com/1660-4601/17/9/3143/s1, Word S1: Guidelines for Implementing the Workers' Healthcare Assistance Model (WHAM).

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CAPÍTULO V – IMPLEMENTAÇÃO DE UMA ABORDAGEM INTERDISCIPLINAR PARA PROMOÇÃO DA SAÚDE DOS TRABALHADORES NA INDÚSTRIA DO PETRÓLEO, BRASIL (2006–2015)[5]

Este capítulo procurou responder ao último objetivo secundário delineado para o desenvolvimento da tese. Apresenta-se os resultados de um estudo longitudinal retrospectivo que pretende demonstrar a efetividade de práticas interdisciplinares em ST a partir do cuidado integral e integrado.

No artigo, a primeira autora participou na conceptualização, desenvolvimento da metodologia, da validação, da investigação, da recolha e análise de dados e na escrita do manuscrito.

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Implementation of an Interdisciplinary Approach to Promote Workers Global Health Status in the Oil Industry, Brazil (2006–2015)

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Abstract: This study intends to analyse the behaviour of epidemiological variables of workers in an oil industry of Bahia, Brazil, before and after implementation of interdisciplinary practices in occupational health assessments between 2006 and 2015. This is a retrospective longitudinal study carried out in two time periods. Data were collected from the workers electronic medical record and time trends were analysed before (2006–2010) and after (2011–2015) the implementation of the interdisciplinary practices focusing on health promotion. The data were complementarily compared to a control group from the same industry. A statistically significant reduction for data on the number of smokers, periodontal disease and of days away from work was obtained. A significant increase in the number of physically active subjects was also observed. While not statistically significant, a reduction in the number of workers with obesity and overweight, with caries and altered glycemia, was identified. Coronary risk and high blood pressure indicators have shown aggravation. It can be concluded that an interdisciplinary health approach during the annual occupational assessments, with action directed to the population needs, can be associated with the improvement of the health indicators assessed, contributing to increased worker productivity in the oil industry.

Keywords: worker's health; interdisciplinary communication; chronic noncommunicable diseases (CNCDs); health promotion; oil industry

1. Introduction

Chronic noncommunicable diseases (CNCDs) are one of the greatest public health problems today, responsible for 68% of the world's deaths in 2012 [1], and for 68.3% of deaths in Brazil in 2011 [2]. The Global Action Plan for the Prevention and Control of NCDs 2013–2020 [3] from the World Health Organization (WHO) establishes some priority goals for improving the health status of the population, including reducing the prevalence of smokers, increasing prevalence of physically active persons, reducing the relative coronary risk, periodontal disease, caries, as well as controlling high blood pressure, diabetes, overweight and obesity. The Strategic Action Plan for Coping with CNCDs in Brazil from 2011 to 2022 is based on three main guidelines: (i) Surveillance, information, assessment and monitoring; (ii) health promotion; and (iii) integral care [4], ratifying the need to develop health strategies that are capable of embracing health complexity. Accordingly, the promotion of global health should be understood as a mechanism that works only with an interdisciplinary and integrated effort, aimed at an aggregating knowledge of several scientific fields that dialogue for holistic health [5]. In

the context of work, CNCDs impact on the reduction of labour force participation, the number of hours worked, greater job rotation and early retirements, as well as the commitment of salaries, gains and achieved position. Estimates for Brazil suggest that the loss of labour productivity and the decrease in family income resulting from only three CNCDs, i.e., diabetes, heart disease and stroke, led to a loss in the Brazilian economy of 4.18 billion US dollars (USD) between 2006 and 2015 [6,7].

CNCDs are the main sources of disease burden in Brazil, and important policies for prevention and control have been implemented [7]. The Brazilian Ministry of Health [8] organized the surveillance of CNCDs aiming to respond to the scenario of growth of these pathologies in the country. This surveillance consists in a set of actions and processes allowing to know the occurrence, magnitude and distribution of the CNCDs and its main risk factors in Brazil, as well as to identify its economic, social and environmental determinants. In addition, one of the initiatives of the CNCDs surveillance aims to characterize the CNCDs time trend. These actions are essential for the planning, monitoring and evaluation of the activities of integral care and of the public policies of prevention and control of CNCDs in Brazil. The three essential components of CNCDs surveillance are: (a) Monitoring of risk factors; (b) monitoring the morbidity and mortality of CNCDs; and (c) monitoring and evaluation of health assistance and promotion actions to combat CNCDs.

The monitoring of the prevalence of CNCDs risk factors, especially those of a behavioural nature, i.e., diet, sedentary lifestyle, or chemical dependence on tobacco, alcohol and other drugs, whose scientific evidences of association with chronic diseases are proven, is one of the most important actions of surveillance [9]. The Brazilian Ministry of Health periodically invests in two important national health surveys for this purpose: National Health Survey (NHS) [10] and Surveillance of Risk Factors and Protection for Chronic Diseases by Telephone Inquiry (Vigitel) [1]. Numerous health programs and actions in Brazil converge towards the same CNCDs control objective. The Brazilian National Health Promotion Policy (PNPS) sustains that the interdisciplinary effort results in the prevention of acute and chronic diseases situations, as well as in the reduction of possible state health expenditures [11]. The Brazilian National Food and Nutrition Policy (PNAN) [12] reports that adequate food consumption and the consequent improvement of the nutritional status of citizens has a direct impact on the prevention and control of CNCDs. The Brazilian National Program to Combat Tobacco (PNCT) [13,14] is part of the solid multisectoral tobacco control policy and aims to reduce the prevalence of smokers and the consequent morbidity and mortality related to the consumption of tobacco products in Brazil [15]. The Brazilian National Oral Health Policy (PNSB) [16] aims to control oral diseases such as caries and periodontal disease, assuming that the performance of the oral health professionals should not be limited exclusively to the biological field or technical, i.e., dental, work, extending its interdisciplinary practices through education and prevention, distribution of hygiene kits, caries treatment, application of fluoride, extraction and restorations. The National Program for the Promotion of Physical Activity, "Agita Brasil" [17,18], is an initiative of the Brazilian Ministry of Health that aims to increase the knowledge of the population about the benefits of physical activity, drawing attention to its importance as a predominant factor of health protection, in order to involve citizens in the practice of such activities. In articulation with the scientific societies, i.e., Cardiology, Diabetes, Hypertension and Nephrology societies, the Brazilian Ministry of Health [19] presented the Plan for Reorganization of Attention to Hypertension and Diabetes Mellitus with the purpose of linking the patients with these diseases to the health units, guaranteeing follow-up and systematic treatment, through professionals' training of and services reorganization. In addition to being aligned with the Global Action Plan for the Prevention and Control of NCDs 2013–2020 [3], the above-mentioned Brazilian programs have in common the character of prevention, health promotion and intersectoral actions.

The challenges for facing CNCDs in Brazil are significant and for that purpose, the articulation of actions is of fundamental importance both in the public and private sectors. Despite its rapid growth, the impact of CNCDs can be reversed through broad and cost-effective health promotion interventions to reduce the risk factors, as well as improved health care, early detection and timely treatment [20].

The Brazilian public policies have been effective in meeting the goals of the Strategic Action Plan for Coping with CNCDs in Brazil from 2011–2022 [4,21–23]. They comprise policies such as the integration and the articulation of the different sectors, organs and institutions for the construction of guidelines on CNCDs, actions in the scope of regulation of hypercaloric foods and advertisements, encouraging family farming to plant food, creation of conditioning environments for healthy living habits, agility in implementing tobacco-free environments throughout the country, and use of information as a management tool. With respect to achieving the goal of reducing the prevalence of smoking by 30% by 2022, a reduction up to 28% was already reached in 2017 and for the goal of increasing the prevalence of free-time physical activity by 10% in 2017, 23% in 2017 has already been achieved. However, the actions to curb the growth of obesity in adults need to be revised, since there was a growth up to 2017 of 25% in Brazil.

In the current scenario of transformative health care, it is imperative that health professionals focus on care that is centred on the need of each individual in an integrated way [24]. Thus, the process of interdisciplinary work in health teams, emerging and increasingly urgent, has been supported by innovative policies, practices and care models that bring professionals and patients closer to the limits of traditional disciplinarity [25]. In this context, interprofessional education is understood as a practice of achieving interdisciplinarity as members of more than one care profession are allowed to learn together and in an interactive way, in order to improve interprofessional collaboration or the health and the well-being of patients [26]. Interprofessional collaboration has been associated with a number of positive outcomes, including improvements in patient safety and case management, optimized use of the skills of each health care team member, and provision of improved health services, identified as crucial to provision of effective and efficient health care when considering the complexity of individuals' health needs [27]. A study conducted in Mexico by Barceló et al. [28] in 2010 identified, in some cases, improvement in glycaemic control of groups submitted to follow-up by an interdisciplinary team composed of physicians, nurses, nutritionists and psychologists, compared to groups undergoing usual care. The proportion of people with good glycaemic control (A1c < 7%) among those in the intervention group increased from 28%, before the intervention, to 39%, after the intervention. Overall, the proportion of patients achieving three or more quality improvement goals increased more than four-fold between the intervention group, from 16.6% to 69.7% ($p < 0.01$), while among the usual care group if decreased from 12.4% to 5.9% ($p = 0.12$), although not statistically significant. According to the need of interprofessional collaboration, the field of worker's health has, since its emergence, a great potential for disciplinary integration in order to try to organize care in a more comprehensive way, translated into factors of influence on the worker's health, difficult to achieve by the disciplines alone [29]. Occupational health assessments are essential in the examination of the health conditions of the worker and in the preservation of health by the development of the day to day work. In addition, it is the opportunity to assess the worker's overall health, including the risk factors for CNCDs. According to the Regulatory Norm (NR) 7 [30], workers should be examined annually in the periodic assessment. However, this timeframe interval may be long for an adequate monitoring of the risks to the workers' health. The implementation of a management policy for the risk factors of the CNCDs in a company enables the improvement of health, productivity and quality of life for all workers [6].

The main objective of this study is to describe the behaviour of epidemiological variables of a population of workers of an oil industry in Bahia, Brazil, before and after implementation of interdisciplinary health practices focusing on health promotion, carried out during annual occupational health assessments.

2. Materials and Methods

2.1. Data Collection Procedures

This longitudinal retrospective study was developed with data collected from two periods: a first one referring to the years prior to the application of the interdisciplinary health assessment, from 2006

to 2010, and a second one, during its effective application, between 2011 and 2015. The subjects were assessed at the facilities of the occupational health service of an oil industry in Bahia, Brazil, during occupational annual assessments, in appropriate places, by health professionals with experience in the specific work area. In the period from 2006 to 2010, workers attended the oil industry's occupational health service to perform care with professionals in the areas of medical and dental dentistry and, between 2011 and 2015 assessments with nutritionists, nurses, preventive dentistry and physical educators were included. Data with the information requested by the researchers were obtained from the oil industry, subsequently treated to standardize the variable names. A randomly generated code was created in order to guarantee the anonymity of the study participants.

2.2. Study Population

The total population of workers was recruited at the occupational health service of an oil industry in Bahia, Brazil, and had, on average, the participation of 1736 subjects, starting with 1752 in 2006 and ending with 1460 in 2015. It is important to emphasize that this is a convenience sample and that, each year, the study population differed in number and composition. However, this difference between the two periods is not statistically significant, not limiting the interpretation of the results to the total population over time, which is dynamic. In all the years under study, Brazilian men, married, aged between 51 and 60 years, with administrative work regime, residing in the capital state and with high school education, prevailed in the sample. Workers included in the occupational health service and with a direct employment relationship with the oil industry studied were excluded, as well as participants with cognitive limitations or psychiatric disorders which did not allow the correct filling of electronic records, as those who were away from work.

2.3. Measures

The workers were annually assessed by the occupational physicians, in compliance with NR 7 [30], of the Brazilian Ministry of Health, and by the dentists, in compliance with the oil industry's internal norm. During the study period, from 2006 to 2015, health aspects related to smoking (current smoker), activity level of the physically active (150 min of moderate physical activity during the week), relative coronary risk > 3 (difference between Assigned Risk and Average Risk > 3 – Framing Test), altered triglycerides (> 200 > 100 mg/dL), periodontal disease (Community Periodontal Index (CPI) ≥ 3), presence of caries, altered glycemia (fasting glycemia> 126 mg/dL), altered blood pressure (> 120/80 mm Hg), obesity (Body Mass index (BMI) > 30 kg/m^2), overweight (BMI > 25 kg/m^2) and days away from work, were evaluated.

In the period from 2011 to 2015, interdisciplinary health promotion strategies were implemented during the annual occupational assessment, including consultations with the physical educator, nutritionist, nurse and preventive dentistry, with the objective of expanding clinical and educational opportunities for workers and improving the control of CNCDs. Collaborative health professionals explored patient priorities, providing counselling, focusing in education, and assisting with self-management goals. The physical educator promoted a complete physical assessment, using the Jackson and Pollock's protocol of 7 folds [31], approaching aspects related to the habits of life in relation to the practice of physical activity, in order to identify what elements of the sedentary behaviour should be altered to improve the health results. Through the weekly food recall and use of educational food models, i.e., dishes, fruits, vegetables, meats, spoons, beverage cups, etc., the nutritionist focused his intervention on improving the subjects' food profile, seeking to interfere in terms of quality improvement and adequate caloric intake. The work nurse sought to stimulate the improvement of the self-care of workers with their health, as well as to expand healthy practices in the oil industry and within family environment, addressing aspects related to active leisure, level of influence of family relationships on the individual's health, Fagerström test for nicotine dependence [32], regular use of medications, among others. The work dentist began to act in a preventive manner, besides acting as an expert, through the inclusion of procedures such as tartarectomy, fluoride application,

assisted brushing and oral examination using the intraoral chamber, enabling the worker to visualize the oral cavity and to identify areas needing greater care. In an integrated and interdisciplinary way, all health professionals guided the subjects in their needs, defining actions aiming to improve their health conditions. In addition to the practices described, an articulated set of preventive and curative health and individual actions and services were established at the levels of complexity of the worker's health system in the oil industry, such as diet changes, creation of health promotion centres, brushstrokes, tobacco control support groups, and promotion of smoke-free environments, among several others. In summary, the test group was submitted to governmental actions, to the actions carried out by the oil industry and to the interdisciplinary strategies, which included the training of health professionals, broadening the perspective of approaching CNCDs from the perspective of health promotion and distancing from the disease by itself, aiming the self-management of chronic diseases, focusing in the worker-centred care, with the possibility of discussing cases in the interdisciplinary context and with specific referrals for each health need and discussing and assessing the effectiveness of the implemented practices.

2.4. Data Analysis

Data analyses were performed using the IBM® SPSS® Statistics 25.0 [33] (IBM, Armonk, NY, USA), considering a significance level of 0.05 for all situations of statistical inference. Descriptive statistics were calculated to characterize the continuous quantitative variables of the study, referring to risk factors and protection for chronic diseases. The oil industry workers in Brazil, excluding those in Bahia, were used as the control group for the data analysis and had, on average, the participation of 54,211 subjects, starting with 39,204 in 2006 and ending with 59,086 in 2015, a dynamic sample as already clarified.

The assessment of the impact of the health interdisciplinary practices was carried out at two levels with the application of inter and intragroup parametric tests. In the first level, the control group was compared with the test group before and after the health intervention through the Student's *t*-test for independent samples. In the second level, the control group was compared before and after the health intervention, as well as the test group was compared before and after the health intervention through the Student's *t*-test for paired samples. In order to complement the comparison of the means, the percentage variation of each indicator was calculated in the two groups, between the first year and the last year, respectively, 2006 and 2015. Once the first results of a health intervention project are analysed, it is important to know the trend (i.e., if indicators have been improved or, instead, were aggravated) of the health intervention in order to perceive if the changes that have been introduced lead to the initially defined goal of improving the overall health of the worker. Thus, a logarithmic prediction trend line was calculated in Excel 2016 [34] for the sample of the test group, and the results are presented for a scenario without health intervention and with health intervention.

2.5. Ethical Approval

In all stages of the study, the recommendations and guidelines of Resolution 466/2012 [35] of the Brazilian Ministry of Health on ethical aspects regulating research with human beings, approved by the Research Ethics Committee of the Bahia School of Medicine and Public Health and CAAE 84318218.2.0000.5544, were followed. The study included only a retrospective assessment of data available through an Institutional Database, and the analyses were performed as a part of the periodic epidemiological assessment on occupational health and safety risks. Personal data was restricted and was treated in order to guarantee the respect of privacy of the involved workers.

3. Results

For a reliable assessment and comparison of the results obtained with the health intervention program, it is necessary to have similar characteristics of the participants, although opting for a convenience sample. Accordingly, Table 1 shows the distribution by sex of the control and the test groups, and it was verified that despite the difference in the absolute value of the number of participants

between both groups, they are similar at the percentage level, in both male and female sexes, before and after the health intervention, allowing a real comparison of the data. It should be considered that, because the participants work in the oil industry, the male population (85.0–89.3%) will tend to be larger than the female population (10.7–14.9%), a predominantly male population occupation.

Table 1. Sample characterization by sex before and after the implementation of the health intervention program.

Stage	Year	Control Group			Test Group		
		Total (*N*)	Male (%)	Female (%)	Total (*N*)	Male (%)	Female (%)
Before Intervention (BI)	2006	39,204	87.7	12.3	1574	89.3	10.7
	2007	47,152	86.5	13.5	1727	88.9	11.1
	2008	49,140	86.2	13.8	1724	88.9	11.1
	2009	54,269	85.7	14.3	1792	88.9	11.1
	2010	54,537	85.8	14.2	1778	88.6	11.4
After Intervention (AF)	2011	56,645	85.7	14.3	1810	88.5	11.5
	2012	59,836	85.4	14.7	1831	88.7	11.3
	2013	61,492	85.1	14.9	1805	88.4	11.6
	2014	60,753	85.1	14.9	1784	88.5	11.5
	2015	59,086	85.0	14.9	1591	88.2	11.8

The first stage of this study consisted in calculating the descriptive statistics of the indicators so that an overall analysis of the indicators would be possible, specifically to understand in which stages they were before the health intervention program. Table 2 shows that the test group had a decline in the performance of all indicators, except for smokers (−0.6%), when compared to the control group.

Table 2. Indicators' descriptive statistics before and after the implementation of the health intervention program.

Indicator	Stage	Control Group		Test Group	
		Mean ± Std.	Min–Max	Mean ± Std.	Min–Max
Smokers (%)	BI	8.9 ± 0.01	7.4–10.9	8.3 ± 0.01	7.1–9.9
	AF	5.4 ± 0.01	4.3–6.8	4.9 ± 0.01	3.8–6.6
Physically Active (%)	BI	24.4 ± 0.03	21.5–27.6	23.6 ± 0.02	21.4–25.4
	AF	29.1 ± 0.01	28.0–30.2	31.0 ± 0.03	26.6–33.8
Coronary Risk (%)	BI	4.2 ± 0.00	4.1–4.3	5.8 ± 0.01	3.9–7.0
	AF	3.8 ± 0.01	3.2–4.3	6.0 ± 0.00	4.9–7.0
Periodontal Disease (%)	BI	5.3 ± 0.00	4.8–5.6	10.2 ± 0.01	8.1–11.5
	AF	3.6 ± 0.01	2.8–4.6	6.4 ± 0.02	4.0–9.1
Obesity and Overweight (%)	BI	69.2 ± 0.04	65.5–75.0	71.5 ± 0.02	69.5–74.7
	AF	65.2 ± 0.03	61.2–68.1	69.8 ± 0.04	63.6–72.9
Caries (%)	BI	0.9 ± 0.74	0.02–1.73	2.3 ± 2.16	0.02–4.89
	AF	1.6 ± 0.30	1.27–2.02	3.3 ± 1.41	1.79–5.35
High Blood Pressure (%)	BI	13.1 ± 0.69	12.3–13.9	19.8 ± 3.19	14.8–22.2
	AF	12.4 ± 1.07	11.2–13.7	20.4 ± 0.80	19.5–21.7
High Glycaemia (%)	BI	17.3 ± 0.77	16.1–18.0	22.7 ± 5.31	17.3–29.7
	AF	16.0 ± 1.74	13.5–17.5	22.1 ± 3.62	17.2–25.9
Days Away from Work (No)	BI	6.4 ± 0.48	5.85–6.83	8.2 ± 0.23	7.95–8.55
	AF	6.7 ± 0.16	6.51–6.83	6.7 ± 0.48	6.21–7.39

Note: (BI) Before Intervention; (AF) After Intervention.

As mentioned previously, the evaluation of the results of the health intervention in the test group was performed at two levels, inter and intragroup (Table 3). The three most worrying indicators in

the test group are the periodontal disease (10.2 ± 0.01%), high blood pressure (19.8 ± 3.19%) and high glycaemia (22.7 ± 5.31%), which are very high, when compared to the control group, respectively 5.3 ± 0.00, 13.1 ± 0.69 and 17.3 ± 0.77, between 2006 and 2015. These indicators require immediate intervention in global health, since when combined they can lead to the development of several serious chronic diseases.

Table 3. Mean comparison within and among control and test groups.

Indicators	Stage	Control Group (*Mean*)[a]	p^{1-2**}	Test Group (*Mean*)[b]	p^{3-4**}	Percent Variation (%) Control Group	Percent Variation (%) Test Group
Smokers	BI	**8.9**[1]	**0.00**	**8.3**[3]	**0.00**	−0.61	−0.60
	AF	5.4[2]		4.9[4]			
	BI	p^{a-b*}		0.22			
	AF			0.26			
Physically Active	BI	24.4[1]	**0.00**	23.6[3]	**0.00**	0.40	0.51
	AF	29.1[2]		31.0[4]			
	BI	p^{a-b*}		0.30			
	AF			0.10			
Coronary Risk	BI	4.2[1]	0.08	5.8[3]	0.45	−0.27	0.30
	AF	3.8[2]		6.0[4]			
	BI	p^{a-b*}		**0.02**			
	AF			**0.00**			
Periodontal Disease	BI	5.3[1]	**0.01**	10.2[3]	**0.02**	−0.42	−0.62
	AF	3.6[2]		6.4[4]			
	BI	p^{a-b*}		**0.00**			
	AF			**0.01**			
Obesity and Overweight	BI	69.2[1]	**0.02**	71.5[3]	0.20	−0.17	−0.07
	AF	65.2[2]		69.8[4]			
	BI	p^{a-b*}		0.13			
	AF			**0.03**			
Caries	BI	0.9[1]	**0.04**	2.3[3]	0.19	0.06	−0.50
	AF	1.6[2]		3.3[3]			
	BI	p^{a-b*}		0.10			
	AF			**0.01**			
High Blood Pressure	BI	13.1[1]	0.22	19.8[3]	0.37	−0.09	0.38
	AF	12.4[2]		20.4[3]			
	BI	p^{a-b*}		**0.00**			
	AF			**0.00**			
High Glycaemia	BI	17.3[1]	0.09	22.7[3]	0.38	−0.23	−0.35
	AF	16.0[2]		22.1[4]			
	BI	p^{a-b*}		**0.03**			
	AF			**0.00**			
Days Away from Work	BI	6.4[1]	0.18	8.2[3]	**0.00**	0.10	−0.27
	AF	6.7[2]		6.7[4]			
	BI	p^{a-b*}		**0.00**			
	AF			0.45			

Note: (BI) Before Intervention; (AF) After Intervention. Significant differences are presented in bold ($p<0.05$). [a] control group and [b] test group intergroup means comparison; [1]AI and [2] BI intragroup comparison (control group); [3]AI and [4]BI intragroup comparison (test group); *independent sample *t*-test; ** paired sample *t*-test.

The results in Table 4 show that, in the case of the test group smokers and physically active, the indicators follow a similar evolution to the one observed in the Brazilian data (i.e., the smokers decrease and the physically active increase in both cases). On the other hand, a reduction in the obesity and overweight (−0.07%), and also, in the high glycaemia (−0.35%) indicators were identified in the

test group. Relating to the same indicators, Brazilian data reveal an increase, respectively, of 1.28% and 0.23%. An increase in the high blood pressure indicator was identified both in test group and in the Brazilian data.

In order to synthesize the results presented in the Tables 3 and 4, Figure 1 presents the indicators of the test group, corresponding to a statistically significant difference after the health intervention.

Table 4. Percent variation comparison between the test group and the Brazilian workers (2006–2015).

Indicator (%)	Test Group	Brazil
Smokers	−0.60	−0.33
Physically Active	0.51	0.24
Obesity and Overweight	−0.07	1.28
High Blood Pressure	0.38	0.22
High Glycaemia	−0.35	0.23

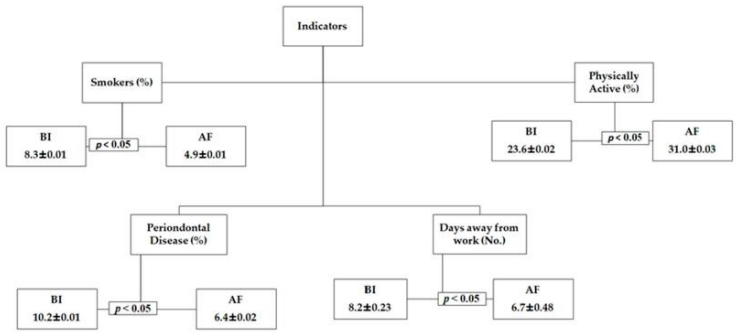

Figure 1. Group indicators corresponding to significant statistical differences after health intervention. Note: (BI) Before Intervention; (AF) After Intervention. Significant differences are presented in bold ($p < 0.05$).

Table 5 presents a comparative analysis of the prevalence of smoking, physically active and obesity among Brazilian workers, the control group and the test group, based on the goals of the Strategic Action Plan for Coping with CNCDs in Brazil from 2011 to 2022, planned by the Brazilian Ministry of Health [4].

Table 5. Comparative analysis based on the goals of the Strategic Action Plan for Coping with CNCDs in Brazil from 2011 to 2022. (Results with the best performance are in bold.)

Brazil CNCDsPlan Goals (2011–2022)	Baseline Value (2010)	Latest Result (2017)	Evolution	Group
Smoking prevalence reduction by 30 %	14.1	10.1	−28	Brazil
	7.4	3.5	−53	Control group
	7.1	3.1	**−56**	Test group
Increase in the prevalence of physical activity practice in free time by 10%	30.1	37	23	Brazil
	27.6	30.8	11	Control group
	25.4	38.1	**50**	Test group
Control of the increase in obesity in adults %	15.1	18.9	25	Brazil
	22.03	24.04	9	Control group
	24.33	24.61	**1**	Test group

The test group stands out in the evolution of the three analysed goals, showing an increase in the prevalence of physical activity in free time by 50% between 2010 and 2017, a percentage well above the proposed target defined in the Strategic Action Plan for Coping with CNCDs in Brazil from 2011 to 2022 [4] of 10% up to 2022. The same positive result can be observed in the control of obesity growth,

where both Brazil and the control group show a significant percentage of growth and the test group reaches the goal of stabilizing this health indicator. Regarding the goal of reducing smoking prevalence by 30%, the overall goal in Brazil (28%) and a significant advance for the test group were observed, reaching a reduction of 56%, also above the control group (53%).

Aiming to summarize the evolution trend of all health indicators, Table 6 presents the obtained results of the indicators in the test group, after health intervention.

Table 6. Test group indicators' assessment after health intervention (2006–2015).

Indicator	Polarity	Trend	Assessment
Smokers	–	↓	Improvement
Physically Active	+	↑	Improvement
Coronary Risk	–	↑	Aggravation
Periodontal Disease	–	↓	Improvement
Obesity and Overweight	–	↓	Improvement
Caries	–	↓	Improvement
High Blood Pressure	–	↑	Aggravation
High Glycaemia	–	↓	Improvement
Days Away from Work	–	↓	Improvement

Note: ↑ – increased; ↓ – decreased.

To each indicator a negative or positive polarity was attributed according to the impact on the worker's health, i.e., smoking has a negative polarity (–) due to its negative impacts on health and physical activity has a positive polarity (+) due to its positive impacts on health. An indicator trend was added to better understand the evolution direction, namely if increasing or decreasing, i.e., coronary risk had increased (↑) and caries had decreased (↓). Finally, an assessment was carried out aiming to identify which indicators had suffered improvement or aggravation since the beginning of the intervention, i.e., periodontal disease has a negative polarity (–) and its trend is to decrease (↓), which represents an improvement (Improvement). On the other hand, coronary risk has a negative polarity (–) and its trend is to increase (↑), representing an aggravation (Aggravation).

Table 6 shows that, in general, interdisciplinary health intervention in the global worker's health reveals positive results in seven of the nine indicators assessed, namely: decrease of the percentage of smokers, increase of the physically active, decrease of the periodontal disease rate, decrease in the percentage of obese people and overweight, decrease in the number of caries, decrease in the number of workers with high glycaemia and a decrease in the number of days away from work. The remaining indicators where no improvements were observed, namely coronary risk and high blood pressure, should be considered as priorities for subsequent health interventions.

Intending to present the results of the indicators in which no improvement was observed, a logarithmic prediction trend line—to a five year period—was calculated in two different scenarios for each indicator, with and without health intervention, Figure 2.

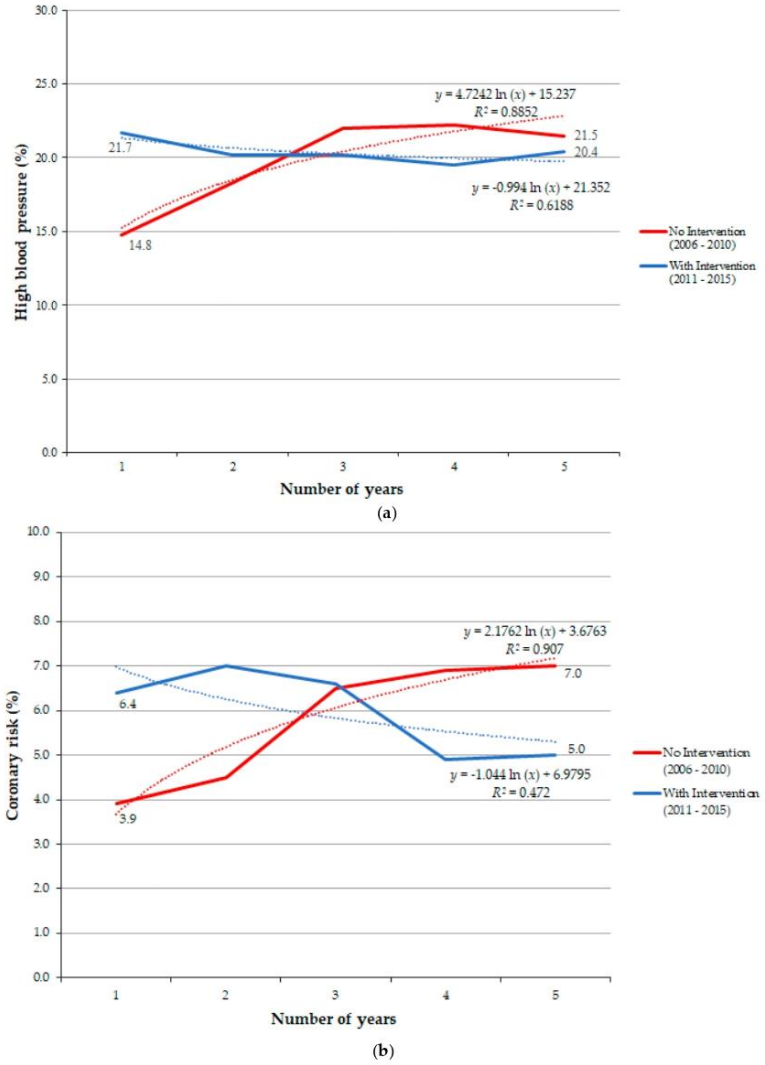

Figure 2. Prediction trend lines corresponding to indicators in which no improvements were observed (**a**) evolution of the high blood pressure indicator, (**b**) evolution of the coronary risk indicator.

The starting values in Figure 2 are different in the two prediction lines due to the fact they are based in the real baseline values of the two different moments: Before intervention and after intervention. The results show that although no significant differences were found in the two types of indicators, the scenario would be aggravated if interdisciplinary health intervention was not implemented.

4. Discussion

According to the Brazilian health targets to control CNCDs [4], the difference between the results in the different levels of interventions are accomplished: at a public level, through the public policies of prevention and control of CNCDs in Brazil, at a private level with broad actions of health promotion being carried out, i.e., corresponding to the control group, and at a private level with interdisciplinary interventions directed to the target population, i.e., corresponding to the test group. The positive results obtained in the test group must be emphasised, reinforcing the understanding that the interdisciplinary health practices have positively affected the global health of the studied population.

Table 2 shows that the test group presented a higher prevalence for diseases in the initial study period (2006–2010), except for the indicators of smoking and obesity and overweight, which were slightly aggravated in the control group. After the implementation of the interdisciplinary interventions (2011–2015), an improvement of the profile of the test group for all the health indicators, with exception of the coronary risk and high blood pressure indicators, is observed, which may be justified by sociodemographic aspects such as sex, age and race, as reported by Khera et al. [36], as well as cultural, whose context is very peculiar in Bahia, Brazil. The results of Table 3 reinforce the results present in Table 2 and report the improvements achieved by the test group in relation to the control group for all health indicators except coronary risk and high blood pressure. Regarding smoking, there was an equivalent reduction between both the test and the control groups, ranging from −0.61 to 0.60, without significant differences, this is explained by the fact that the Program to Combat Tobacco is interdisciplinary and applied in a similar way to both test and control groups. Tables 4 and 5 present the advances obtained in the test group in relation to the Brazilian population for all comparable indicators, except for blood pressure. One of the main objectives of the interdisciplinary intervention is not be to seek that the test group presents better results than the control group, but that the results of the test group approach those of the control group, thus representing a global improvement in the overall health profile of the workers test group.

The sedentary lifestyle causes about three million or 8% of all CNCDs due annual deaths in the world [6]. The benefits of an active lifestyle and the education of workers are essential for the promotion of physical activity and overcoming the barriers commonly reported for this practice, such as the lack of time and access to adequate spaces for the practice of exercise [37,38]. In the period under analysis (2006–2015), a growth of the physically active workers in the mean annual variation of 0.51% (Table 3) per year was observed in the test group, being above the growth variation of the physically active in the control group (0.40%), in accordance with the Brazilian population trend, which was 0.24% per year. These results show that it is possible to change behaviours that meet healthier lifestyles, able to be achieved through structured planning by an interdisciplinary team and centred in the individual. According to Lin (2014), the work context can and should function as an institution that promotes the overall health of the worker.

The obesity epidemic that affects the world, with the consequent increase in the prevalence of diabetes and hypertension, threatens the further reduction of CNCDs [7]. Obesity and overweight are associated with an increased risk of morbidity and mortality due to hypertension, dyslipidaemia, diabetes mellitus and cardiovascular diseases [39]. In this study, the test group presented a higher percentage of workers with obesity and overweight, when compared to the control group, and a more intense percentage variation in the level of overweight reduction after implementation of the interdisciplinary health interventions in the oil industry, whereas there was a growth in the variation of 1.28%in the Brazilian population.

According to Brazilian Ministry of Health [18], cardiovascular diseases are the main cause of morbidity and mortality in the Brazilian population. There is no single cause for these diseases, but several risk factors, which increase the probability of their occurrence. High blood pressure and diabetes mellitus represent two of the main risk factors, contributing decisively to the aggravation of this scenario at the national level [40]. In this study, it was observed that the test group presented a higher percentage of workers with high blood pressure compared to the control group (Table 3),

as well as an increase in the analysed period of 2006 to 2015, reinforcing the need for more specific health intervention actions for this specific population. With regard to altered glycaemia, a higher prevalence was observed in the test group, in addition to the more marked variation in the reduction of the percentage of workers in this group, in the order of −0.35%, whereas the control group varied in −0.23% and the Brazilian population in 0.23%. Although the results of the study for the high cardiovascular risk were not statistically significant, there was a stagnation of the data variation, which shows a control of cardiovascular risk behaviour, emphasizing the efficiency of the health practices implemented, namely at an interdisciplinary level. The study shows that cardiovascular risk and high blood pressure present better results after the interdisciplinary health intervention, indicating a tendency for improvement in both cases.

As a risk factor for the development of a number of chronic diseases related to cancer, lung diseases and cardiovascular diseases, smoking continues to lead the causes of avoidable global deaths in the world [41]. Brazil stands out in the implementation of tobacco control measures in the world, along with countries like Australia, Canada, Panama, Turkey and Uruguay [42] and the success of the Brazilian tobacco control policy between 1986 and 2016 is evidenced by the expressive reduction in the prevalence of smokers over those years [43]. The PNCT follows a model of interdisciplinary action involving physicians, nurses, psychologists, dentists, among others, in which educational, communication and health care actions [15], along with support for adoption or compliance with legislative and economic measures, are potentiated to prevent the initiation of smoking, especially among adolescents and young people, to promote smoking cessation and to protect the population from exposure to environmental tobacco smoke, also reducing the individual, social and environmental damage of tobacco products [9,44]. The PNCT has excellent results and in the study period of 2006 to 2015, the reduction of smokers in the mean annual variation of −0.60% per year in the test group is observed, above the variation of decrease of the Brazilian population, which was −0.33% per year [45], ratifying the importance of the targeted actions developed in the studied oil industry, and recommended in this study.

According to the Pan American Health Organization (PAHO) (2016) [46], in the last decade, scientific evidence of the connection between oral health and systemic disease has continued to grow, making oral health an important component of disease prevention in public health. Behavioural risk factors related to oral diseases are common to other major CNCDs, including an unhealthy diet rich in free sugars, smoking, and harmful alcohol consumption [47,48]. Periodontal disease, an infectious pathology with a multifactorial cause, affects the periodontal tissues and is related to diabetes [49], cardiovascular diseases [50] and stress [51]. In 2010, the prevalence of Brazilians with periodontal disease was 22.7%, in the age group of 35–74 years old, which is high when compared to the sample of this study, which presents a reduction of 4% (8% in 2006 for 4.2% in 2015), after the implementation of interdisciplinary health practices. The test group presents a higher percentage of workers with caries (0.9 ± 0.74%) compared to the control group (2.3 ± 2.16%), however it presents an average annual variation of −0.50% years, being more intense in the reduction of the disease in the studied period of 2006 to 2015, while there was an increase in the number of workers with caries in the control group in the range of 0.06% (Table 3).

The increase in the prevalence of cases of CNCDs in the oil industry can result in a reduction in productivity, absenteeism, disability, early retirement and increased expenses on the health system. The management of risk factors for CNCDs is essential to guarantee workers' overall health [52]. It was observed in this study that the test group presented a greater number of days away from work of workers when compared to the control group before the health intervention period of 2006 to 2010. After the health intervention, the test group was the only group that was able to reverse this trend, with a reduction of the number of days away from work in the range of −0.27% per year, oppositely to the control group, which increased by 0.10% per year (Table 3).

It is clear that a possible scenario without health intervention programs would aggravate performance in all studied health indicators, meaning that interdisciplinary health interventions have and will have very positive and relevant impacts in the short, medium and long term of worker's

health, and it is crucial to continue to invest in actions to assist the main objective, i.e., improving the well-being and the overall health of the worker.

This study is of great epidemiological importance since it deals with the database on workers of an important Brazilian oil industry, thus reflecting two scenes in the studied context universe. First, the national scene of skilled oil workers in the period of 2006 to 2015, typically reported by strata of national surveys, such as Vigitel [1]. Then, it also reflects the level of intervention of health and work technicians, including all professions or disciplines involved, reporting what changes were introduced in relation to the external universe so that the target public, i.e., the test group, is considered under the intervention of the team, besides the intervention that the population undergo in the same period.

It is important to deepen the research of the variables that did not correspond to significant statistical changes, aiming at a better understanding of the scenario such as race, sex, environmental, labour and cultural determinants under analysis. Another relevant aspect is the analysis of the technical and economic viability of the implementation of interdisciplinary health practices, essential in the socioeconomic context of Brazil. Studies of Mendes [53], Bielemann [54] and Djalalov [55] have demonstrated the importance of investing in health promotion.

5. Conclusions

During the period 2006 to 2015 under study there was a strong investment in public policies to control the CNCDs in Brazil. Changes were adopted by different domains of society either public or private institutions. In accordance to this, the oil industry incorporated company wide initiatives and allowed healthier life practices to be stimulated in the labour context, generating positive and improved health outcomes, when compared to the ones corresponding to the Brazilian population. The oil Worker Health Service studied in Bahia, Brazil, carried out specific health strategies, integrating interdisciplinary health interventions centred on the worker, which allow a personalized monitoring of individual needs of workers, something that Brazilian public policies are not able to accomplish. Reported positive results presented in this study are able to sustain the success of such initiatives. It is important to note that the main objective of this interdisciplinary health approach was achieved, namely the improvement of the test group health indicators, with exception of two interconnected indicators: coronary risk and high blood pressure, whose negative results are explained considering the workers sociodemographic profile. The logarithmic prediction trend lines indicate that, in the future, this type of interdisciplinary approach centred in the needs of workers will result in potential health gains, namely in the reduction of workers with coronary risk and high blood pressure, two of the main causes of death in the world.

The results in this study show that the interdisciplinary and integrated approach during occupational health assessments, aiming to satisfy the specific needs of oil workers, are associated with the improvement of the global health indicators, thus representing a positive outcome to this specific industry.

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DISCUSSÃO E CONCLUSÕES

Os capítulos apresentados traduzem o aprofundamento das temáticas abordadas ao longo desta investigação, assim como incluem a discussão detalhada dos resultados encontrados em cada caso. Dessa forma, aqui discutem-se aspectos destacados como relevantes a partir de uma visão integrada de todo o estudo. A Tabela 1 apresenta o resultado da análise teórica dos ODS, DSS e CGD, necessária para a definição dos indicadores de saúde e ambiente que foram considerados na proposição do modelo de gerenciamento de risco em ST, além dos sugeridos pelos especialistas envolvidos na elaboração e validação do IWHAI (**Viterbo**, Dinis, Costa, & Vidal, 2019). Observa-se que, dos 43 indicadores de saúde e ambiente que compõem o IWHAI, apenas 53% encontram correspondência com a CGD e ODS, e 49% com o DSS. Um destaque importante do IWHAI é que 35% dos indicadores foram mapeados a partir da experiência prática dos especialistas e, embora não estejam relacionados diretamente com os referenciais acima identificados, possuem referência na literatura internacional como fatores contributivos para a classificação de risco. A coleta sistematizada de informações fornece aos analistas de risco algumas orientações sobre como estruturar e resolver problemas com foco na avaliação de oportunidades para melhorar as decisões e os cientistas de decisão sugerem a necessidade de padronizar abordagens e desenvolver orientações prescritivas, semelhantes às diretrizes existentes para a realização de análises de custo-eficácia (Yokota & Thompson, 2004). Nesse contexto a aplicação do IWHAI possibilita, de forma inovadora, a coleta de informações em ST em nível interdisciplinar.

Tabela 1. Indicadores de saúde e ambiente baseados na análise teórica dos ODS, DSS e CGD.

Fatores	Indicadores de Saúde e Ambiente	CGD	ODS	DSS
Ambientais e Ocupacionais	Absenteísmo relacionado ao trabalho			
	Acidente de trabalho	✓	✓	✓
	Condições sanitárias do ambiente de trabalho		✓	✓
	Exposição a riscos ambientais (agentes físicos, químicos e biológicos)	✓	✓	✓
	Pragas e vetores	✓	✓	✓
	Qualidade da água potável	✓	✓	✓
	Qualidade do ar	✓	✓	✓
	Riscos ergonômicos - aspectos físicos	✓	✓	✓
	Riscos ergonômicos - aspectos organizacionais	✓	✓	✓
Comportamentais	Aptidão cardiorrespiratória			
	Aspectos sociais - lazer			✓
	Bruxismo			
	Condição periodontal			
	Estágio contemplação para prática de atividade física			
	Força de preensão manual			
	Ingestão de balanço energético	✓		✓
	Ingestão de carboidrato simples	✓		✓
	Ingestão de fibras	✓	✓	✓
	Ingestão de lipídios saturados	✓	✓	✓
	Ingestão de mineral sódio	✓	✓	✓
	Nível de atividade física	✓	✓	✓
	Nível de autocuidado			
	Nível de conhecimento alimentar			
	Nível de força abdominal			
	Nível de flexibilidade			
	Nível e sintomas de estresse		✓	
	Qualidade da higiene oral			
	Relações familiares			✓
	Uso de álcool	✓	✓	✓
	Uso do tabaco	✓	✓	✓
	Sensação de dor			
Metabólicos	Índice de massa corporal	✓	✓	
	Dislipidemia	✓	✓	
	Glicemia alterada	✓	✓	
	Pressão arterial alterada	✓	✓	
	Triglicerídeos		✓	
Pessoais	Cáries			
	Diabetes mellitus	✓	✓	✓
	Doença periodontal		✓	
	Hipertensão arterial	✓	✓	✓
	Lesão em tecidos moles ou duros			
	Patologia osteomuscular	✓		
	Patologia psiquiátrica	✓	✓	✓

O desafio subsequente da investigação foi o desenvolvimento de um método para gerenciamento do risco. O índice *WHRI* (**Viterbo** et al., 2020) foi elaborado e validado e determina o risco em ST através da combinação de variáveis inter-relacionadas que contribuem para a pontuação final a ser atribuída a cada indivíduo, representando, de forma numérica, o risco de cada trabalhador com precisão, o que confirma a acurácia dos cálculos. Após aplicação do *WHRI*, observou-se a possibilidade de distribuição dos valores individuais dos índices em faixas de riscos "baixo", "médio" e "alto e, consequentemente, a divisão das intervenções necessárias de saúde. Diante disto, surge o Modelo de Pirâmide de Riscos em ST, adaptado com base no MPR já existente e desenvolvido em Leeds (Department of Health, 2005), do Modelo de Atenção Crônica (MAC) (Mendes, 2011) e do Modelo dos Determinantes Sociais da Saúde (MDSS) (Ansari, Carson, Ackland, Vaughan, & Serraglio, 2003), conforme se apresenta na Figura 2.

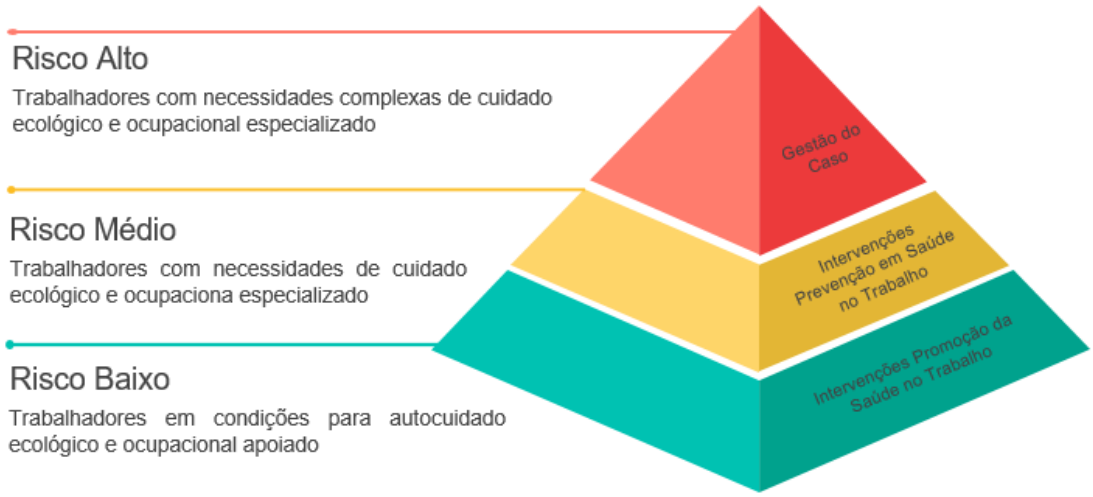

Figura 2. Modelo de Pirâmide de Riscos em Saúde do Trabalhador, adaptado do MPR (Department of Health, 2005), MAC (Mendes, 2011) e MDSS (Ansari, Carson, Ackland, Vaughan, & Serraglio, 2003).

Com uma amostra representativa do estudo, foi possível identificar que 74,3% da população estão na faixa de risco "baixo", 20,6% na faixa de risco "moderado" e 5,1% na faixa de risco "alto". Esses resultados estão de acordo com as MPR do Departamento

de Saúde de Leeds (Department of Health, 2005), que estratificam a população em três níveis relacionados à necessidade de assistência à saúde e definem que de 70 a 80% representa o nível 1 (pessoas em condições simples, que demandam intervenções de promoção da saúde), entre 20 e 30% representa o nível 2 (pessoas em condições complexas, que necessitam das ações de prevenção em saúde) e entre 1 e 5% representa o nível 3 (pessoas em condições altamente complexas, com necessidade de intervenção imediata em saúde), conforme afirmado por Mendes (2012). Esse resultado demonstra a capacidade da *WHRI* de otimizar os recursos da empresa através do diagnóstico completo e integrado da condição de saúde de cada indivíduo e da coletividade, possibilitando a construção de estratégias e intervenções em saúde direcionadas a cada público, conforme demonstrado por outros estudos, como os da *Association of American Medical Colleges* (LaPointe, 2018), bem como por instituições privadas como EY (2017), aumentando, assim, a efetividade da promoção e prevenção do cuidado ecológico e ocupacional.

Com base na Tabela 1, onde se identifica o impacto de cada dimensão dos fatores de riscos global dos trabalhadores, foi possível elaborar o Modelo de Influência dos Fatores de Riscos em ST, adaptado do MDSS conforme se apresenta na Figura 3, que demonstra a interligação entre os fatores pessoais, metabólicos, comportamentais, ambientais e ocupacionais e de que forma os mesmos se influenciam mutuamente. Num contexto de trabalho plural, em que a saúde e o ambiente em que o homem está inserido são avaliados, importa ressaltar que são vários os fatores que integram e impactam o seu estado global. Observou-se que os fatores pessoais, ainda que não modificáveis ou alteráveis, são altamente influenciadores dos fatores metabólicos e que, este segundo, são também influenciadores dos fatores comportamentais. Destaca-se aqui o peso dos fatores ambientais e ocupacionais, pois o trabalhador não é um ser isolado, integrando um ecossistema alargado, influenciando e sendo influenciado de diversas formas. Sendo assim a aplicação dos instrumentos propostos, nomeadamente o IWHAI, *WHRI*, WHAM, e a implementação de intervenções interdisciplinares direcionadas podem alterar comportamentos e ambientes de forma a conseguir melhorar os resultados em ST.

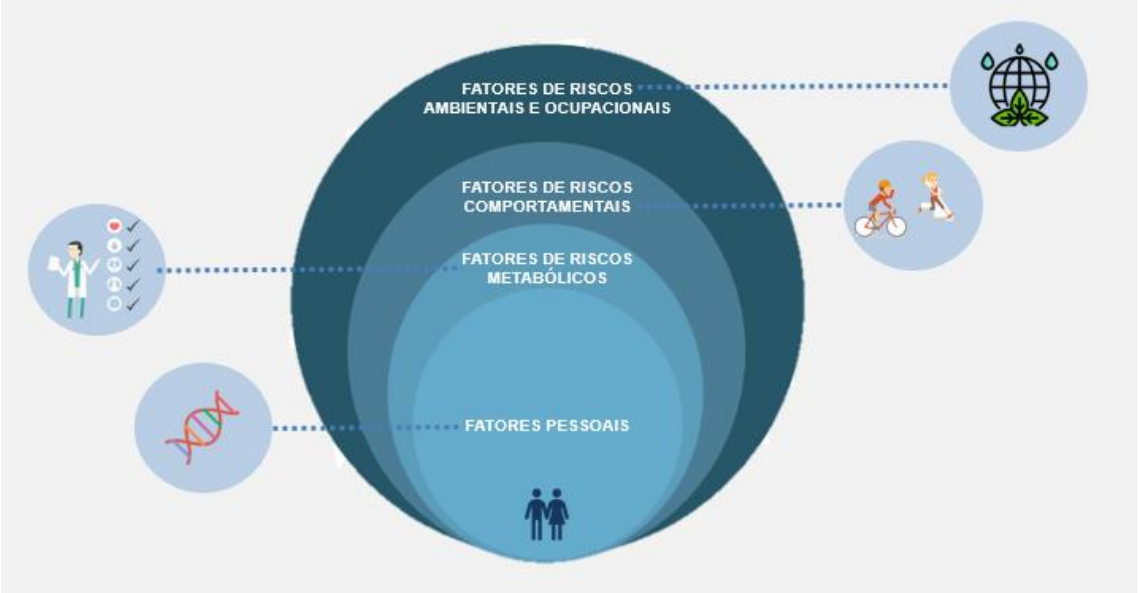

Figura 3. Modelo de influência dos fatores de riscos em saúde do trabalhador, adaptado do MDSS (Ansari, Carson, Ackland, Vaughan, & Serraglio, 2003).

As etapas apresentadas nos capítulos de I a III culminaram na proposta do capítulo IV da tese: o desenvolvimento de um modelo de gestão em saúde (WHAM). Cada uma das etapas foi importante, pois além de serem complementares, possibilitou uma auto validação das mesmas. Este modelo (WHAM) inovador revelou-se de grande impacto na melhoria da ST, na sustentabilidade econômica no contexto do trabalho e consequentemente na sua implicação na sociedade, especificamente no contexto da realidade da indústria petróleo no Brasil. Além da validação científica no capítulo V, o WHAM foi considerado *benchmark* pelo *Boston Consulting Group*, em 2018, que recomendou sua abrangência para toda a empresa petrolífera brasileira, que serviu de base ao estudo, como modelo de gestão em saúde capaz de demonstrar o cuidado com a vida e proteção dos trabalhadores, princípios considerados na Política de SMS da Companhia estudada e com significativo impacto da sua imagem na Bolsa de Valores.

Apesar do reconhecido valor do WHAM na gestão sustentável dos recursos econômicos em saúde e ambiente pelo empregador, importa referir que esse foi um dos objetivos, mas não o mais determinante neste trabalho. Na verdade, a promoção da qualidade de

vida e da saúde global dos trabalhadores, bem como a de um ambiente de trabalho saudável e digno, foram a força motriz, determinada pela necessidade ética de corresponder ganhos em saúde e ambiente para os envolvidos, especialmente para os trabalhadores. Acredita-se que esse objetivo prioritário, uma vez que envolve vidas humanas em articulação com o ambiente, foi cumprido. Destacam-se como as principais limitações para implantação do WHAM a necessidade de manutenção de uma equipe interdisciplinar nos serviços de ST, a existência de monitoramentos ambientais e de saúde mínimos, assim como a ausência de modelo semelhante em ST, uma vez que análises comparativas, no contexto desse trabalho, não são possíveis. Como linhas de investigação futuras, sugere-se a aplicação do WHAM em ambientes de trabalho diferentes da indústria do petróleo, visando à análise da reprodutibilidade do modelo e de sua eficácia através de estudos epidemiológicos da população ao longo do período e da avaliação da sustentabilidade econômica.

Com base no trabalho desenvolvido, considera-se que os objetivos desta tese de doutoramento foram alcançados e que os resultados indicam ser necessário avançar nos caminhos propostos pela ST para que sejam consolidadas novas práticas de *benchmarking* do ponto de vista científico e prático. A vigilância da ST deve ser efetuada de forma contínua e em função das exigências do trabalho e dos fatores de risco profissional a que um dado trabalhador se encontra exposto, devendo ainda ter em consideração a repercussão destes fatores na ST. Para além disto, conclui-se que o conhecimento e a detecção de mudanças nos fatores determinantes e condicionantes do meio ambiente que interferem na saúde humana, com a finalidade de identificar as medidas de prevenção e controle dos fatores de risco ambientais relacionados às doenças ou a outros agravos à saúde, são etapas determinantes na promoção de um ambiente saudável no contexto de trabalho, frequentemente negligenciados e necessariamente relevantes no contexto da ST, justificado toda a investigação desenvolvida no âmbito desta tese, traduzida no significativo acervo de publicações científicas produzido no espaço de tempo entre julho de 2017 e dezembro de 2020.

PRODUÇÃO CIENTÍFICA ADICIONAL

Apresenta-se em seguida uma coleção de vinte publicações que complementam a tese e que incluem artigos, capítulos de livros e comunicações em congressos com premiações. Os estudos estão relacionados ao aprofundamento de temas centrais da investigação, de particular relevância para o campo de ST, tais como gerenciamento de risco, saúde ambiental, vigilância em saúde, programas de promoção e prevenção em ST.

Tratam-se de pesquisas que contaram com a participação de equipe interdisciplinar de saúde e ambiente no trabalho, possibilitando a divulgação de conhecimentos em contexto de publicações indexadas SCOPUS e ou WOS, contribuindo para o reconhecimento da importância da partilha dos saberes envolvidos e da comunicação dos resultados a toda a comunidade científica, algo que o Brasil muito necessita, dada a importância do impacto das ações envolvendo a saúde e o ambiente junto aos trabalhadores, empresas e sociedade em geral.

DESENVOLVIMENTO DE UM INSTRUMENTO QUANTITATIVO PARA INSPEÇÃO SANITÁRIA EM SERVIÇOS DE ALIMENTAÇÃO E NUTRIÇÃO, BRASIL[6]

[6] **Viterbo**, L. M. F., Dinis, M. A. P., Sá, K. N., Marques, C. A. S. C., Navarro, M. V. T., & Leite, H. J. D. (2020). Desenvolvimento de um instrumento quantitativo para inspeção sanitária em serviços de alimentação e nutrição, Brasil. Ciência & Saúde Coletiva, 25(3), 805-816.

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Development of a quantitative health inspection instrument in food and nutrition services, Brazil

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Abstract *The study aimed to develop a Quantitative Health Inspection Instrument (IQIS) large-sized Brazilian food and nutrition services. The inspection technology based on the Potential Risk Assessment Model (MARP) and the Brazilian Health Legislation was used. Twelve dimensions, 41 modules, and 57 risk control (critical/non-critical) indicators were structured on a scale of 0-5, totalling 1,512 indices with closed-ended response coding. The IQIS was validated with the Kappa Coefficient, with excellent agreement for the attributes of clarity and relevance (k = 0.82 and k = 0.92) and good agreement for applicability (k = 0.78). The Kruskal-Wallis test showed no statistically significant difference between the assessments (p = 0.423), the Intraclass Correlation Coefficient was satisfactory (ICC = 0.53), and Cronbach's Alpha (α = 0.71) was acceptable. The final result made it possible to classify the service as having an unacceptable health risk. IQIS is considered to have validated content, be reliable and reproducible to assess the hygienic-sanitary conditions, being a technological innovation for food and nutrition services and sanitary, allowing a detailed and rigorous inspection.*

Key words *Sanitary Inspection, Sanitary Risk, Food Services, Validation Studies*

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Introduction

Foodborne diseases (FBD) are common and underreported in Brazil. The World Health Organization (WHO) estimates that one-third of the population will suffer from FBD annually, but only a small part will make the notification[1-3]. According to the Centers for Disease Control and Prevention (CDC), 48 million people fall ill each year from FBD in the U.S. In 2014, the CDC reported 864 outbreaks, resulting in 13,246 diseases, 712 hospitalizations and 21 deaths[4]. In Brazil, 11,241 outbreaks were recorded in the period 2000-2015. Of these, 218,507 people became ill, and 2,121,110 were exposed. Fifteen percent of the outbreaks were related to food consumed in restaurants and bakeries, and 8.2% with housing and work[5]. Food contamination can occur throughout the production chain, and risk management is a significant health control measure, which is essential to avoid it[6,7]. A considerable proportion of food outbreaks arise from the association between the consumption of food contaminated by improper handling and conservation or distribution[8,9].

Regulation of health risk in food services

The oldest technical health control regulation is the Codex Alimentarius, established by the United Nations Food and Agriculture Organization and the WHO[10]. In 1993, the Food Hygiene Committee of the Codex published a guide for the application of the Hazard Analysis and Critical Control Point (HACCP) system, whose application in Brazil is based on Ordinance Nº 1.428/1993[11,12] of the Ministry of Health. In Brazil, the publication of RDC Nº 216/2004 is a health control milestone, establishing minimal conditions for food and nutrition services, but without an inspection roadmap[13]. The Health Surveillance Center of the State Health Secretariat of São Paulo published Ordinance Nº CVS 5/2013[14], complementing the procedures of RDC Nº 216/2004, defining an inspection roadmap with statewide coverage.

The health inspection technology is highlighted as an instrument of risk management, assessing compliance with health legislation[7] throughout the food chain. The usual health inspection routines evaluate the services using dichotomous variables with compliant and non-compliant indicators, which show the level of compliance with the legislation, without judging the criticality of the analyzed items, such as the Roadmap for the Assessment of Hygienic-Sanitary Conditions in Food Services[15]. The Integrated Handbook for Prevention and Control of Foodborne Diseases[7], published by the Ministry of Health, provides for an inspection roadmap that defines a criterion for classifying indicators based on the relevance of individual risk regarding product quantity and safety and workers' safety. The School Feeding Good Practices Checklist[16] considers the consequence potential of each indicator. On May 10, 2013, the Ministry of Health approved Ordinance Nº 817/2013, with the national guidelines for the elaboration and implementation of the Food Service Categorization Pilot Project[17], implemented in the host cities of the 2014 FIFA World Cup, providing for the classification of the criticality of each indicator, health and safety consequences, level of association concerning outbreak-associated flaws, and weighting to establish values[18].

Technological innovation for large food services

Health surveillance has three sets of practices, with varying risk notions depending on the strategy. Health promotion actions aimed at group education aim at increasing the quality of health of the population and are unrelated to a specific risk factor. Risk or harm prevention actions act on specific factors, based on epidemiological risk, to reduce or eliminate new occurrences. Health protection actions seek to strengthen defenses. They address risk as possible harmful events to health[19]. Considering its dynamic nature, it is necessary to search for new technologies that consider the complex and cross-cutting nature of the processes and manage health risks[20]. All the health inspection guidelines found in the literature[15,16,18,21] are based on the probabilistic risk concept. The notion of risk concept, of great relevance in the area of health surveillance, was thus proposed[22] to cover the complexity of a risk concept.

The potential risk has two essential characteristics that differentiate it from the concept of classic risk, relating to the possibility and not to the probability of occurrence of the unexpected. A classical risk evaluation is based on events that have occurred, while the potential risk builds on those that are occurring and the effects that may or may not occur. The potential risk can be quantified and classified into levels of acceptability, and its operationalization enables the monitoring and comparison of several objects under health

surveillance control. In this context, the Potential Risk Assessment Model (MARP) was developed to gauge risk and its classification in the space of acceptability[19]. It classifies the potential risk into acceptable, tolerable and unacceptable through mathematical formalism. MARP's application is particularized from the risk control indicators, based on a defined acceptability scale classified into critical and non-critical[22] categories.

This study aimed at developing the IQIS for large food services based on the MARP and Brazilian legislation. The use of the potential risk concept evidenced advances in health risk management in related areas such as hemodialysis[20] and radiodiagnosis[22] services. Its application in food and nutrition services is a technological innovation, enabling risk anticipation and health protection.

Methods

This study was developed from October 2015 to May 2016, with the following steps: i) Elaboration of the instrument by sector health professionals; ii) IQIS evaluation concerning content validity through submission to the Expert Committee, as well as external validity and reliability for the performance of Pretest and Test, applied in large food and nutrition service in São Sebastião do Passé, Bahia, Brazil, which prepares 2,541 daily meals for workers: 276 breakfasts, 1,393 lunches, 243 dinners and 629 snacks. The Research Ethics Committee of the Bahia School of Medicine and Public Health approved the research. Figure 1 summarizes the IQIS development and validation process.

Elaboration of the IQIS

This stage counted on a group of seven professionals, of which two are doctors in public health and risk management researcher, two are ergonomists and managers in workers' health, two are nutritionist experts in public health and experience in collective nutrition, and one is a health surveillance expert working in the area of risk management. The literature review allowed the analysis of the existing instruments and methods, as well as the theoretical basis for the decision and elaboration of a new instrument. Following the identification of primary sources, review of secondary sources, critical reading and summary of the literature was performed using keywords or descriptors: risk, health risk, epidemiological risk, potential risk, health surveillance, health inspection, food health inspection, health inspection roadmap, health inspection in restaurants roadmap, industrial kitchen health inspection roadmap, health inspection validation, questionnaires, evaluation instruments, and elaboration and validation of instrument[21,23-28].

The IQIS is based on the MARP, whose mathematical formalism is detailed by Navarro[22], applied to food and nutrition services. This model proposes underlying processes according to the natural flow of the inspector. The main activities that are a potential risk for each of these processes are defined, as are the risk control indicators for each of these activities. Finally, each indicator is classified as critical (I_C) and non-critical (I_{NC}) and associated with an interval scale from zero to 5, where zero evidences nonexistent or inadequate risk control and five is excellent risk control, with the following classification: 0 – nonexistent or inadequate; 1 – insufficient; 2 – reasonable; 3 – good; 4 – very good and 5 – excellent.

The coding of closed-ended answers for each index of the scale was developed to reduce the subjectivity of the evaluator, with six possibilities for each indicator. The food production flow was used as a criterion to define the realms, which were broken down into activities, areas or equipment that generate potential risk, called modules. These developed into risk control indicators and were associated with indices with quantitative variables, coded in closed-ended responses. Fourteen eight-hour meetings were held with professionals, who employed RDC Nº 216/2004. The requirements to meet the resolution were considered in index 3 of each indicator, and the lower and upper grades were defined from the experience and literature researched.

A panel was developed with the professionals to classify indicators into critical and non-critical; these professionals used their knowledge for this task and, later, the table of the association of risk factors for the occurrence of outbreaks was elaborated by National Health Surveillance Agency specialists[18]. The panel was developed from three 8-hour meetings, in which each member expressed his opinion on the indicator in question, achieving the group's consensus.

IQIS validation

Many validity and reliability methods are mentioned in the research literature[29-32] and, concerning methodological conduction, we chose the definitions that establish validity as how

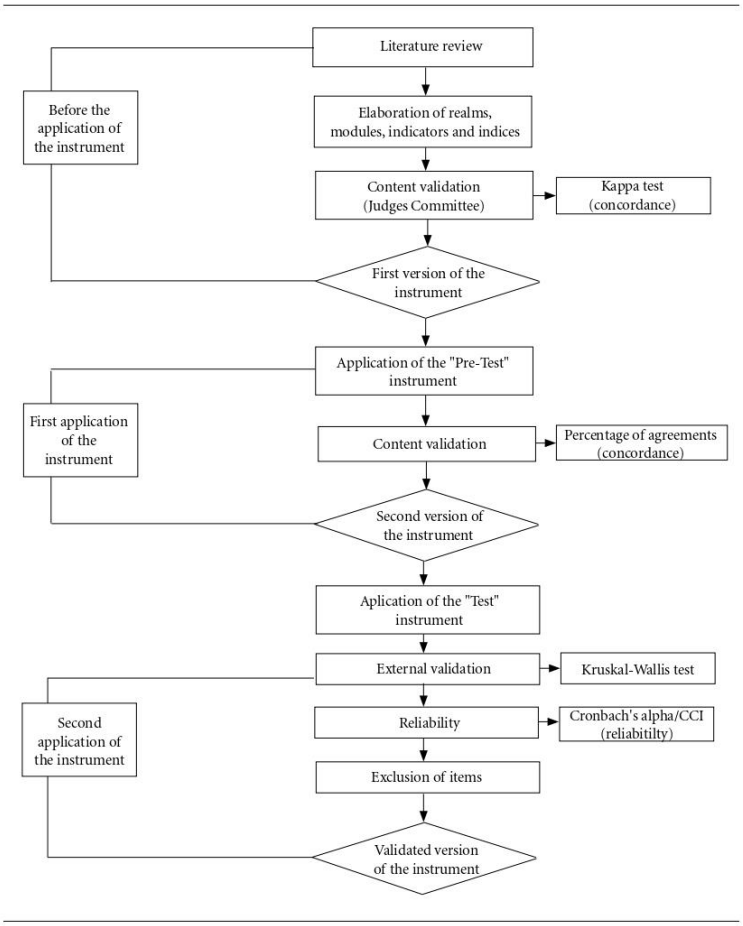

Figure 1. Flowchart of the process of elaboration and validation of the Health Inspection Quantitative Instrument (IQIS).

much a test measures what we wish to gauge and what reliability is related to the accuracy and precision of the measurement procedure[33].

A Judges' Committee was established to validate the content and consisted of three nutritionists, with average professional experience in the areas of food safety and health surveillance of 17 years; one worked as a teacher and two at the Regional Council of Nutritionists. One had a master's degree, and two had specialization in health surveillance. The first version of the IQIS was submitted to the Judges' Committee, along with the electronic spreadsheet for content evaluation, regarding the attributes of applicability, clarity, and

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relevance. Applicability was evaluated on a scale with four alternatives: 1 – fully agree, 2 – partially agree, 3 – no opinion, and 4 – disagree. Clarity was evaluated on a scale with three alternatives: 1 – high, 2 – fair and 3 – low, to verify whether the indicators were written intelligibly. Relevance was assessed on a scale with three alternatives: 1 – relevant, 2 – not relevant, and 3 – not applicable, noting if the items reflected the concepts involved and if they were adequate to achieve the proposed objectives. An eight-character code was created for each set of realm, module, indicator and index to organize the database generated in this stage. Experts gathered for two days in a quiet and uninterrupted environment, answered the 1,344 evaluations and were instructed not to exchange information with each other. The Kappa coefficient was used to analyze the results, considering $k > 0.80$-1.00 as excellent concordance; $k > 0.60$-0.79, good concordance; $k > 0.40$-0.59, moderate concordance; $k > 0.20$-0.39, poor concordance and $k > 0$-0.19, no concordance[34]. All results with a Kappa Coefficient above 0.60 were accepted, i.e. showing good concordance.

The Pretest checked whether all items were understandable to members of the target population. To that end, we invited five nutritionists, with a mean age of 42 years and an average of 14 years of experience in this area, all with specialization in health surveillance or related areas. The IQIS was applied on the same day, by direct observation for all the risk control indicators, except for the documentary ones, answered by interviews with the sector's managers, which was conducted over eight hours during the food service's administrative hours. The evaluators received the printed instrument and were instructed to assess the modules at the same time, as well as not to exchange information among themselves, to avoid influencing the answers. We used interobserver frequency statistical tests in the pre-test analysis, discussing the results in an interactive process between researchers and nutritionists to clarify controversial points. All items with a percentage of concordance less than 80% were analyzed to eliminate or adjust ambiguous indicators or indices or that carried value judgments. We assessed whether the concepts were drafted in a way that was comprehensible to what was expected to be measured and adequate for the proposed objectives. The documents and their modification proposals were analyzed and accepted, generating the second version of IQIS.

The test mainly aimed to evaluate the psychometric characteristics of the instrument. To this end, we invited seven nutritionists with a mean age of 38 years and an average of 11 years' food production experience. All of them had specialization in health surveillance or related areas, and applied the second version of IQIS in the same food and nutrition service of the pre-test, following the same previous conditions. The data were collected with the printed forms imported to the SPSS software version 24.0 to perform the analysis[35].

Statistical analysis

Data statistical treatment was performed through descriptive and exploratory analyses to investigate the accuracy of entries, the distribution of missing cases and the distribution of frequencies. The non-parametric analysis of variance was used to compare the percentages of the adequacy of hygienic-sanitary conditions of the food and nutrition service, employing the Kruskal-Wallis test and considering the significance level of 5% in all analyses[36]. The Intraclass Correlation Coefficient was applied to verify the reliability and usability of the instrument in other contexts using the same Test data, considering that in the case of $ICC \geq 0.75$, reliability should be considered excellent; an ICC of 0.40-0.75 shows satisfactory reliability; and an $ICC < 0.40$[37] reflects poor reliability. Finally, the Cronbach Alpha coefficient was calculated for each realm to verify the internal reliability, where $\alpha \geq 0.70$ values were considered acceptable and $\alpha \geq 0.80$[38,39] were highly reliable values.

Results

The IQIS was defined in its first version based on the requirements of RDC Nº 216/2004[13] and the production process flow. It contained 12 realms and 41 modules, spread into 76 risk control indicators and 1,344 indices associated with quantitative variables. Also, indicators and indices were associated with each realm and module to assess the respective health risk, resulting in 224 different verification items. Each realm-module-indicator-index combination features an IQIS item. Box 1 shows an example of an IQIS Verification Item.

The panel of experts initially ranked 42% of the 76 indicators as critical. After the Pre-test and evaluation of the concordance rate, 57 indicators were redefined and evaluated in light of the risk factors table for the event of outbreak[18]. The Kap-

Box 1. Example of an IQIS Verification Item.

Realm	Module	Risk Control Indicator	Indexes	
Food handlers	Cooking	Hand hygiene	0	Handling workers do not perform hand washing and antisepsis (hygienization) or do not have exclusive lavatory, strategically placed against the food preparation flow.
			1	Handling workers do not use antiseptic odorless liquid soap or odorless liquid soap and antiseptic or non-recycled paper towels or other hygienic and safe hand drying system or dispose of in a paper collector without rational odoon or does not perform frequent, adequate hygiene.
			2	Proper hand hygiene, but no poster is available for guidance on hand washing and antisepsis.
			3	Performing hand hygiene in an exclusive washbasin, strategically placed against the food preparation flow, with adequate frequency (when arriving at work, before and after handling food, after service interruption, after touching contaminated materials, after using restrooms), and when necessary, with antiseptic odorless liquid soap or odorless liquid soap and antiseptic product, using non-recycled paper towels or other hygienic and safe hand drying system, and disposing of in a non-hand-activA A posteror. Poster is affixed and available for guidance on hand washing and antisepsis.
			4	Same previous condition without hand-activations (faucet and paper towel holder).
			5	Same previous condition, with frequent, systematized hand washing every 60 minutes.

pa Coefficient was used to validate the content. The IQIS items were evaluated for applicability, clarity and relevance, and results showed that the instrument has a high interobserver concordance, as per Table 1.

The applicability attribute obtained 78% of the option *I fully agree* in the response of the judges. Clarity was evaluated as high, obtaining 85% of the answers. The relevance attribute achieved the option *relevant* with 91% of the answers. The IQIS was considered validated with an excellent agreement for the attributes of clarity and relevance, with $k = 0.82$ and $k = 0.92$, respectively, and good agreement for the applicability attribute, with $k = 0.78$. Suggestions to change the index texts (30%) were analyzed and accepted and gave rise to the second version of IQIS, adjusted to the opinion of the Committee. The results of the application were analyzed as to the rate of agreement between them. Of the 224 responses of each evaluator, 115 had an agreement of less than 80%, which were reevaluated by the researchers and adjusted, giving rise to the second version. Following content validation, the IQIS was restructured with 12 realms, 41 modules, 57 indicators (30 critical and 27 non-critical), 252 items and 1,512 indices.

The Kruskal-Wallis test was applied to the data resulting from the evaluation of the seven nutritionists in the Test and showed no statistically significant difference ($p = 0,423$) between the evaluations obtained for both the instrument as a whole and its realms. The items were evaluated according to the risk for the maintenance of hygienic-sanitary quality, classified in the 12 realms, as shown in Table 2.

When calculating the proportion of adequate hygienic-sanitary conditions of the food service and of each realm, we observed that the IQIS instrument allowed us to identify the items that required correction in order to comply with the legal requirements, since there was agreement on the answers indicated. There was no statistically significant difference between the evaluations of nutritionists by the Kruskal-Wallis test, showing that the instrument is reliable and reproducible. Using the same database, the statistical analyses of the Cronbach Alpha and the Intraclass Cor-

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Table 1. Interobserver coefficient of concordance – Judges' Committee – Salvador, 2016.

Realms	Total of items	Applicability		Clarity		Relevance	
		N1	Kappa	*N2*	Kappa	*N3*	Kappa
I. Building, facilities, equipment, furniture and utensils	150	120	0.80	138	0.92	141	0.94
II. Hygiene of facilities, equipment, furniture and utensils	354	269	0.76	280	0.79	326	0.92
III. Integrated vector and urban pest control	06	04	0.67	04	0.67	06	1.00
IV. Water supply	24	14	0.56	22	0.94	24	1.00
V. Waste management	90	85	0.94	89	0.99	86	0.95
VI. Food handlers	186	166	0.89	167	0.90	180	0.97
VII. Raw mingredients gredients and packaging	276	204	0.74	237	0.86	229	0.83
VIII. Food preparation	78	65	0.83	64	0.82	78	1.00
XI. Storage and transport of prepared food	42	38	0.9	38	0.9	42	1.00
X. Exposure to the consumption of prepared food	102	64	0.63	79	0.77	84	0.82
XI. Documentation and registration	24	14	0.60	20	0.83	23	0.97
XII. Accountability	12	04	0.33	05	0.44	07	0.61
Total Items	1,344	1,047		1,143		1,226	
Mean			0.72		0.82		0.92
%		78%		85%		91%	

N1 = Number of items with the agreement of the experts in the criterion of high applicability; *N2* = Number of items with the agreement of the experts in the criteria of high clarity; *N3* = Number of items with the agreement of the experts in the criterion high relevance.

relation Coefficient by realm were performed to verify IQIS' reliability, which evidenced acceptable reliability. The Kruskal-Wallis test showed that there was no statistically significant difference between the evaluations ($p = 0.423$), the Intraclass Correlation Coefficient was satisfactory ($ICC = 0.53$), and the Cronbach's Alpha was considered acceptable ($\alpha = 0.71$).

The Test's database was used, and the mathematical formalism of the MARP was applied to each realm of the IQIS to evaluate the potential risk range of the food and nutrition service. The rates of compliance were analyzed to evaluate its effectiveness, in which the responses indicated in indices 3, 4 and 5 were "compliant". Table 3 shows the classification of each realm vis-à-vis the potential risk variation range, as acceptable, tolerable or unacceptable. The results of the application of the IQIS showed that the food and nutrition service evaluated had a mean compliance rate of 35% in the evaluation of the risk control indicators and the potential risk classified in the range of risk variation was deemed unacceptable.

Discussion

In the current Brazilian social and economic context, health control measures require risk management of hygienic-sanitary conditions of food and nutrition services as an essential factor to reduce the incidence of FBDs. Thus, the preparation and validation of a quantitative instrument for inspection of large food and nutrition services, based on the MARP, support prevention and control measures. The IQIS was developed and tested for its validity to corroborate this, with consistent results that allow the immediate application. Its elaboration considered the RDC Nº 216/2004[13] in full, which contributes to standardized terminology, besides ensuring that all national legal requirements be considered. Similar studies, such as the Food Service Categorization Assessment List[18] and the Best Practices in School Food (BPAE)[16], used methods to prioritize items in RDC Nº 216/2004[13], which were more relevant to health risk control, as well as developed their respective risk classification methods at the end of the application of the lists. Despite the different methodologies for classification of risk

Table 2. Percentage of adequacy of the hygienic-sanitary conditions of the food service in the Test, Salvador, 2016.

Blocs	Nutritionists							p-value
	1	2	3	4	5	6	7	
	(%)	(%)	(%)	(%)	(%)	(%)	(%)	
I. Building, facilities, equipment, furniture and utensils	27.10	21.30	23.50	23.20	26.60	25.70	22.80	0.423
II. Hygiene of facilities, equipment, furniture and utensils	33.30	29.90	26.00	31.60	33.30	33.90	27.40	0.423
III. Integrated vector and urban pest control	0.00	0.00	0.00	0.00	100.00	0.00	0.00	0.423
IV. Water supply	41.70	41.70	41.70	50.00	16.70	41.70	41.70	0.423
V. Waste management	40.20	37.30	41.20	36.30	40.60	41.10	40.20	0.423
VI. Food handlers	33.30	32.50	31.70	38.90	38.10	30.20	31.00	0.423
VII. Raw ingredients, ingredients and packaging	35.80	35.40	28.00	32.70	36.70	39.30	28.70	0.423
VIII. Food preparation	34.30	38.60	27.20	39.50	32.50	33.30	30.60	0.423
IX. Storage and transport of prepared food	40.50	38.10	40.50	40.50	40.50	40.50	40.50	0.423
X. Exposure to the consumption of prepared food	42.20	38.60	42.20	42.20	43.10	44.10	42.20	0.423
XI. Documentation and registration	33.30	33.30	33.30	33.30	33.30	33.30	33.30	1
XII. Accountability	50.00	50.00	50.00	50.00	50.00	50.00	50.00	1
Mean	34.31	33.06	32.11	34.85	40.95	34.43	32.37	3

Percentage of adequacy of hygienic-sanitary conditions: no statistically significant differences were achieved by the Kruskal-Wallis test.

Table 3. Classification of potential risk in the range of variation, obtained from the answers given in the Test, Salvador, 2016.

Blocs	Nº of items	Nº of risk indicators	Nº of critical risk indicators	% of compliance	Classification of potential risk
I. Building, facilities, equipment, furniture and utensils	57	9	1	27	Tolerable
II. Hygiene of facilities, equipment, furniture and utensils	59	4	3	30	Unacceptable
III. Integrated vector and urban pest control	1	0	1	14	Unacceptable
IV. Water supply	6	1	5	38	Acceptable
V. Waste management	17	1	1	67	Acceptable
VI. Food handlers	23	0	3	64	Unacceptable
VII. Raw ingredients, ingredients and packaging	27	2	4	61	Unacceptable
VIII. Food preparation	20	1	5	57	Unacceptable
IX. Storage and transport of prepared food	7	3	2	69	Acceptable
X. Exposure to the consumption of prepared food	21	3	3	65	Unacceptable
XI. Documentation and registration	3	2	1	33	Acceptable
XII. Accountability	2	1	1	100	Acceptable
Total		27	30	35	Unacceptable

The data of the seven nutritionists were used to calculate compliance, and classification of potential risk values.

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control indicators as critical and non-critical, a similarity between the IQIS critical indicators and the Food Service Categorization Checklist is observed[18]. The MARP applied to food and nutrition services resembles HACCP in its purpose of ensuring food security, but evidences different methodological aspects, since it is used to analyze potential hazards of operations, based on the concept of probabilistic risk. On the other hand, the MARP works with the potential risk, regarding a possible health problem, without necessarily describing the problem and its probability. It is a concept that expresses the value judgment about the potential exposure to a possible risk[19], and this is an advance in food safety assurance.

Although it is usual to use the health inspection instrument to collect nonconformities in food and nutrition services, it is necessary to use methods to classify the risk control indicators, defining their respective criticalities, for the adequate health risk management. Table 3 data analysis showed that the proportion of nonconformities in each realm is not always equivalent to their level of criticality. We observed that, concerning realms *VII. Raw materials, Ingredients, and packaging; VIII. Food preparation; and X. Exposure to the consumption of the prepared food*, while more than 60% of their items were evaluated with appropriate hygienic-sanitary conditions, they were classified with a potentially unacceptable risk and jeopardized the whole system. The MARP facilitates the comparison of the potential risks evaluated, guiding crucial stages of risk management, as well as implementing corrective measures in cases of failure. A similar study evaluates the risk classification of food and nutrition services as a reliable strategy for risk communication and food security promotion, significantly contributing to reduced foodborne diseases[40].

The validation of quantitative instruments, with a view of risk management for food safety control in collective food and nutrition, is useful and gains substantial significance by supporting various professionals in the field of research and practice, enabling an accurate view of the most critical issues, without losing sight of the other items required by law. IQIS has been shown to be a viable application instrument, with a reduced level of interference of the evaluator due to the objective response options, appropriate for a detailed and thorough inspection, which takes time to complete in large food and nutrition services. It should be noted that this time difference to implement the IQIS and dichotomous instruments is not significant, which reinforces its applicability by private nutritionists, as well as by regulatory bodies linked to health surveillance.

The lack of validation studies involving quantitative evaluation tools for food and nutrition services – which include all the items required in RDC Nº 216/2004[13] – and of a gold standard appear as hindrances to the design of this study, which led to the combination of several methodological strategies to ensure the validation of the IQIS. Among the main limitations of this research is that sample size was restricted by the need of the group of evaluators to apply the IQIS concurrently, since the reality of food production is dynamic and changes its hygienic-sanitary conditions in the respective sectors as per the production flow throughout the day.

Conclusions

The results of the IQIS evidence content validity and it can be used with good reliability and reproducibility by nutritionists to evaluate the hygienic-sanitary conditions of the large food and nutrition services and to manage the priority risks, supporting the adoption of best practices of food handling and favoring the prevention of diseases. The contributions evidenced the relevance of developing the IQIS, taking into account the need for nutritionists to have a specific technological innovation for the segment of collective feeding that meets the requirements of RDC Nº 216/2004[13] and allows health risk management, covering all its complexity. Similar work will generate knowledge and tools to ensure health risk management in food and nutrition services, thus contributing to the provision of safer food with a lower probability of foodborne diseases. An essential benefit of the work is the appropriate management of resources in the hierarchy of improvements, fundamental in the current socioeconomic context of crisis and scant resources. We recommend that the technical application of IQIS be extended to other food and nutrition services, as well as its possible be considered for use by regulatory agencies such as Health Surveillance. As a perspective for future studies, we suggest the preparation of instructional material for a better understanding of the instrument by professionals employing the IQIS and a more objective and appropriate version for application in realities with reduced availability of resources or health emergency situations.

Collaborations

LMF Viterbo: worked in the conception, research, methology and final writing. KN Sá: worked in the conception, research, methology and final writing. MVT Navarro: worked in the conception and final writing. CASC Marques: worked in the research. HJD Leite: worked in the conception, research, methology and final writing.

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PREVALENCE OF NURSING DIAGNOSTICS IN OIL INDUSTRY WORKERS IN BAHIA, BRAZIL[7]

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Original Article

Prevalence of Nursing Diagnostics in Oil Industry Workers in Bahia, Brazil

Prevalência de diagnósticos de enfermagem em trabalhadores da indústria de petróleo na Bahia, Brasil

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ABSTRACT | OBJECTIVE: To describe the prevalence of nursing diagnostics and to analyse differences between the groups according to the indicator created from the diagnoses and intervention of the CIPE® relating to job satisfaction. **METHOD:** 869 workers attending the occupational health assessments of an oil industry with nurse practitioners, using a data collection form to support clinical reasoning in the definition of diagnostics and intervention, with CIPE®. Data collected were grouped into five indicators: food aspects, interpersonal relationships, physical health, health behaviours and working conditions. **RESULTS:** 13 types of diagnoses and 18 interventions were mapped, being the most prevalent "job satisfaction" (85.0 %) and "promoting healthy relationship and communication techniques" (76.3 %), respectively. The student's t-test was used to compare scores of the five indicators between the groups. The "satisfied at work" revealed better interpersonal relationships ($p < 0.001$). The group intervened with the initiative "to promote healthy relationships and communication techniques and to encourage healthy relationships" demonstrates better interpersonal relationships ($p < 0.01$) and better physical health ($p < 0.05$). The best working conditions ($p < 0.01$) were identified in the group subject to "other interventions". **CONCLUSION:** Structured performance of the nurse practitioner in the worker healthcare enables the development of strategies aimed at implementing improvements within organizational aspects of the nursing work.

DESCRIPTORS: Nursing. Occupational health. Standardized nursing terminology.

RESUMO | OBJETIVO: Descrever a prevalência de diagnóstico de enfermagem e analisar diferenças entre os grupos segundo o indicador criado a partir dos diagnósticos e intervenção da CIPE® relativas à satisfação do trabalho. **MÉTODO:** 869 trabalhadores participaram das avaliações de saúde ocupacional de uma indústria petrolífera com enfermeiros, utilizando um formulário de coleta de dados para apoiar o raciocínio clínico na definição de diagnóstico e intervenção, com CIPE®. Os dados coletados foram agrupados em cinco indicadores: aspectos alimentares, relações interpessoais, saúde física, comportamentos de saúde e condições de trabalho. **RESULTADOS:** foram mapeados 13 tipos de diagnósticos e 18 intervenções, sendo os mais prevalentes "satisfação no trabalho" (85,0 %) e "promover técnicas saudáveis de relacionamento e comunicação" (76,3 %), respectivamente. O teste t foi utilizado para comparar os escores dos cinco indicadores entre os grupos. O "satisfeito no trabalho", revelou melhores relações interpessoais ($p < 0,001$). O grupo intervencionado com a iniciativa "promover técnicas saudáveis de relacionamento e comunicação e incentivar relações saudáveis"," demonstra melhores relações interpessoais ($p < 0,01$) e melhor saúde física ($p < 0,05$). As melhores condições de trabalho ($p < 0,01$) foram identificadas no grupo sujeito a "outras intervenções". **CONCLUSÃO:** O desempenho estruturado do enfermeiro na área da saúde do trabalhador possibilita o desenvolvimento de estratégias voltadas à implementação de melhorias nos aspectos organizacionais do trabalho de enfermagem.

DESCRITORES: Enfermagem. Saúde Ocupacional. Terminologia padronizada de enfermagem.

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Introduction

The world of work has changed in the last century, affecting workers in their multiple dimensions[1]. There have been changes in the concepts, goals, objectives and in the way of seeing and performing the task in the specific context of work. Work has been shaping the new configurations of reality and society, thus adapting to the emerging requirements. As a result, organizations are increasingly committed to creating a dynamism that facilitates evolution, productivity and economy, in ways that allow optimizing the time and scope of defined goals[2]. It is not just about new tasks or functions, involving new competences, different ways of performing and organizing work, which contribute to shape and modify the relationships between the worker and the work environment[1].

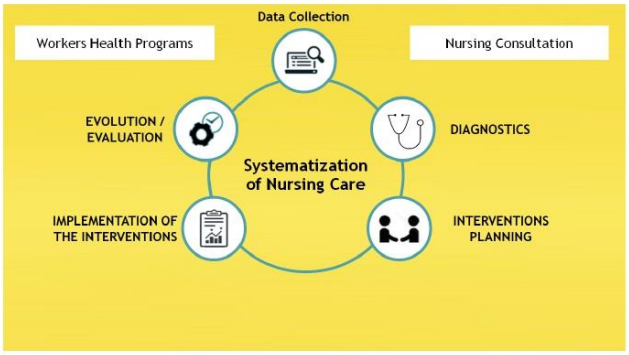
In such a scenario, job satisfaction has been identified as a relevant factor influencing the worker, which can manifest on health, quality of life and behaviour, with important consequences for individuals and organizations[3]. The Theory of Work Satisfaction[4] is based on two pillars: the importance given by the worker to the goal to be achieved; and the motivation that drives the individual to act (performance) to obtain the results (satisfaction), i.e., a pleasurable emotional state, resulting from the positive assessment of the reality of the work, concerning the values of the individual. On the other hand, dissatisfaction is the opposite, resulting from the negative assessment of the same reality, in comparison with the personal values of the worker. Thus, work is one of human being's ways of positioning as a single individual, and undeniably, one of the components of happiness[5], resulting from the full satisfaction of psychosocial needs, the feeling of pleasure and the sense of contribution in the exercise of professional activity. It is one of the organizing axes of social life, acting as a determinant of people's living conditions and health.

A brief review of the state of the art has revealed a growing concern by the employer[6-7] to realize how satisfied workers are. Associated with this factor, is the degree of productivity, although exclusively focused on the offshore context of the oil industry. A study developed by Ullberg and Torbjørsrn[8] in an offshore oil industry found that, associated with absenteeism, issues such as job dissatisfaction and stress suggesting a higher investment by companies in the social and organizational factors that should be the basis of health promotion. Another study by Dickey et al.[9] suggests that the companies should provide promotion and training skills for workers, aiming to reduce absenteeism and job dissatisfaction.

Parallel to changes in technologies and ways of organizing work, there has been a significant evolution of the concept of health and the struggle to ensure that the world of work is not a source of suffering, illness, injury and death[10]. Therefore, the transformation of productive processes must take place to make them health promoters, instead of promoting sickness and death. In this field of health, there is a diversity of knowledge that enables collective, interdisciplinary and intersectoral interventions[11]. The principle of the worker's integral health invokes the right to health in an unrestricted sense of full citizenship, including actions of health promotion, prevention and assistance, in an integrated manner, with the broad and effective participation of workers, professionals and researchers, educational institutions, union representatives, services, civil society and other institutional and social actors. This concept is in constant transformation, since the health problems caused by the work activity change with the work itself, conditioning the understanding, in time and space, of the notion of health[1]. Accordingly, the role of the professional in the worker's health (WH) field is multidimensional, established in a network of interactions, and it is important to consider the objectivity and subjectivity inherent to health at work, considering that the object that constitutes it is human beings whose technical interventions are permeated by interpersonal relationships.

In this scenario, the nurse practitioner has been gaining space in organizations, as long as they can work on workers' quality of life, protection against chemical, physical, biological and psychosocial agents, health maintenance, occupational or non-occupational diseases, and in rehabilitation for work[12-13]. The Systematization of Nursing Care (SNC) is a methodology for organizing and systematizing healthcare, based on the principles of the scientific method (Figure 1), aiming to identify health-disease situations and nursing care needs, as well as to subsidize interventions for the promotion, prevention, recovery and rehabilitation of individual, family and community health[14-15].

Figure 1. Systematization of nursing care in the Workers Health field. Elaborated by the authors



Also, the International Classification for Nursing Practice - CIPE®[16] terminology - consists of an information system that classifies nursing phenomena, actions and results, allowing the description and characterization of nursing practice. It represents a unifying framework for all classification systems available worldwide. The CIPE® terminology instrumentalizes the SNC at work, making it possible to assess the health situation of the workers, the epidemiological analyses, as well as the contribution to the development of health policies and the planning of care. Recent studies by Calvacante et al.[17] and Rabelo-Silva et al.[18] reinforce the importance of the practice of using diagnostics and interventions in several areas of nursing, and the lack of knowledge related to the use of CIPE® in the WH field is seen as a knowledge gap that needs to be addressed in the oil industry of today.

This study aims to contribute to the development of strategies focused on implementing improvements to the organizational aspects of the nursing work, namely in the job satisfaction field. Therefore, it is intended to describe the prevalence of nursing diagnoses and to analyse if there are significant differences between groups according to the indicator created from the diagnoses and interventions of the CIPE applied in nursing consultations during the periodic examination of the occupational health service of an oil industry, Bahia, Brazil.

Materials and Methods

Study design

This is a cross-sectional, descriptive study, conducted at the occupational health service of an oil industry in Bahia, Brazil, from February to November 2017. 869 oil Brazilian workers attended by nurse practitioners with a direct employment relationship with the oil company were included in the research. Workers with no direct employment relationship with the oil company were excluded from the present study.

Workers attended the occupational health service to perform the annual periodic examination, which in addition to the medical assessments provided by law had the participation of occupational nurses to carry out consultations, with a focus on preventing injuries and promoting health. For standardization of healthcare, the 6 nurses of the service prepared a semi-structured interview script, based on the Interdisciplinary Worker's Health Approach Instrument (IWHAI)[19], already published, which addresses the social characteristics of workers, socio-environmental components, personal characteristics, level of self-care, environmental components, exposure to risk agents, health surveillance, family relationships and relationships in the workplace Table 1 shows the IWHAI indicator which varies on a scale from 0 to 4, with 0 meaning non-existent or inadequate and 4 an optimal index.

Table 1. Semi-structured interview script for consultation with the occupational nurse, Salvador, Bahia, Brazil, 2017

Dimension	Domain	Parameter
Working Conditions Related Factors	Work environment relationships	Refers to a stable relationship in the work environment and does not identify health interferences
	Ergonomic Aspects	Adapted post/work area, assessed by ergonomists (task and activity analysis), provides adequate posture, no pain complaints
	Exposure to Risk Agents	Exposure equal to or less than the tolerance limit or exposure above the tolerance limit with the use of protective equipment, with biological training and/or monitoring, when applicable
	Health Surveillance	Physical structure in dimensions compatible with the activity; Adequate hygienic-sanitary conditions; Organized environment, organization of furniture, free circulation area in order to allow the safe movement of people
Behavioural Factors	Self-care level	Healthcare, understands and uses available resources to improve health status regularly
Personal Factors	Personal Factors	Healthy; Does not have chronic diseases; Irrelevant pathologies
Social and Community Networks Factors	Social aspects	Uses leisure and/or spirituality and/or social environments to promote health and realizes this need, in addition to positively reflecting on health
	Family relationships	Stable family relationship and does not identify health interference
Living Conditions Related Factors	Environmental Components	Work environment where there is no exposure to contaminated environmental components (air, soil and/or water quality), with environmental monitoring

Source: Adapted from Viterbo et al.[19]

During the study period, consultations were held by 4 of the 6 nurses, with specific training in ergonomics and mental health. Examinations were carried out in appropriate rooms, with an average duration of 30 minutes and the interview script was applied in this context. For each identified health domain, the respective nursing diagnoses and interventions were defined by the same nurses, using the terminology CIPE® as taxonomy.

For the development of the investigation, the researchers requested information from the institution's electronic medical records, which included the data collected by nurses during the periodic exam consultations. The database obtained was treated intending to standardize the names of the variables and, subsequently, a randomly generated code was created to guarantee the anonymity of the study participants. The information collected was grouped into five indicators for data analysis, as shown in Table 2.

Table 2. Indicators and the corresponding aggregated variables, Salvador, Brazil, 2017

Indicators	Variables
Food aspects	simple carbohydrate
	fibres
	saturated lipids
	liquids
	sodium mineral
Interpersonal relationships	social characteristics
	socio-environmental components
	family relationships
	work place relationships
Physical aspects	flexibility
	abdominal strength
	arm strength
	oral hygiene
	pain during physical activity
	diabetes mellitus
	altered glycaemia
	hypertension
	altered blood pressure
	dyslipidaemia
	weight
	periodontal community index
Health behaviours	alcohol consumption*
	food choice
	smoke
	oral hygiene
	level of physical activity
	self-care level
Working conditions	environmental components
	exposure to risk agents
	health surveillance
	food security

*World Health Organization[20] criteria were used as a reference for consumption pattern analyses.
Source: Elaborated by the authors.

Statistical Analysis

Statistical analyses were performed in SPSS version 25 for Windows. Among the aspects investigated in Table 1, the dimension "Factors Related to Working Conditions", which comprises aspects related to: i) work environment relationships, ii) ergonomic aspects, iii) exposure to risk agents and iv) health surveillance, was established to be the focus of this study. In line with this, the prevalence of each domain was analysed and the study of "Relations in the Work Environment" was delineated. The scale of this domain was specified as follows: 0 - refers to a conflictive, permanent relationship in the work environment that interferes with the worker's health, 1 - refers to a relationship in the work environment that causes specific mobilizations and identifies interferences in the worker's health in this period, 2 - refers to relationship in the mobilizing work environment at specific moments and does not identify interferences in the worker's health, 3 - refers to a relationship in the stable work environment and does not identify interferences in the worker's health and 4 - the same previous condition and encourages healthy habits in the work environment. Based on the findings of the diagnoses and interventions, the participants were divided into four different groups, with Groups I, "Satisfied in the work environment", considering respondents 0 and 2 of the scale and II, "Dissatisfied in the work environment", considering respondents 3 and 4 of the scale related to the diagnoses found and Groups III, "Promoting healthy communication techniques and encouraging healthy relationship policies" and IV, "Other interventions", related to the interventions. Groups II and IV aggregate all diagnoses and interventions differing from those defined in Groups I and III, respectively.

Student's t-test for independent samples was applied to compare the scores calculated between the groups and the five considered indicators: food aspects, interpersonal relationships, physical health, health behaviours and working conditions. The construction of the indicators followed the transformation of the variables composing them into total scores through the SPSS. Scores were calculated based on the sum of the indices (0-4) attributed to each variable integrated in an indicator (see Table 2). The scores means were then calculated.

The grouping of variables followed the guidelines identified in the existing literature[3,19,21]. No comparisons were made by sex as previous studies, such as those by Dickey et al.[9] and Burke et al.[22] reveal no sex differences in job satisfaction levels of oil industry workers.

Data from Groups I, II, III and IV were subsequently compared with Table 2.

Ethical Approval

In all stages of the study, the recommendations and guidelines of Resolution 466/2012 of the Brazilian Ministry of Health on ethical aspects regulating research with human beings, were followed. The study was approved by the Research Ethics Committee of the BAHIANA School of Medicine and Public Health and CAAE no. 84318218.2.0000.5544. Before participating in the study, all subjects gave their informed consent for inclusion. The study included only a retrospective assessment of data available through an Institutional Database, and the analyses were performed as part of the periodic epidemiological assessment on occupational health and safety risks. Personal data was restricted, also considering the Ethics Committee approval, and was treated in order to guarantee the respect of privacy of the workers involved in the study.

Results

In this study a total of 869 workers completed the interview, Males (93.0 %) with a mean age of 45 years, between 23 and 72 years, prevailed. Regarding marital status, 50.5 % are married, 37.9 % are single, 2.6 % are divorced and 4.9 % relate another state. In terms of the work regime, 52.4 % work in administrative hours, followed by 25.4 % with shift work. In relation to schooling, 49.6 % have completed high school, 31.6 % higher education, while 18.8 % declared another school situation.

The nursing diagnoses of the CIPE® taxonomy related to the organizational aspects of the work were mapped, being the most prevalent: work satisfaction (85.0 %), stress overload (6.0 %) and stress due to change (or transfer) of the workplace environment (5.9 %). The other diagnostics represent 3.1 %, according to the data presented in Table 3.

Table 3. Nursing diagnostics of the CIPE® taxonomy related to the organizational aspects of the work, Salvador, Brazil, 2017

CIPE® Diagnostics	*n*	%
Impaired adaptation	1	0.1
Anxiety	6	0.7
Complication associated with health care	2	0.2
Discomfort	1	0.1
Stress due to change (or transfer) of the environment	51	5.9
Relationship problem	5	0.6
Risk of low self-esteem, situational	1	0.1
Risk of dissatisfaction with health care	2	0.2
Impaired sleep risk	7	0.8
Job satisfaction	739	85.0
Stress overload	52	6.0
Impaired socialization	1	0.1
Night shift work	1	0.1
Total	869	100.0

Source: Elaborated by the authors.

From the data analysed, the nursing interventions of the CIPE® taxonomy related to the organizational aspects of the work were identified, being the most prevalent: promoting healthy relationships and communication techniques (76.3 %), encouraging healthy relationship policies (6.4 %), assessing the characteristics of stress (5.1 %) and to obtain data on ability to manage stress (3.7 %). The other interventions represent a percentage of 8.5 %, according to the data detailed in Table 4.

Table 4. Nursing interventions of the CIPE® taxonomy related to the organizational aspects of work, Salvador, Brazil, 2017

CIPE® Interventions	*n*	%
Assess the characteristics of stress	44	5.1
Advise the patient	1	0.1
Assess behaviour against adaptation	3	0.3
Assess satisfaction with heal:h care	3	0.3
Collaborate with the actions developed by health promotion services	1	0.1
Listen to the worker	1	0.1
Manage anxiety	2	0.2
Manage negative behaviour	1	0.1
Implementing fun and leisure activities for workers and family members	25	2.9
Encourage healthy relationship policies	56	6.4
Collect data on anxiety	5	0.6
Collect data on ability to manage stress	32	3.7
Collect data on stress level	3	0.3
Collect data on sleep	4	0.5
Guidance on management (control) of stress	22	2.5
Orient on sleep	2	0.2
Provide bedtime routine	1	0.1
Promote healthy relationships and communication techniques	663	76.3
Total	869	100

Source: Elaborated by the authors.

Table 5 shows the results between Groups I and Group II, using the indicators outlined in Table 2.

Table 5. Relationship between the satisfied workers (Group I) versus the unsatisfied workers (Group II) and the studied indicators, Salvador, Brazil, 2017

Indicators	Satisfied in the work environment Group I (*n* = 739)		Unsatisfied in the work environment Group II (*n* = 130)		
	M	*StD*	*M*	*StD*	*t*
Food Aspects	13.6	1.60	13.5	1.77	-0.656
Interpersonal Relationships	13.5	1.96	11.9	2.27	-7.365***
Physical health	43.8	7.40	42.9	6.73	-0.971
Health behaviours	20.1	3.38	19.9	3.06	-0.564
Working conditions	12.2	1.25	12.3	1.13	0.797

Note: *** $p < 0.001$; *M* = Mean; *StD* = Standard Deviation; *t* = *t*-test result.

The workers who are more satisfied with their workplace are also those reporting better interpersonal relationships ($p < 0.001$), as shown in table 5, where the total score of the indicators was used.

Table 6 shows the results between Groups III and Group IV, using the indicators outlined in Table 2.

Table 6. Relationship between the promotion of healthy communication and policies (Group III) versus other interventions (Group IV) and the studied indicators, Salvador, Brazil, 2017

Indicators	Promotion of healthy communication techniques and encouragement of healthy relationship policies Group III (n = 719)		Other interventions Group IV (n = 150)		
	M	*StD*	*M*	*StD*	*t*
Food aspects	13.6	1.58	13.4	1.80	-1.606
Interpersonal relationships	13.4	1.91	12.9	2.75	-2.738**
Physical health	44.0	7.29	42.0	7.35	-2.330*
Health behaviours	20.1	3.38	19.9	3.15	-.188
Working conditions	12.1	1.21	12.5	1.34	3.114**

Note: * $p < 0.05$; ** $p < 0.01$.; *M* = Mean; *StD* = Standard Deviation; *t* = *t*-Test result.

Better interpersonal relationships ($p < 0.01$), better physical health conditions ($p < 0.05$), and better working conditions ($p < 0.01$) were also reported among workers who received intervention in promotion of healthy relational and communication techniques and encouragement of healthy relationships, as shown in table 6.

Discussion

According to Brazilian last census (2010), the city of Salvador, Bahia, Brazil, with an area of 693 831 km², has 2.675.656 million of inhabitants. 51.9 % are females, 28.6 % of the population works and the schooling rate from 6 to 14 years of age is 95.9%. In this study, workers are mostly male (93.0 %), related to a traditional prevalence of this sex in this industry, and have completed high school (49.6 %).

The Theory of Job Satisfaction[4] is based on two main aspects that involve the emphasis of workers to achieve company goals and the motivation that leads individuals to act to obtain results. The Table 3 presented the CIPE® taxonomy nursing diagnoses related to the organizational aspects of the work investigated and it can be observed that the highest percentage of participants reported being satisfied with the workplace (85.0 %). Job satisfaction was identified as a relevant factor that affects workers and can be reflected in health, quality of life and behavior[3]. This satisfaction represents one of the determining factors for the fullness of the human being, because when the worker is able to develop work with pleasure, living with feelings of recognition and appreciation, the work environment becomes a place of growth and satisfaction[23,24]. Another relevant aspect demonstrated in the findings presented in Table 3 were the diagnoses "Stress overload" (6.0 %) and "Stress due to change (or transfer) of the environment" (5.9 %), related to changes in the world of work, involving new tasks, skills and different ways of executing and organizing work to meet increasingly challenging productivity goals[1,2].

Table 4 shows the nursing interventions of the CIPE® taxonomy related to the organizational aspects of work. The most prevalent interventions were the "Promote healthy relationships and communication techniques" (76.3 %), followed by the "Encourage healthy relationship policies" (6.4 %). The study by Dickey et al.[9] suggests that companies offer promotion and training skills to workers, with the aim of reducing absenteeism and job dissatisfaction. Other important results found were "Assess the characteristics of stress" (5.1 %) and "Collect data on ability to manage stress" (3.7 %). Job dissatisfaction results from the individual's negative assessment of work reality, compared to his personal values[4] and a study developed in the oil industry by Ulleberg and Rundmo[8] suggests its association with absenteeism and stress. Accordingly, it is particularly recommended that companies invest more in social factors and organizational factors that should serve as a basis for health promotion.

As shown by the results in Table 5, allowing to analyse the relationship between satisfied, dissatisfied workers and the indicators studied, there are significant differences in interpersonal relationships between the group of satisfied workers in their workplace (Group I) and the other diagnoses associated with non-adaptation (Group II).The most satisfied subjects are those who report the best quality in their interpersonal relationships,

whether they are socioenvironmental, family or work environment relationships. This result is in line with what has already been identified in other studies in oil industry area[7–9], namely the occurrence of better physical health quality in satisfied individuals. In unsatisfied individuals, previous studies[3,25] point out to the occurrence of health problems such as fatigue, respiratory distress, headache, digestive problems, increased cholesterol, heart disease and muscle pain, thus highlighting that being unsatisfied at work increases the probability to developed certain diseases.

Along with technological changes and the ways in which work is organized, the concept of health evolves in search of ensuring that it is not a cause of suffering, disease and death[10]. The results in Table 6 demonstrate that workers intervened in order to promote healthy policies and communication (Group III) report better quality in their interpersonal relationships, physical health and working conditions, than those involved in other interventions (Group IV). Collective, interdisciplinary and intersectoral interventions[11] in companies enable the WH prevention and promotion, as well as the reduction of absenteeism and job dissatisfaction[9].

Although the association between job satisfaction and the health of individuals is scientifically recognized[3], there are still gaps to be filled, such as the lack of attention paid to the multidimensional aspects of job satisfaction, as well as the limited number of studies that consider occupational health as a result of the articulation between physical and psychic factors.

Conclusions

The importance of the application of the CIPE® terminology is based on its high level of objectivity in nursing diagnostics, allowing the design of interventions directed to the specific needs of individuals in the organizational context of work. This potentiality makes the interventions efficient and effective, promoting the maintenance of individuals' health and their productivity.

In the present study, the 13 nursing diagnostics identified of the CIPE® taxonomy related to the organizational aspects were decisive in determining the 18 interventions to be applied. The prevalence of workers satisfied with work stands out, an important result that also leads to higher productivity and a healthier overall health condition. On the other hand, the initiative "Promotion of healthy communication techniques and encouragement of healthy relationship policies" prevails in the interventions. This particular initiative has resulted in the identification that healthier workers are effectively those with better interpersonal relationships and better physical health.

The potential of nurses' performance and the application of CIPE® terminology in the organizational context of workplace environment has proved to be an effective methodology in the development of strategies aimed at the implementation of improvements regarding the organizational aspects of work in the field of WH.

The main limitation of this study is based on the size of the sample, which does not allow to infer the results for the general population of Brazilian oil industry workers. In particular, the reported male dominance in this particular industry, conditions comparative analyses relating sex, considering the small percentage of women involved in the study.

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Author contributions

Viterbo LMF, Silva IB, Leite JSF participated in the conception, design, search and statistical analysis of the research data, interpretation of results, writing of the scientific article. Vidal DG participated in the statistical analysis of the research data, interpretation of the results, writing of the scientific article. Moura A participated in the statistical analysis of the research data, interpretation of the results. Dinis MAP participated in the supervision of the study and critical revision of the final version of the manuscript.

Competing interests

No financial, legal or political competing interests with third parties (government, commercial, private foundation, etc.) were disclosed for any aspect of the submitted work (including but not limited to grants, data monitoring board, study design, manuscript preparation, statistical analysis, etc.).

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HEALTH MONITORING AND INTERVENTION PLAN ON OIL INDUSTRY WORKERS: RESULTS FROM A CASE-STUDY[8]

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Health Monitoring and Intervention Plan on Oil Industry Workers: Results from a Case-Study

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Abstract Oil industry workers are particularly vulnerable to risks related to their especial working conditions like exposure to hazardous chemicals, explosions and fires, working in confined spaces and often in remote areas or in offshore platforms. Dedicated work health surveillance plans that take into consideration environmental risks are of the utmost importance to safeguard workers health and to communicate identified faults and gaps to other institutional departments to provide adequate intervention. This work presents an assessment case-study of an on-going health intervention and monitoring plan focused on oil industry workers and the quality of potable water distributed. In the assessment of risks to health, the quality of water for human use is case-sensitive as water is vital to life but may act as a transmission vector for several diseases whose symptoms may appear as acute (often as a consequence of water contamination by microorganisms or toxic substances) or chronic, usually more related to the ingestion of chemically contaminated water. In the study timeline, six parameters were identified as critical in the water quality: Total Coliforms, *Escherichia coli*, iron, pH, turbidity and colour. A global graphical distribution of nonconformity analysis by working service for each geographic location and for the entire period of the study highlighted the two worse water quality work sectors: 'Oil Extractions Stations' and 'Baths & Changing Rooms'. Corrective measures arising from this case-study of the on-going health monitoring and intervention plan focus on sensibilization for improvement of workers hygiene and for cleaning and sanitization procedures.

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Keywords Oil industry workers · Potable water quality · Health intervention monitoring plan

1 Introduction

Safety at work is determinant to provide for decent work conditions [1]. Workers' health (WH) has a direct and quantifiable positive impact on labour productivity, improving the sustainability of social security systems as these are dependent of healthy active populations. Keeping workers healthy implies occupational risk identification and prevention to promote safe and healthy workplace conditions. Oil industry workers are particularly vulnerable to risks related to their especial working conditions like exposure to hazardous chemicals, explosions and fires, working in confined spaces (underground or underwater) and often in remote areas or in offshore platforms. In addition to the harshness specificity of their work, oil industry workers are also subjected to poor environmental and sanitary conditions, which are occupational risks present in other working sectors. For these type of professions, dedicated WH surveillance considering environmental risks are of the utmost importance to safeguard workers health, to prevent damaging working conditions and to communicate identified faults and gaps to other institutional departments to provide adequate intervention.

This work presents an assessment case-study of an on-going health intervention and monitoring plan focused on oil industry workers using the quality of potable water distributed as an indicator of work safety conditions. In the assessment of risks to health, the quality of water for human use is case-sensitive as water is vital to life but may act as a transmission vector for several diseases whose symptoms may appear as acute (often as a consequence of water contamination by microorganisms or toxic substances) or chronic, usually more related to the ingestion of chemically contaminated water [2, 3]. However, the development of disease by ingestion of contaminated water is also dependent on the health condition and immunity of individuals. Frequently, in the oil industry sector, specially at offshore conditions or in remote areas, water supply and sanitation infrastructures are poor or even inexistent. In Brazil, in these situations, potable water is self-supplied by Alternative Collective Solutions (ACS) as defined by the Brazilian governmental decree on quality control on water for human use [4]. According to this regulation both public and private companies may provide potable water from these ACS supply systems and are also responsible for water treatment procedures to comply with potable water standards [5]. Usually, water supplied by ACS is captured from wells or superficial water sources and then submitted to several treatment stages namely sedimentation, filtration, flocculation and disinfection [4–6]. Treated water is kept in local reservoirs and distributed to different working sectors by internal piping systems.

2 Materials and Methods

2.1 Study Design

This study focuses on the quality of potable water supplied by ACS systems to ten oil field exploration locations in the northern Brazilian state of Bahia, covering the period 2015 to 2018. In this state, the on-going health monitoring and intervention plan includes 848 oil industry workers (91% males; 9% females). The geographic location of the ten oil exploration stations is presented in Fig. 1. In each oil field station, the water sampling plan included six points for collecting samples: (1) at water capture points-wells and reservoirs; (2) at oil extraction stations—water reservoirs; (3) taps in administrative facilities; (4) taps in medical offices; (5) taps in bath and changing rooms and (6) taps in areas for food preparation and consumption. All water samples were analysed for microbiological, physico-chemical

Fig. 1 Geographic location of the ten oil exploration stations included in this case-study. *Source* google maps

and organoleptic parameters according to the referred Brazilian regulation [4]. In the entire period of the study the total number of water samples collected at the six referred points amounted 39,399 water samples.

2.2 Data Analysis

Data analysis was performed using IBM® SPSS® Statistics for Windows v. 25.0. Water quality parameters and distribution of nonconformity cases by region, by year and by sampling point were analysed to identify critical situations. Variables distribution were found to be non-normal ($p < 0.05$) therefore, *Spearman's correlation coefficient* (r_s) was used to assess associations between variables. Rate of change in time (period 2015-2018) was calculated as well as medians of bulk non-conformity analysis. A graphical distribution of the water quality parameters by year and region was used for an easier interpretation of the results.

3 Results and Discussion

A descriptive analysis of nonconformity water quality analyses is presented in Table 1. In the observed timeline (2015–2018), six critical parameters were identified: Total Coliforms, *Escherichia coli*, iron, pH, turbidity and colour. These parameters

Table 1 Total nonconformity water quality analyses by parameters between 2015 and 2018. N is the total number of analysis in each year; n refers to the number of nonconformities for which the correspondent percentage value is in brackets

Water quality parameters (total number of analysis)	2015	2016	2017	2018
	N = 8809	N = 13,257	N = 10,344	N = 6946
Number (n) and % of nonconformity water analysis				
Total nonconformities	1180 (13.4)	1659 (12.5)	1253 (12.1)	1017 (14.6)
Total coliforms	301 (19.7)	569 (37.2)	363 (23.7)	297 (19.4)
Escherichia coli	136 (38.0)	68(19.0)	81 (22.6)	73 (20.4)
Aluminium	5 (55.6)	2 (22.2)	2 (22.2)	0 (0.0)
Ammonia	1 (33.3)	1 (33.3)	0 (0.0)	1 (33.3)
Benzene	0 (0.0)	1 (100)	0 (0.0)	0 (0.0)
Lead	1 (50.0)	1 (50.0)	0 (0.0)	0 (0.0)
Chloride	6 (37.5)	1 (6.3)	3 (18.8)	6 (37.5)
Total hardness	0 (0.0)	1 (100)	0 (0.0)	0 (0.0)

(continued)

Table 1 (continued)

Water quality parameters (total number of analysis)	2015	2016	2017	2018
	N = 8809	N = 13,257	N = 10,344	N = 6946
Iron	64 (35.2)	75 (41.2)	43 (23.6)	0 (0.0)
Total Iron	12 (52.2)	10 (43.5)	1 (4.3)	0 (0.0)
Manganese	16 (32.7)	22 (44.9)	11 (22.4)	0 (0.0)
Nitrate	0 (0.0)	0 (0.0)	2 (100)	0 (0.0)
Nitrite	0 (0.0)	0 (0.0)	2 (100)	0 (0.0)
pH < 6	125 (16.0)	229 (29.4)	236 (30.3)	189 (24.3)
pH > 9	5 (22.7)	5 (22.7)	7 (31.8)	5 (22.7)
Selenium	0 (0.0)	1 (100)	0 (0.0)	0 (0.0)
Sodium	4 (57.1)	1 (14.3)	2 (28.6)	0 (0.0)
Total dissolved solids	0 (0.0)	0 (0.0)	1 (16.7)	5 (83.3)
Sulphate	0 (0.0)	2 (100)	0 (0.0)	0 (0.0)
Carbon tetrachloride	0 (0.0)	0 (0.0)	7 (100)	0 (0.0)
Turbidity	115 (24.5)	151 (32.2)	104 (22.2)	99 (21.1)
Zinc	1 (100)	0 (0.0)	0 (0.0)	0 (0.0)
Colour	388 (23.7)	519 (31.7)	388 (23.7)	342 (20.9)

stand out throughout all period of analysis, worsening in the case of: Total Coliforms (+3.7%), pH < 6 (+8.3%) and Colour (+0.7%).

Figure 2 presents the global graphical distribution of nonconformity water analysis by working service for each geographic location and for the entire period of the study. Water samples collected at 'Oil Extractions Stations' (33.9 to 59.0%), and 'Baths & Changing Rooms' (4.4 to 35.7%) comprise most of nonconforming analyses for all geographic locations. These results suggest a post-contamination of water after capture and treatment or deficient cleaning and sanitizing procedures at bathrooms and changing rooms. Poor hygiene habits may also contribute to the degradation of water quality in these working facilities. On the other hand, the usual harsh conditions at oil extractions stations may be the cause for poor water quality at these points: here the contamination of treated water kept in reservoirs is likely to be of environmental origin [5, 7].

A detailed distribution of the nonconforming water analyses by parameters and by sampling point (working service category) is presented in Table 2.

Table 2 highlights that samples collected at 'Oil Extraction Stations' (31.9–45.5%) and 'Bath & changing rooms' (20.4–31.8%) systematically present the worse values (in bold) in all of the six previously identified critical parameters. This pattern is corroborated by parameters associations confirmed by the *Spearman correlation test* values presented in Table 3.

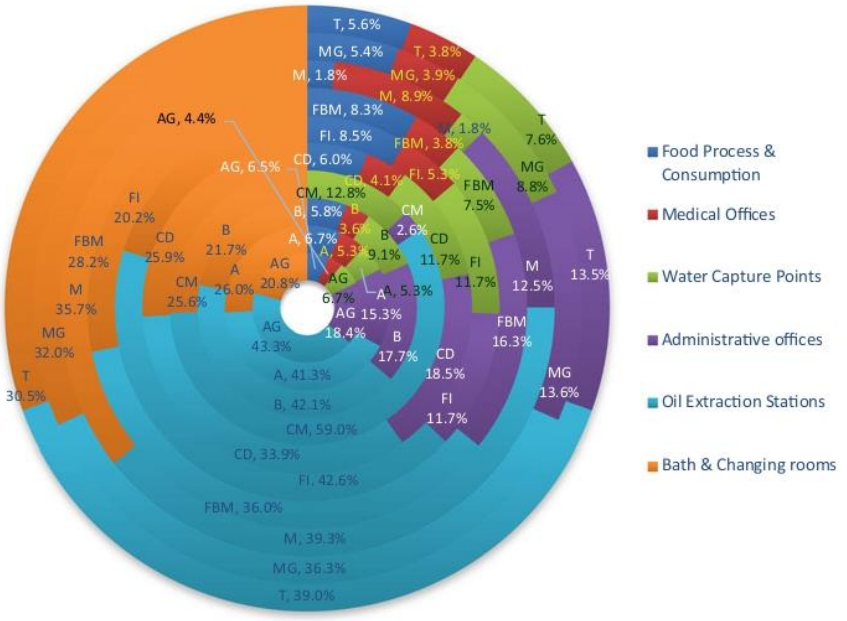

Fig. 2 Distribution of nonconformity analysis by working service for each geographic location and for the entire period of the study. Total number of nonconformity analysis N = 4977

Table 2 Nonconforming water quality analyses by parameters and by type of sampling point

	Water capture points	oil extraction stations	Bath & changing rooms	Food areas	Administrative offices	Medical areas
Total coliforms	137 (9.0)	**607 (39.7)**	**382 (25.0)**	94 (6.1)	247 (16.1)	63 (4.1)
E. coli	34 (9.5)	**152 (42.5)**	**73 (20.4)**	18 (5.0)	71 (19.8)	10 (2.8)
Turbidity	29 (6.2)	**176 (37.5)**	**131 (27.9)**	31 (6.6)	84 (17.9)	18 (3.8)
Colour	132 (8.1)	**617 (37.7)**	**441 (26.9)**	121 (7.4)	256 (15.6)	70 (4.3)
Iron	23 (12.6)	**58 (31.9)**	**55 (30.2)**	8 (4.4)	31 (17.0)	7 (3.8)
pH < 6	62 (8.0	**289 (37.1)**	**231 (29.7)**	51 (6.5)	115 (14.8)	31 (4.0)
pH > 9	1 (4.5)	**10 (45.5)**	**7 (31.8)**	0 (0.0)	3 (13.6)	1 (4.5)

Table 3 *Spearman* correlations among water quality parameters analysed

Parameters	A	B	C	D	E	F	G
A. Total Coliforms	1						
B. *Escherichia coli*	0.76**	1					
C. Colour	0.84**	0.74**	1				
D. Iron	0.65**	0.61**	0.63**	1			
E. pH < 6	0.34*	0.39*	0.34*	0.41**	1		
F. pH > 9	-0.08	-0.13	-0.09	-0.02	-0.25	1	
G. Turbidity	0.78**	0.76**	0.81**	0.65**	0.61**	-0.18	1

*significant at 0.05 level
**significant at 0.01 level

Strong positive correlations were identified between Total coliform and Colour ($r_s = 0.84$, $p < 0.01$), *E. coli* ($r_s = 0.76$, $p < 0.01$) and Turbidity ($r_s = 0.78$, $p < 0.01$). Other strong positive correlations were also identified between Colour and *E. coli* ($r_s = 0.74$, $p < 0.01$) and Turbidity ($r_s = 0.81$, $p < 0.01$). Another strong positive correlation was observed between *E. coli* and Turbidity ($r_s = 0.76$, $p < 0.01$). Moderate positive correlations were identified between Iron and Total Coliform ($r_s = 0.65$, $p < 0.01$), Colour ($r_s = 0.63$, $p < 0.01$), *E. coli* ($r_s = 0.61$, $p < 0.01$) and Turbidity ($r_s = 0.65$, $p < 0.01$). Turbidity and pH < 6 are positive moderate correlated too ($r_s = 0.61$, $p < 0.01$). Moderate-weak positive correlations between pH < 6 and Total Coliform ($r_s = 0.34$, $p < 0.05$), Colour ($r_s = 0.34$, $p < 0.05$), *E. coli* ($r_s = 0.39$, $p < 0.05$) and Iron ($r_s = 0.41$, $p < 0.05$) were observed.

Coliform organisms (reported as total coliforms) have for long been recognized as a suitable microbial indicator of water quality, largely because they are easy to detect and to quantify in water samples [8, 9]. Coliform bacteria can be found in both faeces and the environment (nutrient-rich waters, soil, decaying plant material) as well as in drinking-water containing relatively high concentrations of nutrients thus, the presence of total coliforms is related to contamination of environmental origin [2, 5]. High levels of turbidity may reduce the efficiency of disinfection and interfere with the measurement of total coliforms [10]. Nonconform sample analysis in turbidity and pH can be originated by deficient water treatment at the capture point, namely by inadequate use of water flocculants, poor filtration systems (or lack of filters maintenance) or by the absence of pH correction after using flocculant and disinfectant agents [5, 11]. Colour alterations in water samples may be associated with the presence of undesirable substances such as iron (which was identified as a non-conformity parameter until 2017); or may be an indicator of public health concern if associated to the presence of coliforms. Orange to brown colour may be caused by the presence of 'iron bacteria', which thrive in rich iron and manganese waters, and this situation occurs naturally in several Brazilian regions [5]. 'Iron bacteria' oxidize iron and manganese contributing to lower waters' pH [12] which may contribute to the considerable number of pH < 6 nonconform

Table 4 Rate of change (2015–2018) of water quality nonconformity analyses by location

Region	CM	CD	T	MG	FBM	A	AG	B	M	FI
Rate of change (%)	−84.4	−70.3	−34.3	−30.3	−3.5	6.7	21.5	66.3	66.7	212.5
Median (Mdn)	6	217	149	149	198	31	206	145	12	21
Q_1 (25th percentile)	4	104	114	122	193	24	152	102	6	10
Q_3 (75th percentile)	22	296	154	213	324	58	245	150	18	42

analyses (Table 2). These bacteria tend to form biofilms that clog filters and screens, reducing the effectiveness of water treatments and slimes that stick to wells casings, pumps and pipes, degrading water supply appliances. Measures to reduce this type of hazard require the installation of pH sensors and automatic pH correction devices and the implementation of a plan for frequent cleaning of piping and substitution of filters.

Table 4 presents the variation of nonconformity analysis by geographical location. These results point out two groups: in five locations (CM, CD, T, MG and FBM) water quality results have improved (−3.5% to −84.4%) and in the remain (A, AG, B, M and F) results are worse (6.7% to 212.5%).

The location which has experienced the greater improvement (CM) is simultaneously the one with the lowest median (Mdn = 6; $Q_1 = 4$; $Q_3 = 22$), however, best improvements are observed in locations presenting the highest medians (CD, T, MG, FBM). Results suggest that the origin of water quality problems is persistent in the second group of locations, probably because they are not being addressed in the most effective manner.

4 Final Remarks

Of the six parameters which were systematically nonconform, coliform bacteria are the most concern as they should not be detectable in treated water supplies and, if found, suggest inadequate treatment, post-treatment contamination, or excessive nutrients at the water source. Therefore, the coliform test can be used as an indicator both of treatment efficiency and the integrity of the distribution system. *Escherichia coli* is abundant in human and other animal faeces; it is commonly found in sewage, treated effluents, and waters and soils subjected to recent faecal contamination, whether from humans, wild animals, or agricultural activity. Because animals can transmit pathogens that are infective in humans, the presence of *E. coli* or thermotolerant coliform bacteria must not be ignored, because the presumption remains that the water has been faecally contaminated and that treatment has been ineffective. In this situation the presence of *E. coli* may represent a threat to human

health, specially to those more vulnerable such as the immunosuppressed. Although coliform organisms may not always be directly related to the presence of faecal contamination or pathogens in drinking-water, the coliform test is still useful for monitoring the microbial quality of treated piped water supplies. If there is any doubt, especially when coliform organisms are found in the absence of thermotolerant coliforms and *E. coli*, identification to the species level or analyses of other indicator organisms may be undertaken to investigate the nature of the contamination. Treatment of very contaminated waters may be difficult and only partially successful. Regular sanitary inspections are needed because even a properly constructed water system may be the source of non-potable water if adequate maintenance, surveillance and routine water analysis are neglected [13]. Elimination of environmental risks in the oil activity sector is inherently difficult but, as measures to reduce risks by water contamination, it is strongly recommended: (1) the installation of monitoring devices and sensors along the water collecting and distribution system to detect defects and failures; and (2) the implementation of regular audits and surveillance plans for water treatment procedures by both internal services and independent companies, besides those responsible for water supply.

This case-study stresses the importance of health monitoring plans for work conditions specially in high-risk professions like oil industry workers. Education for improvement of workers hygienic procedures, handling of foods and cleaning and sanitization of bathrooms and changing rooms are corrective measures arising from this case-study of the on-going health monitoring and intervention plan.

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MEDICAL EMERGENCY RESOURCE CLASSIFICATION INSTRUMENT (MERCI) IN THE OIL INDUSTRY, BRAZIL[9]

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Medical Emergency Resource Classification Instrument (*MERCI*) in the Oil Industry, Brazil

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Abstract The area of medical urgency and emergency is an important component of health care. Oil and Gas companies exist in a variety of locations in Brazil. The quality of medical infrastructure and specialties differs, and it is important to ensure optimal workers medical care. This paper describes the development of an objective tool for classifying levels of medical emergency response services in the oil industry, Bahia, Brazil, based on the steps that make up a complete cycle of medical emergency care: emergency detection, specifically requested resources, first aid on site, specialized care, and assisted removal to definitive treatment unit. A committee of 12 recognized occupational health and medical emergency experts with at least five years' experience participated in content validation through the Delphi Technique. The indicator was subdivided into 4 indices based on the risk profiles observed from the internal risk analysis documents. Medical Emergency Resource Classification Instrument (*MERCI*) aimed to reduce the subjectivities of the assessment and allocation of resources in medical emergencies, considering the characteristics of oil and gas companies regarding the assessment of risk scenarios, location and exposed population. The proposed methodology can lead top management to routinely adopt *MERCI*, ensuring the maintenance of medical emergency response resources, with a level of service appropriate to the needs of industry and workers.

Keywords Occupational medical urgency · Oil industry · Tool validation

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1 Introduction

The area of medical urgency and emergency is an important component of health care [1]. It relates health situations with risk of loss of life, aggravation and degrees of suffering at varying levels of criticality and complexity, which therefore require safe and immediate intervention. In 2002, the publication of the technical regulation of urgency and emergency care [2], defined some concepts of this area in relation to the components of mobile fixed pre hospital care, comprising basic and advanced support units. In addition, it classified hospital units and introduced Medical Regulation as the ordering and guiding element of the Urgency and Emergency Systems.

In the business area, the Ministry of Labour and Employment [3] established minimum parameters for urgency and emergency, through Regulatory Standard No. 7 [3], item 7.5.1—First Aid: Every establishment must be equipped with material necessary for the provision of first aid, considering the characteristics of the developed activity; keep this material stored in a proper place and in the care of a person trained for this purpose. The needs of corporate outpatient care range from meeting the simplest demands to emergency situations that require rapid and safe response. Thus, the user should be properly oriented to ensure continuity of treatment, paying attention to the limits of the service [4].

Oil and Gas companies exist in a variety of locations in Brazil where the quality of medical infrastructure and specialties differs, and it is important to ensure optimal medical care for the workers. For this reason, health professionals need to assess local health facilities to ensure they can provide the health needed for the workers [5]. More specifically, the scope of a particular company may range from operating in remote areas to administrative services in offices, allocating support and management teams, making it difficult to provide materials, treatment drugs, and maintaining skilled staff appropriate to the scenarios and risks posed. However, regardless of where it operates, emergency situations must be anticipated and dealt with quickly and effectively in order to minimize their effects. In order to develop an effective Medical Emergency Response, it is important to first determine the expected standard of care. There are several standards, most using a tiered approach based on response time [6]. In 2017, the Oil Spill Response Joint Industry Project [5], an international association that gathers and publishes good practices for Oil and Gas companies, published a health services assessment checklist to a qualitative assessment, guiding internal decisions of companies without however claiming to be a scoring tool.

This paper describes the process of developing an objective tool for classifying levels of medical emergency response services in the oil industry, Bahia, Brazil, based on the steps that make up a complete cycle of medical emergency care: emergency detection, specifically requested resources, first aid on site, specialized care, assisted removal to definitive treatment unit.

2 Materials and Methods

The study deals with the development of a Medical Emergency Resource Classification Instrument (*MERCI*) in the Brazilian Oil Industry. Carried out from February to June 2019, at the worker health service in the oil extraction and production industry in Bahia, Brazil, the study involved six medical emergency specialists with at least 10 years of experience in the oil industry to develop the *MERCI*. A committee of 12 recognized occupational health and medical emergency experts with at least five years' experience participated in content validation through the Delphi Technique [7]. Figure 1 details the *MERCI* elaboration process.

The study was approved by the Research Ethics Committee of the Bahiana School of Medicine and Public Health of Brazil and registered with CAAE 84318218.2.0000.5544.

2.1 MERCI *Development*

The development stage included the group of experts, 30% of each profession, including physicians and nurses. The literature review allowed the analysis of previously referenced instruments, as well as the theoretical framework for the decision and development of a new instrument based on current references. It was structured in its final version with two documents, namely "checklist" and "classification of service size", as follows. The Checklist consists in two steps: (i) identification of the emergency service to be studied and (ii) quantitative assessment, including three

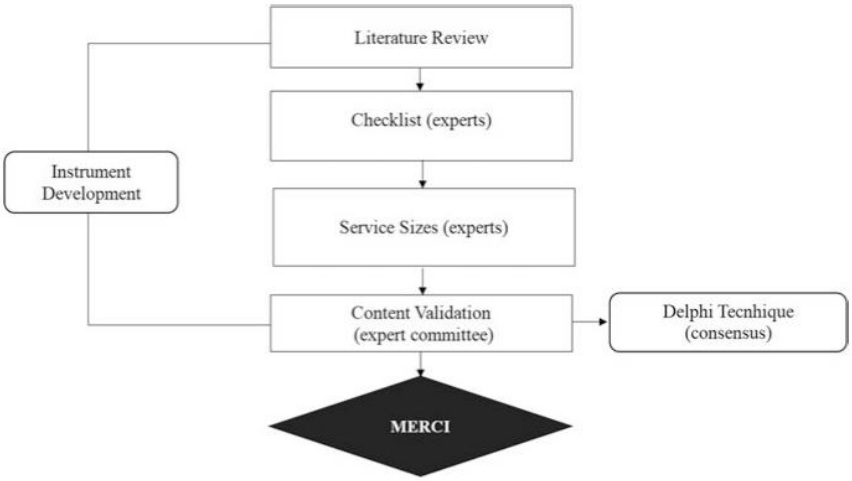

Fig. 1 Flowchart of *MERCI*'s content elaboration and validation process

criteria: risk scenarios (administrative and operational), accessibility (urban or remote area) and population. Corresponding scores were defined, which together generate a score for the service. To classify the five sizes of care, the following dimensions were considered: (i) time to cover specialized support, which may be 24 or 12 h, (ii) composition of the service team, (iii) ambulance support, (iv) materials, treatment drugs and equipment and (v) medical regulation centre.

2.2 MERCI *Validation*

To validate the content through the Delphi Technique [7], a panel was developed with 12 experts, using their knowledge, from five eight-hour meetings in which each member gave their opinion on the documents under discussion, until the group consensus.

3 Results and Discussion

The details of the *MERCI* quantitative assessment stage are presented in Table 1, allowing a clearer understanding about its organization.

The scenario indicator was subdivided into 4 indices based on the risk profiles observed from the internal risk analysis documents:

1. Administrative risk—characterized as a place with activities where the results of an accident are unlikely to cause serious injury, although other non-work-related acute medical conditions may occur. This is the case of offices, for example.

Table 1 *MERCI* checklist quantitative assessment

Indicator	Score	Indices
Risk scenario	1	Administrative risk
	2	Industrial risk—warehouses/workshops
	3	Industrial risk—thermoelectric/drilling rigs/oil transfer stations
	4	Industrial risk—offshore platform/oil treatment terminal
Accessibility	1	Urban area
	2	Remote area
Population	1	Up to 50 workers
	2	100–150 workers
	3	150–500 workers
	4	Over 500 workers
MERCI score		

2. Industrial risk—warehouses/workshops: characterized as a place where work activity can result in injury accidents that can lead to work leave and medical treatment, and physical distancing from specialized medical teams can delay the establishment of conducts within a reasonable time.
3. Industrial risk—thermoelectric/drilling rigs/oil transfer stations: characterized as a place where work activity can cause serious injury to multiple casualties related to heavy equipment, pressurized systems and important chemical/fuel inventory.
4. Industrial risk—offshore platform/oil treatment terminal: characterized by the same risk profile as onshore production facilities, compounded by the physical limitation of resource maintenance and access difficulties for emergency response.

Regarding the accessibility indicator, two indices were considered: urban area and remote area.

1. Urban area: companies located in an urban area tend to less influence score because they are close to resources provided by agencies outside the emergency response support organization. In addition, from the point of view of responding to medical emergencies, there is a reduced response time between emergency identification to hospital care for definitive treatment.
2. Remote area: the occurrence of emergency situations in remote areas leads to a greater need for attention, for reasons previously mentioned, besides the difficulties in accessing the last stage of an emergency care cycle (definitive treatment), access to external resources is not facilitated.

The population indicator starts from the notion of exposure. Exposure, in the context of technological accidents, is considered to be elements and/or systems (including people and property) that are present in risk areas and are therefore subject to potential losses. They may include the number of inhabitants or types of property in a given place which, when combined with the specific vulnerability of each target, provide input for estimating existing risks in the area of interest. The indicator consists of 4 indices based on population ranges: up to 50 workers, 51 to 150 workers, 151 to 500 workers and more than 500 workers.

The final score calculation (Eq. 1) is achieved by the sum of the all scores assigned to each of the three assessed indicators, namely: the risk scenario and the population indicators could have a score ranged 1–4 and the accessibility indicator could have a score ranged 1 to 2.

$$Risk\ Scenario_{Score} + Accessibility_{Score} + Population_{Score} = MERCI_{Score} \quad (1)$$

By applying the scoring of Table 1, based on the characteristics of the operational installation, resource sizes will be defined, respecting the distribution below:

- Size 1–10 points—installations rated size 1 should have advanced 24-h support staff with dedicated removal capabilities. In addition, equipment, treatment drugs and consumables appropriate to the response capacity and, where applicable, resources for specific installation scenarios should be made available,
- Size 2–7 or 9 points—size 2 should be staffed with 24-h basic support personnel with dedicated on-site ground remediation capabilities, regulated by tele-medical facilities, with equipment, treatment drugs and consumable support appropriate for the responsiveness;
- Size 3–5 or 6 points—size 3, due to the characteristics of exposed population, location and profile of risk scenarios, should have the presence of a physician and nurse during their opening hours. The standard of equipment, treatment drugs and consumables appropriate to the responsiveness;
- Size 4—up to 4 points—size 4 must have the presence of a trained nursing professional for emergency response appropriate to the opening hours of the facility regulated by a remote physician, using telemedicine resources. In addition, it has a standard of equipment, treatment drugs and consumables suitable for its responsiveness and can request external resource for removal, when necessary, as well as in size 5;
- Size 5—up to 3 points—considering exposed population, risk rating, and location, the facility can be serviced by trained workforce personnel, with no specialization requirements supported by first-aid kits appropriate to their responsiveness for initial care. However, the rescuer may request an ambulance for removal if necessary (contracted public service resource, not dedicated to local emergency plan).

An example of *MERCI* application is:

- Risk scenario indicator: Industrial risk—offshore platform/oil treatment terminal (score 4);
- Accessibility indicator: Remote area (score 2);
- Population: 150–500 workers (score 3).

The final *MERCI* score would be 9, so a size 2 service should be applied.
To the five sizes classification, five dimensions were considered:

- Time to cover specialized support, which may be 24 h, 12 h or absence of urgency and emergency nurse's support;
- Composition of the team for primary care may include a physician specialized in urgency and emergency, an urgency and emergency specialized nurse, an ambulance driver or the absence of professionals in situ;
- Ambulance support may vary according to the availability of the resource, site fixed ambulance or by request when necessary, as well as the level of complexity of the ambulance service, which may be basic support (nurse and ambulance driver) or advanced support (physician, nurse and ambulance driver);
- Standardized materials, treatment drugs and equipment to meet the complexity of each service size;

Table 2 *MERCI* service size classification

Dimensions	Size I	Size II	Size III	Size IV	Size V
Time for expert support coverage	24 h assistance	24 h assistance	12 h assistance	12 h assistance	–
Care staff	Physician, nurse and ambulance driver	Nurse and ambulance driver	Physician and nurse	Nurse	–
Ambulance support	Site fixed ambulance	Site fixed ambulance	Drive ambulance	Drive ambulance	Drive ambulance
	Advanced life support	Basic life support	Advanced life support	Advanced life support	Advanced life support
Materials, treatment drugs and equipment	Size I standard	Size II standard	Size III standard	Size IV standard	First aid kit
Medical regulation centre	Aero medical rescue	Advanced life support	–	–	–

- Available medical regulation centre with advanced support ambulance (physician, nurse and ambulance driver) or with aero-medical rescue.

Table 2 shows the classification of the service size and main characteristics.

4 Conclusions

The developed *MERCI* tool aimed to reduce the subjectivities of the assessment and allocation of resources in medical emergencies considering the characteristics of oil and gas companies regarding the assessment of risk scenarios, location and exposed population. The dissemination of the proposed methodology can lead top management to adopt this system routinely, ensuring the maintenance of medical emergency response resources, with a level of service appropriate to the needs of industry and workers.

The application and implementation of *MERCI* at the oil extraction and production industry, as well as the development of statistical analyses to validate the reliability and reproducibility of the instrument, with scientific publication of results, is recommended in future works.

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COMMUNICATION OF ENVIRONMENTAL RISKS TO POTENTIALLY EXPOSED WORKERS: AN EXPERIENCE IN THE OIL INDUSTRY, BAHIA, BRAZIL[10]

[10] Costa, A. S., **Viterbo, L. M. F.,** Vidal, D. G., Dinis, M. A. P., & Simões, H. (2020). Communication of Environmental Risks to Potentially Exposed Workers: An Experience in the Oil Industry, Bahia, Brazil. In P. M. Arezes, J. S. Baptista, M. P. Barroso, P. Carneiro, P. Cordeiro, N. Costa, … G. Perestrelo (Eds.), Occupational and Environmental Safety and Health II. Studies in Systems, Decision and Control (pp. 59–64).

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Communication of Environmental Risks to Potentially Exposed Workers: An Experience in the Oil Industry, Bahia, Brazil

André Santana Costa, Lilian Monteiro Ferrari Viterbo, Diogo Guedes Vidal, Maria Alzira Pimenta Dinis and Hélder Simões

Abstract Conflicts between workers and health experts and their multiple rationalities must always be considered in the risk communication process. Disagreements are frequent in understanding occupational exposure to environmental agents among stakeholders. The present study aimed to describe the evolution of differences between experts and oil industry workers in Bahia, Brazil. The Tool of Instructions to the Double was applied and the results followed over three annual assessment cycles (2017–2019). In the observed period, a reduction in the share of disagreements between workers and experts was identified: 25.2% (n = 183) to 3.1% (n = 22), representing a percent variation of 98.9% relating the understanding of occupational noise exposure based on normative classification. The relations of conflict between workers and experts and the multiple social and cultural dimensions must always be considered as an important challenge in workers' health. Thus, the use of models encouraging dialogue and value knowledge from the experience of workers seem to be more appropriate in conflicting contexts, enhancing risk control, protection and health promotion.

Keywords Occupational health · Environmental risks · Occupational hygiene

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1 Introduction

Risk communication is an area of intervention in the field of public health and the environment, through the use of multiple methodologies, with the objective of mitigating risks, answering doubts of groups involved and resolving communication barriers, aiming at its greater effectiveness [1]. Such communication, seen as a technology for risk control and health and safety promotion, aims to understand the sociocultural context of the worker, in order to add information to their knowledge and experience, and should be done in a clear and understandable way [2]. This communication may imply a formal or informal estimate if an event poses a high or low threat to personal worker safety and, based on that perceived threat, indicate how to respond [3]. Findings from empiricist research in the context of liberal democracies, among other aspects, consider that people's risk and values are different, probabilities can be difficult to interpret, and risk debates are conditioned by their social/political text [4]. Thus, this practice is more likely to succeed when the audience, rather than manipulated, is empowered [5]. In dealing with risk communication, it is often perceived that while scientists determine risks, potentially exposed populations perceive it. According to Beck [6], there are multiple rationalities around risk, sometimes generating conflicts, particularly in the relationship between scientists/experts and lay people, and a distancing of views on the subject, constituting a point of divergence in a supposed dialogue between the interested parties. Monetization of risks, i.e., when risk reduction in the workplace is not possible and the employer compensates the worker with additional consideration compensation due to work in more severe typified circumstances [7], can also be a situation that generates disagreements in risk classification between lay people and experts.

According to Sato [8], the clarification of a proposal for risk communication in the workplace from the knowledge of workers is not a new practice, having the Italian Labour Movement (ILM) [9] inspired in Brazil, the obligation to prepare the Environmental Risk Map by the Internal Accident Prevention Commissions (CIPA) [10] Thus, the mapping of risks in the workplace, or simply risk mapping is recognized as the first configured contribution of ILM. Although this model has as its premises the formation of homogeneous groups, workers' experience or subjectivity, consensual validation and non-delegation, thus enabling the participation of workers, it has been questioning how referrals and discussions take place between employees and employers, on the findings of the risk map limited to the floor plan design to be displayed somewhere in the company [11]. Other more technically strengthened methods adapted from Occupational Health and Safety Assessment Standard (OHSAS) OHSAS 18001:2007 [12] and known in Brazil as Preliminary Risk Analysis for Occupational Hygiene (APR-HO) have been used. APR-HO is a formative document that aims to characterize and recognize the exposure to occupational hazards of workers in a company, through field research and information collected after observing the activities performed in the occupational environment. As it can be verified from observation and interview, it does not

the highlight workers' perceptions about potential risks to which workers may be exposed, and further validation by the group of workers belonging to the homogeneous exposure group is consequently recommended.

This study aims to describe the evolution of divergences about environmental risks between workers and experts in an oil company in Bahia, Brazil, based on risk communication premises, considering the elaboration of APR-HO as a complex integrator of experiences.

2 Materials and Methods

This is a descriptive study, developed over 3 cycles of annual periodic occupational assessments, from January 2017 to September 2019, where 2116 workers in various positions of an oil industry in Bahia, Brazil were individually evaluated. The evaluation was performed by occupational hygiene experts and, at the same time, the worker was assisted by a working physician, dealing with exposure to risks in an interdisciplinary manner, considering the environment and the individual, respecting the specific aspects of each subject involved (interdisciplinary). The professionals had on average ten years of experience in the area. The occupational evaluation range 15–40 min.

The evaluations followed the following procedures: (i) presentation of APR-HO, produced in advance in the field through direct observation of the workers' activities, (ii) discussion and validation of APR-HO, (iii) guidance on the use of equipment personal protective equipment (PPE), respiratory protection equipment (RPE) and chemical handling, (vi) performing mask screening test, (for workers eligible for the respiratory protection program), (v) delivery of PPE and (vi) updating records in computerized systems. By internal procedure, an APR-HO is considered valid when the simple majority of the population that makes up the homogeneous group (50% + 1), is in accordance with the description of environmental risks and exposure times for each of the agents.

Workers who expressed disagreement with the risk description were selected and visited at their workplace by a field team. In this practice, and individually, the workers were submitted to the Tool of Instructions to the Double [9, 13], a methodological approach based on the assumption that the worker has a degree of knowledge (experience) that the expert (in their field as workers) does not have. As Clot explains [14], this methodology implies group work in the course of which a volunteer subject receives the following task: "Suppose I am your look-alike and that tomorrow I must replace you in your job. What instructions should you give me so that no one notices the replacement?" With this, the worker is invited to think about what is performed automatically and usual, which seems simple, but which, when detailed, allows to glimpse how much of unprecedent, creative and specific there is in every work activity. During this period, the percentages of "disagreements" with the risk mapping performed by occupational hygiene experts in the field were followed up.

The study was approved by the Research Ethics Committee of the Bahiana School of Medicine and Public Health and CAAE no. 84318218.2.0000.5544. Before participating in the study, all subjects gave their informed consent for inclusion.

3 Results e Discussion

From January 2017 to September 2019, the percentages of workers who disagreed with the experts regarding the exposure to environmental risks described in the APR-HO showed significant variation, maintaining a downward trend, as shown in Table 1.

A reduction in the number of workers in disagreement during the period from 2017 to 2019 was observed from 25.2 to 3.1% (from 183 to 22 workers). In this period, a smaller movement of workers in this unit (inputs and outputs) can also be observed, suggesting that the same population was subjected to the methodology for consecutive years, consolidating the knowledge about risks in the workplace and, at the same time, their experience contributing to improve field expert assessment methods. In general terms, the disagreements were based on the understanding on the part of the worker that the mere existence of noise in the working areas was enough to cause some injury. Therefore, the layperson did not consider for this judgment the limits imposed by the health and safety rules in force.

Table 2 presents the categorization of workers' disagreement regarding exposure to environmental risks.

The analysis of Table 2 shows a significant reduction in all categories of disagreement, with the most significant variation being between 2017 and 2019 (−20 to 100%). In none of the categories is identified an aggravation, except for the "All previous options" category, which presents a considerable aggravation between 2018 and 2019 (300%). However, with the best results (2017–2019), the categories of disagreement between workers and specialists, namely "Other" (−100%), "Risk category" (−94.1%) and "Described activities" (−93.0%), are highlighted. Overall, total disagreements had an effective reduction of 98.9%

The categorization of disagreements enabled an approach directed to the specific needs of each worker, resulting in a significant improvement of workers' understanding of risk exposure. Considering a better workers acceptance in understanding the risk to which they are potentially exposed, it is necessary to understand

Table 1 Disagreement between workers and experts regarding exposure to environmental risks

Year	2017		2018		2019	
	n	(%)	*n*	(%)	*n*	(%)
Disagreement	183	25.2	36	4.9	22	3.1
Total	726	100	737	100	716	100

Table 2 Categorization of workers' disagreements regarding exposure to environmental risks (2017–2019)

Disagreement Categories	2017 *n* (%)	% Δ (2017–2018)	2018 *n* (%)	% Δ (2018–2019)	2019 *n* (%)	% Δ (2017–2019)
Identified risk agents	35 (19.1)	**−62.9**	13 (36.1)	**−23.1**	10 (45.5)	**−71.4**
Described activities	43 (23.5)	**−90.7**	4 (11.1)	**−25.0**	3 (13.6)	**−93.0**
Frequency/duration of risk exposure	36 (19.7)	**−86.1**	5 (13.9)	**−20.0**	4 (18.2)	**−88.9**
Risk category	17 (9.3)	**−23.5**	13 (36.1)	**−92.3**	1 (4.5)	**−94.1**
All previous options	5 (2.7)	**−80.0**	1 (2.8)	300.0	4 (18.2)	**−20.0**
Other	47 (25.7)	**−100.0**	0 (0.0)	0.0	0 (0.0)	**−100.0**
Total disagreements	183 (100)	**−80.3**	36 (100)	**−38.9**	22 (100)	**−98.9**

Notes to the table: disagreements reduction in bold

that the work activity is not an object given to a researcher who would collect it, but an object to be built and rebuilt, in partnership with the protagonists of the work under review. This is because the activity is not limited to what can be directly observed, recorded and quantified, and confrontation and verbalization of the operator is essential [15].

In this sense, theoretical contributions provided by ergonomics are appropriated, as a discipline that also explores the environment and its interaction with operators. The method developed by Oddone et al. [16] was also able to unravel the lines between work, based on four assumptions, in the form of concepts: the homogeneous group, the experience, or subjectivity, of the worker, the consensus validation and non-delegation. It is necessary to understand that all living beings have normative capacity and that the curiosity and the search to learn from others is a driving force [17]. Considering a better acceptance in understanding the risk to which they are potentially exposed, it is understood that the work can be built and rebuilt, in partnership with workers and specialists. This is because the activity is not limited to what can be directly observed, recorded and quantified, being essential to confront and verbalize the worker [18].

4 Conclusions

It should be noted here that risk communication prescribing risk prevention and protection norms and conducts must be aware of the fact that these may be unreliable and acceptable to the population. Thus, conflicting relations between workers and experts and the multiple social and cultural dimensions must always be considered as an important challenge. Thus, the use of Technique of Instructions to the Double encouraging dialogue and value knowledge from the workers' experience

seem to be more appropriate in conflicting contexts. In order to minimize conflicts, enhancing risk control, protection and health promotion using communication strategies, it is necessary to analyse the sociocultural mediations involved.

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AEDES AEGYPTI: ENVIRONMENTAL INSPECTION FOR PROMOTING A SAFE WORK ENVIRONMENT IN AN OIL INDUSTRY IN BAHIA, BRAZIL[11]

[11] **Viterbo, L. M. F.,** Costa, A. S., Vidal, D. G., & Dinis, M. A. P. (2019). Aedes aegypti: Environmental Inspection for Promoting a Safe Work Environment in an Oil Industry in Bahia, Brazil. Book of Abstracts of 15th European Ecological Federation (EEF) Congress "Embedding Ecology in Sustainable Development Goals," 108. Lisboa: SPECO.

30/07 | 19h00
POSTER SESSION I
Room C6 atrium | Topic 1 - Environmental risks and health

PO – 1 (EEF2019-13645) - AEDES AEGYPTI: ENVIRONMENTAL INSPECTION FOR PROMOTING A SAFE WORK ENVIRONMENT IN AN OIL INDUSTRY IN BAHIA, BRAZIL

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Objectives: Environmental health demands multidisciplinary actions. This study relates environmental inspections to control Aedes Aegypti, the main vector for dengue, proliferation in the work environment of an oil industry in Bahia, Brazil, during 2018. Methods: Inspection technology was used to identify environmental and occupational risk factors, on a scale of 0 to 4, i.e., 0 - sites with vector-born diseases (VBD) proliferation, 1 - Suitable sites for VBD proliferation (high vegetation, accumulation of water or larvae presence) 2 - Disorganized areas and/or presence of disused or unfamiliar to the environment objects, 3 - Clean, organized areas without water accumulation, free of disused or unfamiliar to the environment objects and without sites favourable for VBD proliferation and 4 - Same as in 3, but monthly schedule of inspections. Semi-annual inspections at 66 workplaces were carried out by environmental health specialists (M = 2 h). Results: For the first and second semesters results were, respectively: indexes 0 - 32 % and 24 %, 1 - 65 % and 72 %, 2 – 2 %, 3 - 2 % and 4 - 0 %. Collective actions were carried out to treat the identified risks, namely the elimination of containers with water or larvae presence and worker awareness campaigns. The number of sites with larvae was reduced in 70.5 %. Conclusions: Preliminary results of assessments show that investing in actions to identify environmental risks in the work context has positive effects on workers' health, with the development of healthy environmental practices, contributing to global well-being.

Keywords: Environmental inspection, Vector-borne diseases, Work environment, Oil industry, Aedes aegypti

UTILIZAÇÃO DA CIPE® NA VIGILÂNCIA SANITÁRIA EM SERVIÇOS DE SAÚDE DO TRABALHADOR: UM RELATO DE APLICAÇÃO NA INDÚSTRIA DO PETROLEO NA BAHIA, BRASIL[12]

[12] **Viterbo, L. M. F.,** Caribé, J. da S., & Pereira, J. R. (2018). Utilização da Cipe® na Vigilância Sanitária em Serviços de Saúde do Trabalhador: Um Relato de Aplicação na Indústria do Petróleo na Bahia, Brasil. Anais Do 13º SINADEn e 16º SENADEn, 1–2. Florianópolis.

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3893713 UTILIZAÇÃO DA CIPE® NA VIGILÂNCIA SANITÁRIA EM SERVIÇOS DE SAÚDE DO TRABALHADOR: UM RELATO DE APLICAÇÃO NA INDÚSTRIA DO PETROLEO NA BAHIA, BRASIL

Autores:

Lilian Monteiro Ferrari Viterbo ; Janaina da Silva Caribé ; Jamile Ribeiro Pereira

Resumo:

Introdução: **A Vigilância em Saúde do Trabalhador (VISAT) é um componente do Sistema Nacional de Vigilância em Saúde, como definido na Portaria GM/MS nº 1.378, de 9 de julho de 20131, que visa à promoção da saúde e à redução da morbimortalidade da população trabalhadora, por meio da integração de ações que intervenham nos agravos e seus determinantes decorrentes dos modelos de desenvolvimento e processos produtivos. A especificidade de seu campo de ação é definida por ter como objeto a relação da saúde com o ambiente e os processos de trabalho, realizada com a participação e o saber dos trabalhadores em todas as suas etapas. Dentre os princípios da VISAT estão: a integralidade das ações, que inclui a articulação entre as ações individuais com ações coletivas, entre as ações de planejamento e avaliação com as práticas de saúde, e entre o conhecimento técnico e os saberes, experiências e subjetividade dos trabalhadores e destes com as respectivas práticas institucionais e a responsabilidade sanitária pressupõe assumir um princípio ético-político da ação em Vigilância em Saúde do Trabalhador, que compreende o entendimento de que o objetivo e a justificativa da intervenção é a melhoria das condições de trabalho e saúde. As instancias envolvidas na VISAT têm o dever de identificar situações que resultem em risco ou produção de agravos à saúde, notificando aos setores sanitários competentes, adotando e ou fazendo adotar medidas de controle quando necessário. A Vigilância Sanitária (VISA) enquanto componente indispensável à Saúde do Trabalhador, é descrita como um conjunto de ações capazes de eliminar, diminuir ou prevenir riscos à saúde e de intervir nos problemas sanitários decorrentes do meio ambiente, da produção e circulação de bens e da prestação de serviços de interesse da saúde2. Identifica-se tal temática como de relevância para a saúde do trabalhador e uma área de atuação da enfermagem onde o cuidado, a partir dos ambientes de trabalho, constitui uma oportunidade de proporcionar qualidade da assistência prestada. **Objetivo: **o presente estudo pretendeu descrever a experiência da atuação do enfermeiro do trabalho nas etapas de implantação da vigilância sanitária em serviço de saúde do trabalhador, assim como a utilização dos diagnósticos de enfermagem a partir da taxonomia CIPE3 como pilar para a execução do Processo de Enfermagem no campo descrito. **Metodologia: Para que se possa acompanhar as demandas e dar tratamento adequado de forma sistemática a todas as ações destinadas à Vigilância Sanitária, faz-se necessário identificar as demandas, organizá-las por prioridades e implementar soluções (ou ações para minimizar riscos e agravos). Como embasamento teórico da etapa inicial do Processo de Enfermagem, foi utilizada a teoria da Tríade de Donabedian. Este teórico considera que devem ser formados sistemas inter-relacionados compostos por elementos novos e antigos; de atividades centralizadas e descentralizadas; de controle e de motivação; de prevenção de riscos e de promoção da qualidade4. Foi realizado um estudo a partir de dados das consultas de enfermagem realizadas a 875 trabalhadores, no período de janeiro a setembro de 2017, na indústria do petróleo na Bahia, Brasil, que enfatizava a dimensão: Promoção da saúde e qualidade de vida. Os trabalhadores puderam classificar sua percepção em relação às condições sanitárias de seu ambiente de trabalho, a partir de escala intervalar de 0 a 5, onde 3 seria a condição ideal. Os índices foram assim descritos: 0 - Estrutura física em péssimo estado de conservação; condições higiênico-sanitárias precárias; ambiente desorganizado / caótico; 1 - Estrutura subdimensionada; condições higiênico-sanitárias com presença de sujidades; ambiente desorganizado, porém com área de circulação preservada; 2 - Estrutura física em dimensões compatíveis com a atividade; condições higiênico-sanitárias satisfatória, porém sem padrão operacional padrão; ambiente organizado com área de circulação preservada; 3 - Estrutura física em dimensões compatíveis com a atividade; condições higiênico-sanitárias ótimas com padrão operacional padrão; ambiente organizado, ordenamento de móveis, área de

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circulação livre de forma a permitir a movimentação segura de pessoas; 4 - Mesma condição anterior, com piso antiderrapante; evidência de treinamento periódico; organização em função do fluxo do ambiente e 5 - Mesma condição anterior e com Plano de Manutenção e Implantação de Ferramenta de Organização 5S. **Resultados:** Não identificados muitos diagnósticos relacionados à Vigilância Sanitária no catálogo CIPE. Foi levantado inicialmente um diagnóstico de enfermagem da CIPE: Vigilância em saúde prejudicada. Este diagnóstico foi utilizado 250 vezes nos ambientes de trabalho. Também foram mapeadas intervenções, no total de 4 enunciados: sendo 81% inspecionar o local de trabalho, 17% iniciar ações de vigilância em saúde, 2% gerir às ações de vigilância e acompanhamento de saúde e 1% estabelecer medidas de intervenções e controle, com participação dos serviços de vigilância. Utilizou-se um instrumento de triagem, onde, dos 250 diagnósticos aplicados nos ambientes, 126 foram extraídos do índice zero, 10 com índice um, 87 com índice dois e 27 diagnósticos com índice três. **Conclusão:** O aprimoramento da qualidade da assistência prestada pela enfermagem, nos serviços de saúde do trabalhador, deve ser uma busca incessante. Com este trabalho, foi identificado a necessidade da construção e utilização de estruturas, modelos, que facilitem a avaliação e a implementação de mudanças que venham contribuir para a prevenção e manutenção da saúde dos seus usuários. A atuação direcionada e científica a partir da consulta de enfermagem utilizando a terminologia CIPE®, amplia o nível de cuidados junto aos trabalhadores da indústria do petróleo na Bahia, indo além de diagnósticos e intervenções relacionados à fatores pessoais e promoção da saúde, possibilitando a identificação, intervenção e controle dos riscos nos ambientes de trabalho. Tal experiência, a partir de uma interface interdisciplinar e intersetorial, propicia a ampliação do olhar do enfermeiro do trabalho em seu campo de atuação e pode contribuir de forma significativa para a melhoria da qualidade das intervenções sejam elas individuais ou coletivas. **Contribuições para a enfermagem:** Este trabalho se propõe a contribuir para a atuação do enfermeiro nos ambientes de trabalho, através da Vigilância Sanitária, de forma científica e integrada, implicando na diminuição dos riscos e direcionando os esforços para uma assistência mais eficaz e efetiva. Vislumbra também, a ampliação do cuidado, ao trabalhador, a partir não de alterações biológicas, mas através de interface quanto ao ambiente no qual ele está inserido, o que proporciona um novo olhar nas ações de prevenção em saúde.

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HEALTH BEHAVIORS AS A MEDIATOR OF THE ASSOCIATION BETWEEN INTERPERSONAL RELATIONSHIPS AND PHYSICAL HEALTH IN A WORKPLACE CONTEXT[13]

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Health Behaviors as a Mediator of the Association Between Interpersonal Relationships and Physical Health in a Workplace Context

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Abstract: The etiology of diseases is multifactorial, involving genetic, environmental, and lifestyle-related behaviors. Considering the pathway that involves behavioral processes, a huge body of empirical evidence has shown that some healthy behaviors such as non-smoking, any or moderate alcohol consumption, a healthy diet, (e.g., fruit and vegetable intake), and physical activity, decrease the risk of disease and mortality. This study aimed to explore the potential mediating effect of combined health behaviors on the association between interpersonal relationships and physical health in a Brazilian adult worker population from the Occupational Health Service within the oil industry in Bahia, Brazil. The sample included 611 workers, of which 567 (92.8%) were males and 44 (7.2%) females, age ranging from 18 to 73 years (M = 41.95; SD = 8.88). The significant predictors of physical health were interpersonal relationships and health behaviors. Health behaviors contributed significantly to a reduction in the effect of interpersonal relationships on physical health outcomes. As far as it is known, there has been no prior work in Brazil that simultaneously examined the best predictors of physical health in oil workers using this conceptual model. Interventions in the workplace environment need to consider health behavior as a mediator between interpersonal relationships and physical health, aligned in a global psychosocial approach to health at work.

Keywords: physical health; health behaviors; interpersonal relationships; mediator; predictor

1. Introduction

One of the most important goals of medicine and public health is to prevent disease. The etiology of diseases is multifactorial, involving genetic, environmental, and lifestyle-related behaviors. Considering the pathway that involves behavioral processes, a huge body of empirical evidence has shown that some healthy behaviors such as non-smoking, any or moderate alcohol consumption, a healthy diet (e.g., fruit and vegetable intake), and physical activity decrease the risk of disease and mortality [1–13].

The individuals' social relationships have been linked not only to mental health but also to morbidity and mortality [14,15]. The two general theoretical models that propose processes through which social relationships may influence health are the stress buffering and main effects models. The buffering hypothesis [16] suggests that social relationships may provide resources (e.g., informational, emotional, or tangible) that promote adaptive behavioral or neuroendocrine responses to acute or chronic stressors and thus moderate or buffer the deleterious influence of stressors

on health. The main effects model [17] proposes that social relationships may be associated with social influences, services, information, and psychological states that may influence engagement with healthy behaviors, which in turn influence the biological systems (e.g., endocrine, immune), and lastly influence physical health. According to some theorists, such as Umberson [18], Lewis and Rook [19], these health behaviors may mediate the connections between social relationships and health outcomes that are presented in the literature [14,17,20–24]. For example, perceived social support has been linked to better health behaviors, such as fruit and vegetable consumption and exercise [25,26]. While perceived stress increases the probability for risk-taking behaviors [27], family, friends, and coworkers are likely to observe such behavioral changes and comment or attempt to intervene, such as pressing the subject to seek help [28]. Accordingly, social relationships facilitate healthier behaviors and adherence to medical regimens, which in turn protect the subject from developing the disease. Additionally, other potential mechanisms that might explain how social support can influence health are related to biological mechanisms, especially the immune-mediated inflammatory processes [29,30].

Despite evidence on health behavior mechanisms linking social support to physical health outcomes, the major models of social support and health have privileged psychological mechanisms such as perceived stress, depression, and positive effect [31]. Furthermore, much of the empirical evidence on the connection between lifestyle-related behaviors and physical health have been obtained from a single behavior and treat other health behaviors as confounds [32,33]. Studies on the relationship between physical activity and the prevention of coronary heart disease have included dietary factors such as covariates [7,34]. Furthermore, meta-analysis and systematic reviews have shown that the study of the relationship between health behaviors and disease and mortality usually do not include social relationships (e.g., Loef and Walach [5]). Finally, regardless of the three decades of studies that have verified the beneficial effects of social ties on health, much empirical evidence is needed, with special attention to different cultural contexts, where seeking support, social norms, and independence versus interdependence in the context of social relationships, differ [28].

Therefore, given the scarcity of international studies on this matter, specifically in Brazil, and considering the previous arguments, this study intends to explore the potential mediation effect of combined health behaviors on the connection between interpersonal relationships and physical health in a Brazilian adult worker population within the oil industry. Additionally, the correlations among variables, including sociodemographic ones, were explored, and the independent contribution of each variable in accounting for physical health outcomes, after adjusted for covariates (e.g., occupational stressors), were examined.

2. Methods

2.1. Participants

The sample included 611 workers, of which 567 (92.8%) were males and 44 (7.2%) were females, with an age range of 18 to 73 years ($M = 41.95$; $SD = 8.88$), all of whom were recruited from the Occupational Health Service of the Brazilian oil industry in Bahia. The exclusion criteria included participants with cognitive limitations or psychiatric disorders, as they do not allow the correct accomplishment of the electronic medical records. The inclusion criteria referred to patients (i.e., workers) from the Occupational Health Service of the Brazilian oil industry in Bahia.

The questionnaires were applied at the facilities of the mentioned Occupational Health Service, in a private, quiet room. The data were identified only with the registration numbers, thus ensuring confidentiality. The data were collected through electronic medical records for the year 2017 and the consultations were carried out throughout the year 2017.

All the users of the occupational health service were invited to participate in the study in person at the time of consultation of medicine and/or nursing and, thus, the sample is a convenience sample. After verbal consent, the data were collected under the medical database under analysis. The evaluation protocol took an average of 45 minutes to complete.

The study was approved by the Occupational Health Service of the Brazilian oil industry in Bahia and was also approved by the Ethics Committee of the Bahian School of Medicine and Public Health, based on the opinion of the Research Ethics Committee, CAAE no. 84318218.2.0000.5544, Brazil. All aspects related to privacy, confidentiality, access, and use of medical records, in the sense of compliance with ethical and legal requirements, were taken into care. In line with the guidelines of the Federal Medical Council, Brazil, the institution's corporate guidelines state that only the Coordinator of the Occupational Health Medical Control Program may authorize access to medical and administrative information recorded in medical records. Accordingly, this study was officially authorized and signed by the responsible authority.

This evaluation clearly had a double function: i) a medical evaluation that benefited the patients alone, that allowed to guide and optimize the medical intervention; and ii) participation in research. Assuming these premises, patients participating in this study were given an opportunity to improve or deepen their medical assessment in several dimensions, the variables under analysis, and thus, also ensure adequate and close intervention to the needs identified in a personalized way. This was a reward which was verbalized by the researchers as felt by the participants, considering the subsequent interventions based on the results of the extensive medical evaluation.

2.2. Instruments

Sociodemographic Questionnaire. A single worksheet to collect information on gender, age, education, birthplace, civil status, and nationality, was used.

Electronic Medical Records of the Year 2017. Software for collecting data on physical health, nutrients intake, health behaviors, interpersonal relationships, and workplace environment, was used. The individuals were evaluated by doctors, psychologists, nurses, and other health professionals in terms of the degree to which each problem affected them, on a Likert-type scale (i.e., 0 to 5: 0—absence to 5—high presence/frequency). Several items were grouped into outcome variables, as indicated below. The collection of electronic medical records was approved by the Directorate of the Occupational Health Service and the Ethics Committee of the Bahian School of Medicine and Public Health, based on the opinion of the Research Ethics Committee, CAAE no. 84318218.2.0000.5544, Brazil, as a valid instrument for the clinical evaluation of the composite variables under analysis: physical health, nutrients intake, combined health behaviors, interpersonal relationships, and workplace environment. Lower scores mean lower physical health, poor nutrients intake, lower combined health behaviors, and lower quality of interpersonal relationships. Conversely, lower scores may mean a better workplace environment.

2.3. Outcome Variables

Physical Health. This composite variable includes different dimensions, namely: Classification of flexibility, abdominal strength, strength of arms, oral hygiene, pain when exercising physical activity, diabetes melitus, glycemia, hypertension, blood pressure, dyslipidemia, body weight, periodontal community index, and personal characteristics. The internal consistency was 0.71 and the score ranged from 0 to 65.

Nutrients Intake. This composite variable includes different dimensions, namely: Simple carbohydrate, fibers, saturated lipids, mineral sodium, and liquids. The internal consistency was 0.61 and the score ranged from 0 to 25.

Health Behaviors. This composite variable includes different dimensions, namely: Physical activity level, smoking, alcohol consumption, self-care level, food choices (fruit and vegetable intake), and oral hygiene. The internal consistency was 0.65 and the score ranged from 0 to 30.

Interpersonal Relationships. This composite variable includes different dimensions, namely: Socio-environmental components, family relations, social characteristics, and relationships in the workplace environment. The internal consistency was 0.60 and the score ranged from 0 to 20.

Workplace Environment. This composite variable includes different dimensions, namely: Exposure to risk agents, health surveillance, food safety, and environmental components. The internal consistency was 0.55 and the score ranged from 0 to 20.

2.4. Data Analysis

Data analyses were carried out using the SPSS version 24 for Windows (IBM Corporation, New York, NY, USA). Descriptive statistics were calculated to characterize the study variables. The Pearson correlation test was used to examine the associations among the study variables. Hierarchical multiple regression analysis was used to calculate the independent contribution of workplace environment, nutrients intake, interpersonal relationships, and health behaviors in order to provide an estimate of incremental variance accounting for physical health, after being adjusted for age and gender. The mediation analyses were carried out with the PROCESS model [35] to SPSS. The bootstrapping technique with estimated coefficients from 5000 bootstrap samples was applied to determine direct and indirect effects. Confidence intervals (*CI*) that do not contain zero indicate a significant indirect effect. Pairwise deletion was used to handle missing data.

3. Results

3.1. Descriptive

Descriptive statistics of key measures are presented in Table 1. The total score was used for all variables.

Table 1. Descriptive statistics for the study variables ($N = 571$).

Variables	Total Sample					
	M		*SD*		*Min*	*Max*
Physical health	43	0.72	7	0.32	19	61
Workplace environment	12	0.19	1	0.23	7	18
Nutrients intake	13	0.59	1	0.62	7	22
Interpersonal relationships	13	0.35	2	0.06	5	19
Health behaviors	20	0.04	3	0.34	7	30

M: mean; *SD*: standard deviation; *Min*: minimum; *Max*: maximum.

3.2. Correlations

The correlations among the key measures are presented in Table 2. Physical health was significantly associated with all key measures, except with the workplace environment.

Table 2. Correlations for the study variables.

Variables	1	2	3	4	5
1. Physical health	-				
2. Workplace environment	−0.01	-			
3. Nutrients intake	0.28***	0.13**	-		
4. Interpersonal relationships	0.32***	0.18***	0.09	-	
5. Health behaviors	0.65***	0.03	0.39***	0.37***	-

**$p < 0.01$, two-tailed; ***$p < 0.001$.

3.3. Hierarchical Multiple Regression Analysis to Predict Physical Health

The results from the hierarchical regression analyses are presented in Table 3. The first block, including age and gender, significantly contributed to the regression model, $R^2 = 0.06$, $F(2, 565) = 19.69$, $p < 0.001$, and Cohen's $f^2 = 0.06$. Adding the workplace environment in the second block, the model remained statistically significant, $F(3, 564) = 13.17$, $p < 0.001$, but this variable did not significantly

contribute to the explained variance. Nutrients intake and interpersonal relationships were entered in the third step, and the model remained significant, $F(5, 562) = 32.84$, $p < 0.001$, and Cohen's $f^2 = 0.21$, contributing an additional 16% to the explained variance. Health behaviors were added in the final step, and the model remained significant, $F(6, 561) = 82.22$, $p < 0.001$, and Cohen's $f^2 = 0.44$, contributing an additional 24% to the explained variance. The final model explained 47% of the variance, with Cohen's $f^2 = 0.89$.

Table 3. Hierarchical regression analyses predicting physical health.

Model[a]	*B*	*β*	*t*
Step 1: $R^2 = 0.06$**			
Age	−0.14	−0.18	−4.27***
Gender	4.73	0.16	3.90***
Step 2: $R^2 = 0.06$; $\Delta R^2 = 0.00$			
Workplace environment	−0.10	−0.02	−0.43
Step 3: $R^2 = 0.23$***; $\Delta R^2 = 0.16$***			
Nutrients intake	1.00	0.22	5.75***
Interpersonal relationships	1.11	0.32	8.35***
Step 4: $R^2 = 0.47$***; $\Delta R^2 = 0.24$***			
Constant	17.91		
Age	−0.12	−0.15	−4.86***
Gender	2.93	0.10	3.14**
Workplace environment	−0.28	−0.05	−1.52
Nutrients intake	0.08	−0.06	0.50
Interpersonal relationships	0.43	0.12	3.64***
Health behaviors	1.33	0.58	15.97***

[a] Only Steps 1 and 4 show the complete model for that step. Other steps show only new variables, and coefficients are not for interpretation. ** $p < 0.01$; *** $p < 0.001$, two-tailed.

3.4. Mediation Analysis

Simple mediation analyses, the most commonly employed type of mediation model, were conducted, cf. model 4 in Hayes [35]. The interpersonal relationships variable was input into the model as predictor, health behaviors as mediator, and physical health as outcome variable. A statistically significant effect of the interpersonal relationships on health behaviors ($B = 0.54$, $SE = 0.06$, $p < 0.001$), was observed. The total effect of the interpersonal relationships on physical health outcomes was significant ($B = 1.06$, $SE = 0.14$, $p < 0.001$), but their effect was significantly reduced ($B = 0.30$, $SE = 0.12$, $p < 0.01$) when health behaviors was controlled ($B = 1.41$, $SE = 0.08$, $p < 0.001$). The analysis of the indirect effect with bootstrapping data extracted, supported a significant level ($B = 0.76$, $SE = 0.10$, 95% *CI* (0.58, 0.96).

4. Discussion

The current study aimed to explore the potential mediation effect of combined health behaviors on the connection between interpersonal relationships and physical health in a Brazilian adult workers population in the oil industry.

The findings confirmed expectations that health behaviors mediated the relationship between interpersonal relationships and physical health in the sample. Several evidences have shown the link between social relationships and health outcomes [14,17,21,23,24], but most of the mechanisms that have been studied are perceived stress, depression, and positive affect [31], which affect the physical health through the immune system and inflammatory processes [29,30,36–40]. Besides the stress buffering and main effects models to explain the relationship between interpersonal relationships and physical health, the findings suggest a mediational model since the impact on health was also driven

on behaviors, as smoking, alcohol consumption, a poor diet, and lack of physical activity, relevant in the field of worker's health [41].

While the link between interpersonal relationships and physical health is well known in the literature (e.g., Feeney and Collins [42]), theoretically driven on stress buffering and main effects models, less information exists whether health behaviors work as mediational mechanisms on this relationship. On one hand, the engagement in health-risk behaviors act as compensatory factors to cope with interpersonal problems or isolation. According to some theoretical models (e.g., self-medication hypothesis and experiential avoidance model) [43,44], some behaviors are taken to avoid or escape from unwanted emotional states, such as shame, sadness, frustration, or reducing interpersonal conflicts [43]. This hypothesis is not new in the field of adverse childhood experiences. Several years ago, the CDC-Kaiser Permanente Adverse Childhood Experiences (ACE) study [45] hypothesized that the relationship between exposure to adversity and premature death was explained by behaviors such as smoking, alcohol or drug abuse, overeating, or sexual behaviors [46]. The authors of that study argued that individuals exposed to adversity could consciously or unconsciously use such behaviors, considering their pharmacological or psychological benefit, as coping devices in the face of the stress of abuse, domestic violence, or other forms of family and household dysfunction. On the other hand, the interpersonal relationships may provide incentives for engagement in health behaviors and thereby protect people from disease. As previously mentioned, interpersonal relationships could facilitate healthier behaviors, such as non-smoking, any or moderate alcohol consumption, a healthy diet (e.g., fruit and vegetable intake), and physical activity, which in turn protect the subject from developing the disease.

5. Conclusions

As far as it is known, there has been no prior work in Brazil that simultaneously examined the best predictors of physical health in oil workers using this conceptual model. Specifically, the results from this study suggest that nutrients intake, interpersonal relationships, and health behaviors are predictors of physical health.

In this sense, interventions in the workplace environment and, specifically, interventions in health at work need to focus on these factors, aligned with a psychosocial approach to this phenomenon. It is therefore important that planning interventions and regular monitoring of workers in their workplaces should consider this psychosocial and holistic approach. Finally, these results acknowledge the success of health interventions in this particular industry under study.

Furthermore, the findings added to the theory that the possible existence of a mediational model where health behaviors have an important role as a mediator between interpersonal relationships and physical health. Additionally, in terms of practical implications, the findings of this study make a compelling case for interpersonal relationships to be recognized by companies as a risk factor for engaging in risk-behaviors and consequently the development of disease. With such recognition, the occupational health services need to include the assessment of quality of interpersonal relationships of their workers, both at work and in a family context.

Conducted in SPSS with the PROCESS model, with a theoretical background compatible with the statistical analyses carried out, and based on the recent literature on this subject, this preliminary study presents statistically significant and theoretically relevant results, allowing researchers to guide studies towards an increasingly robust and up-to-date mediation effects and processes.

6. Limitations and Future Directions

This study has two main limitations that can be addressed in future research.

First, the sample is not representative of the population of oil workers in Brazil, so care must be taken when it comes to generalizing the results. However, specifically, the sample is representative of the population of workers recruited from an Occupational Health Service within the Brazilian oil industry in Bahia.

Additionally, a mediational hypothesis implies a causal sequence that cannot be tested with cross-sectional data. Considering that this is a cross-sectional study, any causality relationships between the variables under study must be interpreted with caution. Nevertheless, the psychopathology symptoms or other psychological diseases at the moment of the questionnaire being administrated, were not accessed. Finally, being a cross-sectional study, any causality relationships between the variables under study must be interpreted with care. In spite of the cross-sectional study design, these results point to the success of independent variables, i.e., nutrients intake, interpersonal relationships and health behaviors, in predicting the dependent variable, physical health.

Future studies should explore associations between mechanisms, such as relationships-related health behaviors, and other competing mechanisms, such as depression and anxiety.

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EFFECTIVENESS OF AN ORAL HEALTH PROGRAM AMONG BRAZILIAN OIL WORKERS[14]

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Effectiveness of an Oral Health Program Among Brazilian Oil Workers

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Abstract The aim of this study was to assess the effectiveness of the implementation of an oral health program among Brazilian oil workers, Bahia. The program consists in an annual consultation, with and an occupational dentist and oral health technicians, performing oral examination, in addition to having access to plaque and gingival indices obtained in the exam. The Oral Hygiene Index (OHI) was used, as well as the "Quality of oral hygiene", "Periodontal disease", "Systemic Arterial Hypertension" (SAH) and "Diabetes Mellitus" (DM) questionnaires. The reduction of periodontal disease was associated with the improvement of oral hygiene quality, with a positive impact in the reduction of the probability to develop high blood pressure and DM. The oral health promotion programme was effective in keeping or maintaining good oral health among workers, also resulting in savings to the company.

Keywords Periodontal disease · Oral health program · Oil industry

1 Introduction

The World Health Organization [1] defines strategies for oral disease prevention and health promotion, detailed in four different objectives: (i) reduction of the burden and disability of oral diseases, particularly in poor and marginalized populations; (ii) promotion of healthy lifestyles and reduction of risk factors for oral health arising from environmental, economic, social and behavioral causes; (iii) development of oral health systems that equitably improve oral health outcomes, responding to people's legitimate demands and are financially fair; and

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(iv) frame oral health policies, based on the integration of oral health into national and community health programs, and promote oral health as an effective dimension to society's development policy.

The relative high risk of oral disease is related to socio-cultural determinants such as poor living conditions, low education level, lack of traditions, beliefs and culture in support of oral health. In addition, oral disease control depends on the availability and accessibility of oral health systems, but the reduction of oral disease risks is only possible if services are oriented towards primary health care and prevention. Specifically regarding the worker, severe oral health conditions and unmet dental care needs can interfere with the individual's workday, either through absenteeism or presentism. Stimulating self-care through plaque control, either by assisted brushing or by the dental prevention procedure, is an important measure in health promotion and disease prevention [2].

The implementation of a Workers Oral Health Program, based on the principles of health promotion and prevention, aiming at reducing oral illness and, consequently, improving the quality of life, is of fundamental importance in the industry context. In this sense, this study aimed to analyze the association between the Quality of Oral Hygiene (QOH), Periodontal Disease (PD), hypertension and diabetes in workers under intervention of the Workers Oral Health Program of the studied oil company.

2 Materials and Methods

The study was performed at the occupational health service of the oil industry, Bahia, Brazil, in 2018. 715 workers were enrolled in the Workers Oral Health Program and were attended by an occupational dentist and oral health technicians, in consultation with an average duration of 45 min, in which they received information about the plaque and the damage that it can causes, oral examination with the aid of intraoral camera, performed plaque development assessment, assisted brushing and dental floss with the aid of audio-visual material, receiving home-use pads as an aid in brushing, in addition to having access to plaque and gingival indices obtained in the exam. To classify the Oral Hygiene Index (OHI), the Greene and Vermillion Simplified Oral Hygiene Index protocol [3], referred by Chaves [4], as well as the probing technique for PD diagnosis, were used. The use of OHI as a tool for assessing the quality of oral hygiene of the worker, besides allowing a more directed orientation to each individual, made possible the data analysis and its association with other health indicators. To collect information a questionnaire covering the "Quality of oral hygiene", "Periodontal disease", "Systemic Arterial Hypertension (SAH)" and "Diabetes Mellitus" (DM), was used.

Data analysis was performed using SPSS version 25 for Windows (United States, New York, IBM Corporation). Chi-square (χ^2) test was used to test associations between nominal variables. Correlation analysis between variables was performed using *Pearson's* correlation (r^2) coefficient.

The study was approved by the Research Ethics Committee of the Bahiana School of Medicine and Public Health of Brazil, registered with CAAE 84318218.2.0000.5544.

3 Results and Discussion

According to Table 1, men (91.3%), aged between 50–59 years (46.2%), married (57.1%) and with complete middle level of education (64.3%), prevailed in this study.

Table 1 Sample characterization

Variables	Sex		*p*
Age	Male	Female	
<29	25 (3.8)	5 (8.1)	0.001
30–39	157 (24.0)	28 (45.2)	
40–49	138 (21.1)	13 (21.0)	
50–59	302 (46.2)	15 (24.2)	
>60	31 (4.7)	1 (1.6)	
Marital Status			
Single	237 (6.3)	30 (48.4)	0.025
Stable union	20 (3.1)	1 (1.6)	
Married	373 (57.1)	25 (40.3)	
Divorced	21 (3.2)	6 (9.7)	
Other	2 (0.3)	0 (0.0)	
Education			
Incomplete middle level	56 (9.9)	1 (1.7)	0.191
Complete middle level	362 (64.3)	39 (66.1)	
Incomplete high level	2 (0.4)	0 (0.0)	
Complete high level	111 (19.7)	13 (22.0)	
Complete high level with post-graduate studies	32 (5.7)	6 (10.2)	
OHI			0.005
Bad oral hygiene (OHI >3.0).	5 (0.8)	0 (0.0)	
Poor oral hygiene (OHI 2.1 to 3.0)	56 (8.6)	0 (0.0)	
Regular oral hygiene (OHI 1.1 to 2.0)	239 (36.6)	14 (22.6)	
Proper oral hygiene (OHI 0.0 to 1.0)	148 (22.7)	23 (35.5)	
Adequate oral hygiene with basic semi-annual therapy	205 (31.4)	26 (41.9)	

(continued)

Table 1 (continued)

Variables	Sex		*p*
Age	Male	Female	
PDI			0.183
0—Untreated periodontitis, with tooth mobility, associated with risk factors (smoking and/or CNCDs)	4 (0.6)	0 (0.0)	
1—Untreated periodontitis, with tooth mobility, not associated with risk factors (smoking and/or CNCDs)	3 (0.5)	0 (0.0)	
2—Periodontitis without treatment, without tooth mobility, associated or not with risk factors (smoking and/or CNCDs)	11 (1.7)	0 (0.0)	
3—Treated periodontitis, associated or not with risk factors	7 (1.1)	3 (4.8)	
4—Same previous condition associated with periodic maintenance consultation	1 (0.2)	0 (0.0)	
5—Does not have periodontal disease	627 (96.0)	59 (95.2)	

Notes CNCDs—Chronic Non-communicable Diseases; OHI—Oral hygiene index; PDI—Periodontal disease index

The results reveal that male workers have worst QOH ($p = 0.005$), a result previously identified by Al-Ansari and Honkala [5]. The majority of workers have a proper (56.1%) or regular QOH (35.4%). Relating the PDI, no significant differences were found between male and female workers ($p = 0.183$). In general, 95.9% of the workers do not present periodontal disease. Despite this, 2.5% of the periodontal disease diagnostics do not have treatment and have higher probability to be associated with CNCDs and smoking. Table 2 aims to present the results of the association between PDI and other factors, such as the quality of workers oral hygiene and the arterial hypertension and DM prevalence among workers. The number and percentage (between parentheses) of workers are presented, as well as the value of chi-square association and *Pearson* correlation (last line of each association).

The results in Table 2 reveal a significant association ($p = 0.001$) between the QOH and the PDI. Based in this outcome it is possible to state that the realization of an adequate oral hygiene with the performance of basic semi-annual therapy is associated with a lower probability to develop PD. Previous studies [6–8], have also reported that a poor oral hygiene results in a high risk of periodontitis by two- to five-fold.

Another important result is the identified association between arterial hypertension and the PD ($p = 0.003$). HBP can lead to changes in microcirculation, able to cause ischemia in the periodontium, which favours periodontal disease [9, 10]. An association between the reduction of PD and the cumulative reduction of DM was also found ($p = 0.003$). This result is in accordance with past studies [11, 12] reporting that the treatment of periodontal disease is associated with diabetes reductions of approximately 0.4%.

Table 2 Association between periodontal disease and oral hygiene, high blood pressure and diabetes mellitus

		PDI					
		0	1	2	3	4	5
QOH	Bad oral hygiene (OHI >3.0)	0 (0.0)	0 (0.0)	1 (9.1)	0 (0.0)	0 (0.0)	4 (0.6)
	Poor oral Hygiene (OHI 2.1 to 3.0)	4 (100)	1 (33.3)	6 (54.5)	1 (10.0)	0 (0.0)	44 (6.4)
	Regular oral hygiene (OHI 1.1 to 2.0)	0 (0.0)	2 (66.7)	4 (36.4)	3 (30.0)	0 (0.0)	244 (35.6)
	Proper oral hygiene (OHI 0.0 to 1.0)	0 (0.0)	0 (0.0)	0 (0.0)	4 (40.0)	0 (0.0)	166 (24.2)
	Adequate oral hygiene with basic semi-annual therapy	0 (0.0)	0 (0.0)	0 (0.0)	2 (20.0)	1 (100)	228 (33.2)
		$\chi^2 = 106.1$ ($p = 0.001$); $r^2 = 0.226$ ($p = 0.001$)					
HBP	SAH with associated clinical conditions (ACD or CKD)	0 (0.0)	0 (0.0)	1 (9.1)	0 (0.0)	0 (0.0)	6 (0.9)
	SAH with presence of target organ injury or DM	0 (0.0)	0 (00)	0 (0.0)	1 (10.0)	0 (0.0)	7 (1.0)
	SAH with 3 or more risk factors	0 (0.0)	1 (33.3)	1 (9.1)	0 (0.0)	0 (0.0)	12 (1.7)
	SAH with 1 to 2 risk factors	2 (50.0)	1 (33.3)	1 (9.1)	4 (40.0)	1 (100)	103 (15.0)
	SAH without risk factor	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	8 (1.2)
	Non hypertensive	2 (50.0)	1 (33.3)	8 (72.7)	5 (50.0)	0 (0.0)	550 (80.2)
		$\chi^2 = 49.4$ ($p = 0.003$); $r^2 = 0.127$ ($p = 0.001$)					
DM	Glycated Hb >9% or Fasting blood glucose >200 mg/dl, maintaining these results for the last 2 years	0 (0.0)	1 (33.3)	1 (9.1)	1 (10.0)	0 (0.0)	10 (1.5)
	Glycated Hb >9% or Fasting blood glucose >200 mg/dl	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	2 (0.3)
	Hb glycated between 7 and 9% or Fasting glycemia between 130 and 200 mg/l	0 (0.0)	1 (33.3)	2 (18.2)	0 (0.0)	0 (0.0)	32 (4.7)
	Glycated Hb < 7% or Fasting blood glucose <130 mg/dl	1 (25.0)	0 (0.0)	0 (0.0)	1 (10.0)	0 (0.0)	10 (1.5)
	Glycated Hb < 7% or Fasting blood glucose <130 mg/dl, maintaining these results for the last 2 years	0 (0.0)	0 (0.0)	1 (9.1)	1 (10.0)	1 (100)	11 (1.6)
	Non diabetic	3 (75.0)	1 (33.3)	7 (63.6)	7 (70.0)	0 (0.0)	621 (90.5)
		$\chi^2 = 110.04$ ($p = 0.001$); $r^2 = 0.181$ ($p = 0.001$)					

Notes ACD—atherosclerotic cardiovascular disease; CKD—Chronic Kidney Disease; SAH—Systemic arterial hypertension; DM—Diabetes Mellitus

4 Conclusions

The results showed that the education actions carried out in the scope of the Workers Oral Health Program allow the involvement of the individuals in relation to the self-care of their oral health condition, contributing to the evident visualization of the amount of bacterial plaque still adhered to the teeth after poor oral hygiene, visualizing existing lesions through the intraoral chamber and performing basic therapy within the oil company. These actions encourage workers to play their role in promoting their own health, also resulting in reduced absenteeism, with evident economic implications.

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THE INFLUENCE OF SOCIAL RELATIONS, LEISURE AND DRUG USE ON MENTAL HEALTH OF OIL INDUSTRY WORKERS IN BRAZIL[15]

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The Influence of Social Relations, Leisure and Drug Use on Mental Health of Oil Industry Workers in Brazil

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Abstract: -The objective of this study was to investigate the influence of social relations, leisure and drug use on the mental health of workers in the oil industry of Bahia, Brazil. It is a descriptive, retrospective research, developed in 2018, involving 622 workers from an occupational health service, to whom the Self Reporting Questionnaire (SRQ-20) and a socioeconomic questionnaire were applied. Men (90.2%), aged between 50-59 years (45.6%), married (54.9%) and with a mean level of schooling (64.2%) prevailed in this study. Of the participants, 50% drink less than once a month and about 90% never smoked. An association between loss of interest in things and increase in alcohol consumption was identified ($p < 0.05$). Another association can be found between feeling nervous, tense or worried and increasing tobacco consumption ($p < 0.05$). In almost 95% of the participants, components of the family environment that positively interfere with health were identified, as well as the use of social and leisure environments to maintain and recover health. Social and leisure relations positively influence the mental health of the studied group, and alcohol and tobacco consumption are associated with common mental disorders (CMD).

Key –Words: Mental health – Oil industry – Health Promotion – Worker's health – Common mental disorders (CMD)

1 Introduction

Mental disorders in the world affect hundreds of millions of people and, if left untreated, represent a significant price in terms of suffering, disability and economic loss [1]. In Brazil, and according to data from the Statistical Yearbook of Social Security 2015[2], common mental disorders (CMD) appear as the third cause among active urban disease-aids, accounting 1,032,959 aids in 2015. CMDs are characterized by symptoms such as insomnia, fatigue, irritability, forgetfulness, difficulty in concentrating and somatic complaints [3]. In population-based studies conducted in industrialized countries, CMD prevalence varies from 7% to 30%. Often found in the community, CMD represent a high social and economic cost, since they are an important cause of lost days of work, as well as increasing demand in health services [4]. Psychiatric epidemiology studies have verified the association of CMD with variables related to living conditions and occupational structure and the Brazilian version of the Self-Reporting Questionnaire (SRQ-20) [5], which is widely used for tracking physical signs and psycho-emotional disorders.

2 Problem Formulation

This study aimed to investigate the influence of social relations, leisure and drug use on the mental health of workers in the oil industry, Bahia, Brazil. Developed in 2018, it is a descriptive, retrospective research, comprising 622 workers of an occupational oil health service, to which the Self Reporting Questionnaire (SRQ-20) was applied. SRQ-20 encompasses 20 dichotomous questions of the yes/no type, of which 4 refer to physical symptoms and 16 to psycho-emotional disorders, as well as a socioeconomic questionnaire. All individuals with an employment relationship with the company were included and excluded those away because of illness.

Data analyses were performed through SPSS version 25 for Windows (United States, New York, IBM Corporation). Chi-square test was used to compare demographic data of sample by sex *t*-test for independent samples was applied to compare SRQ-20 results by sex. The associations between drug consumption, social relations and leisure with the SRQ-20 were performed with the chi-square test. The study was approved by the

Research Ethics Committee of the Bahian School of Medicine and Public Health, Brazil and registered with CAAE 84318218.2.0000.5544.

3 Problem Solution

According to Table 1, men (90.2%), aged between 50-59 years (45.6%), married (54.9%) and with middle level of schooling (64.2%), prevailed in this study.

Table 1. Sample's sociodemographic characterization and SRQ-20 results

	n	%	*n*	%	
	561	90.2	61	9.8	
Age group (years)					
≤ 29	22	3.9	5	8.2	
30-39	143	25.5	27	44.3	
40-49	109	19.4	13	21.3	**0.002**
50-59	256	45.6	15	24.6	
≥ 60	31	5.5	1	1.6	
Marital status					
Single	221	39.4	29	47.5	
Stable union	17	3.0	1	1.6	
Married	308	54.9	24	39.3	**0.001**
Divorced	13	2.3	7	11.5	
Other	2	0.4	0	0.0	
Schooling level					
Incomplete middle level	54	9.6	1	1.6	
Complete middle level	360	64.2	40	65.6	
Incomplete high level	2	0.4	0	0.0	0.191
Complete high level	114	20.3	6	9.8	
Complete high level with post-graduate studies	31	5.5	6	9.8	
Anxiety-depressive mood					
Do you feel nervous, tense or worried?	175	31.2	25	41.0	0.120
Are you easily scared?	22	3.9	8	13.1	**0.001**
Are you feeling sad lately?	59	10.5	10	16.4	0.165
Do you cry more than usual?	7	1.2	7	11.5	**0.001**
Somatic symptoms					
Do you have frequent headaches?	32	5.7	11	18.0	**0.002**
Do you sleep badly?	105	18.7	19	31.1	**0.021**
Do you have stomach discomfort?	78	13.9	8	13.1	0.865
Do you have bad digestion?	42	7.5	8	13.1	0.125
Do you lack appetite?	9	1.6	0	0.0	0.323
Do you have tremors in your hands?	15	2.7	3	4.9	0.321
Decrease in vital energy					
Do you get tired easily?	39	7.0	8	13.1	0.084
Do you have difficulty making a decision?	20	3.6	7	11.5	**0.004**
Are you having difficulty with your tasks?	47	8.4	5	8.2	0.961
Does your work bring suffering?	20	3.6	3	4.9	0.595
Do you feel tired all the time?	16	2.9	5	8.2	**0.028**
Do you have difficulty thinking clearly?	9	1.6	1	1.6	0.984
Depressive thoughts					
Do you feel unable to play a useful role in your life?	2	0.4	0	0.0	0.640
Have you lost interest in things?	14	2.5	3	4.9	0.270
Have you thought about ending your life?	0	0.0	0	0.0	n.a.
Do you feel useless in your life?	4	0.7	0	0.0	0.508

The results reveal that in what respects anxious-depressive mood, 41% of women and 32.2% of men feel nervous, tense or worried and 11% of men feel sad lately. Compared to men, women are more easily frightened (p = 0.001) and cry more than usual (p = 0.001). In the somatic symptoms domain, 18.7% of men reported poor sleep, a result lower than that of women, 31.1% (p = 0.021). Another difference found refers to frequent

headaches, which 5.7% of men and 18% of women reported having (p = 0.002). No significant differences were found between men and women in the case of stomach discomfort, respectively 14% and 13%. In terms of vital energy, 7% of men feel well and 8.4% have difficulty in having satisfaction in their tasks. Women have more difficulty in making decisions (p = 0.004) and feel more tired when compared to men (p = 0.028). In what relates assessing depressive thoughts, 3% of men and 4.9% of women lost interest in things. These differences are not statistically significant.

Table 2 presents the SRQ-20 results found in assessing the association between drug consumption, social relations and leisure.

Table 2. Associations between drug consumption, social relations and leisure, using SRQ-20 dimensions

	SRQ-20 Dimension	**Have you lost interest in things?** *n* (%) **Yes**	*n* (%) **No**	*p*
Alcohol	Drinks once or more a week and consume 5 or more doses per occasion once a week or more	2 (22.2)	7 (77.8)	<0.05
	Drinks once a week or more and can either twice consume 5 or more doses per occasion at least once a week, but more than once a year	0 (0)	59 (100)	
	Drinks 1 to 3 times a month and can or 2 drink 5 doses or more at least once a year	2 (1.9)	102 (98.1)	
	Drinks less than once a month, but at least once per year and 2 drinks 5 or more doses on one occasion	8 (2.5)	316 (97.5)	
	Does not drink alcohol	5 (4.2)	114 (95.8)	
		Do you feel nervous, tense or worried? **Yes**	**No**	
Tobacco	Smokes 15-24 cigarettes/day	2 (66.7)	1 (33.3)	<0.05
	Smokes 1-14 cigarettes/day	5 (38.5)	8 (61.5)	
	Former smoker	3 (33.3)	6 (66.7)	
	Ex-smoker for more than 5 years	6 (13.6)	38 (86.4)	
		Do you feel unable to play a useful role in your life? **Yes**	**No**	
Social aspects and leisure	Uses leisure and social environments as a way of maintaining/recovering health and does not identify the importance of these actions in terms of well-being	0 (0)	7 (100)	<0.001
	Uses leisure and social environments as a way of maintaining/recovering health and identifies the importance of these actions in terms of well-being	1 (0.2)	594 (99.8)	
	Same old condition. Describes positive health outcomes	1 (11.1)	8 (88.9)	
		Do you feel useless in your life? **Yes**	**No**	
	Uses leisure and social environments as a way of maintaining/recovering health and does not identify the importance of these actions in terms of well-being	0 (0)	7 (100)	<0.001
	Uses leisure and social environments as a way of maintaining/recovering health and identifies the importance of these actions in terms of well-being	3 (0.5)	592 (99.5)	
	Same old condition. Describes positive health outcomes	1 (11.1)	8 (88.9)	

It is important to note that more than about 50% of the participants drink less than once a month and about 90% never smoked. In the context of mental health, an association was identified between the loss of interest in things and an increase in alcohol consumption (p <0.05). Another association is found between feeling nervous, tense or worried and increased tobacco consumption (p <0.05).

Components of the family environment positively interfering in health as well as the use of leisure and

social environments to maintain and recover health were identified in almost 95% of the participants. An association was identified between the level of leisure and social relations and the inability to play a useful role in life (p <0.001) and with the feeling of worthlessness (p <0.001).

4 Conclusion

Social and leisure relations positively influence the mental health of the studied group, and alcohol and tobacco consumption are associated with CMD. Considering the complexity of the workplace context, workplaces are favourable environments for addressing this topic in order to protect the workers' health and their social well-being through mainly collective strategies.

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EVALUATION OF THE IMPLEMENTATION OF THE TOBACCO CONTROL PROGRAM IN WORKERS' HEALTH: EVIDENCE FROM AN OIL INDUSTRY IN BAHIA, BRAZIL[16]

[16] **Viterbo, L. M. F.,** Vidal, D. G., Costa, A. S., & Dinis, M. A. P. (2019). Evaluation of the implementation of the Tobacco Control Program in workers' health: evidence from an oil industry in Bahia, Brazil. Proceedings of the International Congress of Health and Well-Being Intervention - ICHWBI2019. Disponível em http://workjournal.org/health-and-well-being-intervention-international-congress-abstracts

International Congress of Health and Well-being Intervention, on May 31 and June 1, 2019, **Instituto Piaget** University Campus of Viseu

Evaluation of the implementation of the Tobacco Control Program in workers' health: evidence from an oil industry in Bahia, Brazil

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ABSTRACT

BACKGROUND: Smoking is a risk factor in the development of chronic diseases, leading the preventable causes of death in the world (1,2).Workplaces have advantages for the implementation of health programs, including those for control and cessation of tobacco use in relation to non-work environments (3). **OBJECTIVE:** This study aims to evaluate the first results of the implementation of Tobacco Control Program (TCP) to combat smoking habits in a population of workers in oil industry, Bahia, Brazil. **METHODS:** This is a retrospective longitudinal study from 2006 to 2015 and data were collected in the electronic medical record of company's occupational service and had, on average, the participation of 1736 individuals, starting with 1752 in 2006 and ending with 1460 in 2015. Despite the population fluctuation the difference is not statistically significant (p> 0.05). Since 2007 the smokers were invited to participate in the TCP of the company, based on methodology recommended by the Brazilian National Cancer Institute, including educational actions, environmental control and interdisciplinary assistance focusing on prevention and damage reduction. Data analysis was performed using the IBM® SPSS® Statistics vs.24.0, considering a level of significance of 0.05 for all statistical inference situations. After evaluating the normality of the variables, the Student's *t*-test was applied to paired samples. In all the years of the study, Brazilian men, married, aged between 51 and 60 years old, in administrative work regime, residents in the state capital and with full secondary schooling, prevailed. In 2006, the percentage of smokers in the institution was 8.6% and in 2015 of 3.9%. Despite the population fluctuation the difference is not statistically significant ($p< 0.05$). The nurses realized appointments to assess the history of smoking, habits associated with smoking, and application of the *Fagerston Nicotine Dependence Test* (4). **RESULTS:** Although Brazilian studies show different rates of abandonment in therapeutic programs, these rates were close to 50% or above, i.e., it was observed that the interventions had some effect on the population submitted to these actions (5). **CONCLUSIONS:** In conclusion, the first evaluation of the TCP in the oil industry reveals that the investment in interdisciplinary programs in the workplace

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has positive effects on the health of the workers involved, namely in the development of healthy practices and lifestyles that, together, contribute to the well-being of the workers. In addition to the positive change that these results highlight, they also play an important role in motivation of the workers not involved in the program to participate in future similar actions.

Keywords: *tobacco, oil industry, workers' health, well-being*

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USE OF LIGHT TECHNOLOGIES AS A STRATEGY FOR CHANGING THE HEALTH PROFILE OF WORKERS WITH CHRONIC CONDITIONS IN THE OIL INDUSTRY, BAHIA, BRAZIL[17]

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ICPCM19-62160 **USE OF LIGHT TECHNOLOGIES AS A STRATEGY FOR CHANGING THE HEALTH PROFILE OF WORKERS WITH CHRONIC CONDITIONS IN THE OIL INDUSTRY, BAHIA, BRAZIL**

ANDRÉ SANTANA COSTA (1); LILIAN MONTEIRO FERRARI VITERBO (2); INGRID BONFIM SILVA (1); SUELI DE OLIVEIRA NASCIMENTO (1); DIOGO GUEDES VIDAL (2); MARIA ALZIRA PIMENTA DINIS (2) • 1 UNIVERSIDADE CORPORATIVA, 41745-002 BAHIA, BRAZIL; • 1 UFP ENERGY, ENVIRONMENT AND HEALTH RESEARCH UNIT (FP-ENAS), UNIVERSITY FERNANDO PESSOA, 4249-004 PORTO, PORTUGAL

POSTER

Anchored in the person-centred approach, the present work intends to analyse the impact of the use of health technologies classified as light technologies [1] in the monitoring of workers with chronic conditions, aiming to improve the health risk factors after periodic annual occupational health assessments in an oil industry, Bahia, Brazil. A total of 1,122 workers were evaluated from February 2018 to March 2019 and 52 subjects were classified as priority for health risk management. Tools indicated for use in assistance to patients with chronic conditions, validated in Brazilian version, developed to define the ability to take care of chronic conditions, such as: "Scale to Assess the Capabilities of Self-care (EACAC)", "Dyslipidemic Knowledge Scale Questionnaire", "Diabetes Knowledge Scale Questionnaire", "Hypertension Knowledge Scale Questionnaire" and the "Screening Test for

Alcohol-related Problems (CAGE)", were used. These tools were organized by the 5As methodology, divided into: Assessment, Counselling, Agreement, Assistance and Follow-up [2], applied during follow-up consultations. Care took place under the logic of the production of comprehensive care, which strengthens sensitive listening, attachment, mutual respect, autonomy and welcoming practices. The main focus resides in interventions oriented to the adoption of healthy habits and adherence to self-care, making workers social producers of their own health [3]. Prioritized workers were followed, on average, after 3 months of periodic annual assessment by an interdisciplinary team, with prepared individualized care plans, monitored for compliance. The 52 workers were reassessed 9 months after the intervention, with an improvement in health risk factor control in 29 workers (55.8%) based on behavioural changes in the follow-up period. The results demonstrate the relationship between the control and prevention of complications of chronic diseases, suggesting that the use of health light technologies may enhance care, worker's autonomy and strengthening of attachments.

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Keywords: light technologies; chronic conditions; person-centred approach; health risk factors

MENTAL HEALTH IN OIL WORKERS IN BRAZIL: THE RELATIONSHIP WITH DRUG ABUSE[18]

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no hemisfério esquerdo). Uma pontuação mais elevada na escala de NIHSS está associada a depressão major. A importância de iniciar a terapêutica antidepressiva assim que diagnosticada a doença, ou em alguns casos quando existir historial prévio. O apoio sociofamiliar como fator de proteção no desenvolvimento de DPA. E a abordagem holística como elemento fundamental para uma intervenção a nível biopsicossocial.
Conclusão: O diagnóstico precoce de depressão no sobrevivente de AVC é fulcral para possibilitar uma intervenção multidisciplinar atempada a fim de promover a recuperação física e cognitiva do utente.

Palavras-Chave: AVC, Depressão, Depressão Pós-AVC, Localização da Lesão, Intervenção Multidisciplinar

Mental Health in Oil Workers in Brazil: the Relationship with Drug Abuse
Saúde Mental em trabalhadores Petrolíferos no Brasil: a Relação com o abuso de Drogas

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Introduction: Due to the high rate of absenteeism and difficulties in the performance of activities, drug use has negative effects on the health of individuals and affects productivity in companies. The present study aimed to analyze the association between alcohol and tobacco consumption and specific dimensions of oil workers' mental health.
Methods: This is a descriptive, retrospective study, encompassing 622 oil industry employees from Bahia, Brazil, during the occupational health exams of 2018. They are mostly male (90.2%) and aged 50-59 years. The Brazilian version of the Self-Reporting Questionnaire (SRQ-20) and another questionnaire were used to assess the frequency of alcohol and tobacco consumption.
Results: About 50% of the participants admitted drinking less than once per month and about 90% reported never having smoked. In terms of mental health, an association between generalized loss of interest and increased consumption of alcohol ($p < 0.05$) was observed for the most serious drinkers (frequency: drinks once or more per week and intensity: consumes 5 or more drinks on occasion). An association between feeling nervous, tense or worried and increased smoking ($p < 0.05$), for smokers of 15-24 cigarettes/day, was also identified.
Conclusions: Alcohol and tobacco consumption were more widely admitted by workers reporting depressive thoughts and anxious-depressive mood symptoms. It is of fundamental importance that preventive actions are taken by oil companies, aiming to minimize the psychosocial risks involved in drug abuse by workers.

Key-Words: Mental Health, Alcohol, Tobacco, Worker's Health, Oil Industry

Family, Leisure and Social Environments' Influence in Mental Health: brazilian oil industry
Influência da Família, Lazer e Ambientes Sociais na Saúde Mental: Indústria Petrolífera Brasileira

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Influência da Família, Lazer e Ambientes Sociais na Saúde Mental: Indústria Petrolífera Brasileira

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Introduction: The World Health Organization estimates that by 2020, mental disorders will account for about 15% of all diseases. Since mental health is conditioned by the family and social context, the present

study aimed to analyse the influence of the family environment, leisure and social environments on workers' mental health.
Methods: This descriptive, retrospective study was carried out with 622 employees of the oil industry, Bahia, Brazil, during the occupational health exams in 2018, mostly males (90.2%), aged 50-59 years. The Brazilian version of the Self-Reporting Questionnaire (SRQ-20) and a social questionnaire were used to identify components of the family environment, i.e., affectivity, adaptation and/or autonomy, which act as mobilizers that interfere with health. Both tools also assessed the use of leisure, i.e., physical, manual, intellectual, artistic, social and tourism activities, and social environments, i.e., living and working conditions, studies and communities, as a way of maintaining and recovering health.
Results: More than 95% of the participants identified components of the family environment that positively influences health. The use of leisure and social environments as a way of maintaining and recovering their mental health, were also reported. At the level of mental health, an association between the level of leisure and social relations and the inability to play a useful role in life ($p<0.001$), and also with the feeling of worthlessness ($p<0.001$), was found.
Conclusions: The family environment, leisure and positive social environments are promoters of mental health and contribute to the overall well-being of oil workers.

Key-Words: Mental Health, Family Environment, Leisure, Worker's Health, Oil Industry

Resiliência das Crianças e Adolescentes: Perceção dos Pais

Resilience of Children and Adolescents: Parents' Perception

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Introdução: A parentalidade tem vindo a assumir um papel central nos temas de saúde, pelas implicações que pode ter não só na saúde e bem-estar dos progenitores, mas sobretudo ao nível do saudável desenvolvimento físico, cognitivo e emocional da criança e do adolescente.
Objetivos: Analisar a perceção dos pais relativamente à resiliência das crianças e adolescentes.
Métodos: Estudo quantitativo, descritivo e correlacional que envolveu uma amostra por conveniência não probabilística de 592 pais. Foi aplicado um questionário de caracterização sociodemográfica e a subescala Internal Assets do questionário Healthy Kids Resilience Assessment Module (versão 6.0), adaptada para a população portuguesa por Martins (2005). É uma subescala tipo Likert constituída por 18 itens classificada em 4 pontos correspondentes às seguintes seis dimensões: Cooperação e Comunicação; Autoeficácia; Empatia; Resolução de Problemas; Autoconsciência e Metas e aspirações.
Resultados: Ao analisar as dimensões da resiliência e o fator global de resiliência das crianças/adolescentes entendidos pelos pais, constata-se que a maior média corresponde à dimensão metas e aspirações ($M = 77,06 \pm 21,75$) e a menor refere-se à dimensão da autoeficácia ($M = 62,37 \pm 19,13$). O coeficiente de variação indica uma dispersão moderada quando comparado com as médias registadas.
Conclusão: A perceção dos pais mais jovens é de que as crianças são mais resilientes em todas as dimensões da resiliência, com diferenças significativas para a empatia, a resolução de problemas e a resiliência global sendo estas variáveis a considerar na promoção da parentalidade positiva.

Palavras-Chave: Resiliência, Práticas Educativas Parentais

IMPLANTAÇÃO DE PROGRAMA DE GESTÃO DE DOENTES CRÔNICOS COM ÊNFASE NO AUTOCUIDADO: UM RELATO DE EXPERIÊNCIA NA INDÚSTRIA DO PETRÓLEO NA BAHIA, BRASIL[20]

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IMPLANTAÇÃO DE PROGRAMA DE GESTÃO DE DOENTES CRÔNICOS COM ÊNFASE NO AUTOCUIDADO: UM RELATO DE EXPERIÊNCIA NA INDÚSTRIA DO PETRÓLEO NA BAHIA, BRASIL

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RESUMO | Introdução: As intervenções de autocuidado apoiado não dispensam a relação entre os profissionais de saúde e os usuários. O foco principal está em apoiar as pessoas para que, por meio do autocuidado, tornem-se agentes produtores sociais de sua saúde. **Objetivo:** Relatar a experiência de implantação do Programa de Gestão de Doentes Crônicos em empresa, baseado no autocuidado apoiado. **Metodologia:** Foi realizado um levantamento bibliográfico de diretrizes clínicas brasileiras relacionadas à assistência às condições crônicas mais prevalentes nos trabalhadores da indústria do petróleo na Bahia, Brasil, em 2016. Em seguida, foi definida equipe interdisciplinar composta por profissionais das áreas de medicina, enfermagem, nutrição, educação física e odontologia, que realizaram a análise documental das mesmas, extraindo destas as possibilidades de atuação, atribuições e intervenções por área técnica. Posteriormente, foram realizados 8 encontros de equipe para estabelecer um modelo de atendimento com enfoque integral, baseado em interdisciplinaridade e estímulo ao autocuidado apoiado, tendo como base a metodologia dos 5As, dividida em: Avaliação, Aconselhamento, Acordo, Assistência e Acompanhamento. Ainda foram realizadas 02 oficinas para capacitação dos profissionais de saúde para atendimento aos trabalhadores. **Resultado:** Foi elaborado um protocolo clínico, instituído como direcionador das ações dos profissionais a esta população, baseada em um modelo de atendimento humanizado e tendo como foco principal a identificação de barreiras, condições psicossociais que prejudiquem o autocuidado e o empoderamento do trabalhador. **Considerações Finais:** A elaboração de protocolo clínico através de encontros interdisciplinares, baseado no autocuidado apoiado, alinha a conduta dos profissionais das diversas áreas, visando uma assistência diferenciada aos trabalhadores portadores de doenças crônicas. Através desse modelo de atendimento, espera-se ampliar a adesão dos indivíduos ao tratamento, pois a equipe é capaz de oferecer o apoio necessário para que os sujeitos se empoderem em relação à sua saúde.

Palavras-chave: Autocuidado; Promoção da Saúde; Indústria Petroquímica; Doenças Crônicas; Protocolos Clínicos.

FLEXIBILIDADE COMO FATOR DE RISCO PARA O ABSENTEÍSMO POR CAUSA OSTEOMUSCULAR E DO TECIDO CONJUNTIVO EM TRABALHADORES NA INDÚSTRIA PETROLÍFERA, BAHIA, BRASIL[21]

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Trabalho Científico Destaque no Simpósio Brasileiro de Saúde do Trabalhador

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FLEXIBILIDADE COMO FATOR DE RISCO PARA O ABSENTEÍSMO POR CAUSA OSTEOMUSCULAR E DO TECIDO CONJUTIVO EM TRABALHADORES NA INDÚSTRIA PETROLÍFERA, BAHIA, BRASIL

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RESUMO | Introdução: O absenteísmo médico é definido como a falta ao trabalho por motivo de doença. A amplitude dos movimentos articulares é definida como flexibilidade e estudos sugerem que pessoas com boa flexibilidade tendem a sofrer menos problemas de dores e lesões musculoesqueléticas. **Objetivo:** Avaliar a relação entre a flexibilidade e o absenteísmo médico causado por patologias osteomusculares e do tecido conjuntivo entre trabalhadores da indústria do petróleo na Bahia, Brasil, no período de 2013 a 2017. **Metodologia:** Foram avaliados 999 trabalhadores quanto à flexibilidade utilizando o teste de sentar e alcançar com banco de Wells e Dilon. Os resultados obtidos foram classificados em fraco, regular, médio e excelente. Foram considerados dois grupos por classificação: Grupo I (fraco, regular e médio) com 757 sujeitos e Grupo II (bom e excelente) com 242. Foram coletados dados através de sistema de prontuário eletrônico e os resultados de flexibilidade foram cruzados com os registros de absenteísmo por causa osteomuscular e do tecido conjuntivo no mesmo período. Foram realizadas análises estatísticas (Qui-Quadrado e Correlação de Cramer's V) para verificar a associação entre as variáveis e determinar a natureza desta associação. O ajuste de uma regressão logística foi realizado com o objetivo de estimar a probabilidade de um empregado do G I vir a se ausentar do trabalho. Resultados: Do total de avaliados, 23,82% se afastaram por patologia osteomuscular e do tecido conjuntivo no período considerado e destes indivíduos, 83,61% pertenciam ao Grupo I e 16,38% ao Grupo II. O resultado do Qui-quadrado foi menor que 0,05 e do Cramer's V foi menor do que 0,5. O modelo de regressão logística estimou que a chance média do funcionário do G I entregar atestado por CID M é 2,661 vezes maior. **Considerações Finais:** Verificou-se associação entre níveis de flexibilidade e afastamento por patologias osteomusculares e do tecido conjuntivo.

Palavras-Chave: Aptidão Física; Absenteísmo; Saúde do Trabalhador; Amplitude de Movimento Articular; Sistema Osteomuscular; Petróleo.

RELAÇÃO ENTRE APTIDÃO CARDIORRESPIRATÓRIA E PORCENTAGEM DE GORDURA CORPORAL EM TRABALHADORES DA INDÚSTRIA DO PETRÓLEO, BAHIA, BRASIL[22]

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RELAÇÃO ENTRE APTIDÃO CARDIORRESPIRATÓRIA E PORCENTAGEM DE GORDURA CORPORAL EM TRABALHADORES DA INDÚSTRIA DO PETRÓLEO, BAHIA, BRASIL

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RESUMO | Introdução: Desde o século XX, ocorreram significativas mudanças nos hábitos de vida da sociedade moderna, marcadas pela diminuição da atividade física e consequente redução da aptidão cardiorrespiratória. A prática regular de atividade física eleva o condicionamento cardiorrespiratório e promove o controle dos níveis de gordura corpórea, atuando como um importante mecanismo de proteção ao surgimento e à progressão dos fatores de risco predisponentes às doenças cardiovasculares. **Objetivo:** Verificar a relação entre aptidão cardiorrespiratória e a porcentagem de gordura corporal em trabalhadores da indústria do petróleo na Bahia, Brasil, em 2017. **Metodologia:** Foram avaliados 885 trabalhadores do sexo masculino e 90 trabalhadores do sexo feminino, o percentual de gordura foi mensurado durante realização da avaliação física no exame periódico no período de fevereiro a agosto de 2017. O valor do percentual de gordura foi obtido através do protocolo Jackson & Pollock (7 dobras), a aptidão cardiorrespiratória predita pela equação de Mathews et. al. 1999. , sendo os dados adquiridos através de prontuário eletrônico. Foi utilizada estatística descritiva e o teste de correlação de Pearson para análises dos dados obtidos. **Resultados:** 885 trabalhadores do sexo masculino, idade média de 44,82 anos, desvio padrão ± 9,84 e índice de correlação p – 0,63, 90 trabalhadores do sexo feminino, idade média de 40,61 anos, desvio padrão ± 9,18 e índice de correlação p – 0,735. Verificou-se uma correlação de intensidade moderada em trabalhadores do sexo masculino e uma correlação de forte intensidade em trabalhadoras do sexo feminino. **Conclusão:** Na população avaliada, níveis elevados de aptidão cardiorrespiratória estiveram associados à menores valores de percentual de gordura corporal, principalmente entre as mulheres. Isso reforça a importância de programas de estímulo à prática regular de atividade física aeróbica pelas empresas, como forma de controle da gordura corporal, impactando nos fatores de risco cardiovascular dos trabalhadores.

Palavras-Chave: Estilo de vida sedentário; Composição Corporal; Aptidão Cardiorrespiratória; Saúde; Petróleo.

CONSULTA DE ENFERMAGEM: CONTRIBUIÇÕES PARA AS AÇÕES DE VIGILÂNCIA EM SAÚDE DO TRABALHO[23]

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4076225 CONSULTA DE ENFERMAGEM: CONTRIBUIÇÕES PARA AS AÇÕES DE VIGILÂNCIA EM SAÚDE DO TRABALHADOR

Autores:

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Resumo:

Introdução: **A Saúde do Trabalhador é composta por diversas áreas complementares, inter-relacionadas, que se destinam, através das ações de vigilância epidemiológica e vigilância sanitária, à promoção, proteção, recuperação e reabilitação da saúde dos trabalhadores submetidos aos riscos e agravos advindos das condições de trabalho. Está inserido também, nesse contexto, a assistência ao trabalhador vítima de acidentes de trabalho ou portador de doença profissional e do trabalho1. A Enfermagem do Trabalho, em consonância com as diretrizes da Política Nacional de Segurança e Saúde no Trabalho (PNSST) atua de forma a proporcionar a melhoria da qualidade de vida do trabalhador e a prevenção de acidentes e de danos à saúde, relacionados ao trabalho ou que ocorram no curso dele, eliminando ou reduzindo os riscos nos ambientes de trabalho2. Os desafios são uma constante. Se, por um lado, vem sendo possível encontrar soluções para algumas das principais disfunções, os riscos que emergem das novas condições de laboração implicam, também, novas formas de mobilização face à fatores para os quais ainda não encontramos adequadas medidas de controle3. O Conselho Federal de Enfermagem (COFEN), por meio da resolução 358/2009, determina o uso da Sistematização da Assistência de Enfermagem (SAE) e a implementação do Processo de Enfermagem (PE) nos ambientes em que o cuidado de enfermagem é realizado, incluindo assim, a Saúde do Trabalhador4. A Consulta de Enfermagem em ambientes de Saúde do Trabalhador, não é uma realidade. A complexidade dos ambientes em que ocorre, associada à particularidade de tantos intervenientes que permeiam os acidentes de trabalho, sua recuperação e retorno ao ambiente laboral, nos sinalizam para a necessidade de estruturação da consulta e implementação do Processo de Enfermagem (PE), a fim de que a atuação do enfermeiro na Vigilância à Saúde do Trabalhador (VISAT) se dê de forma qualificada, eficaz e efetiva. **Objetivo: Elaborar protocolo de atendimento para o enfermeiro do trabalho no âmbito da Vigilância à Saúde do Trabalhador, desenvolvendo um formulário direcionado para anamnese, identificação de diagnósticos e intervenções nessa área, utilizando Classificação Internacional para a Prática de Enfermagem – CIPE®, como terminologia unificadora e sensível a abranger as diversas culturas e cenários da prática. **Metodologia:** A consulta de enfermagem no VISAT foi estruturada em três etapas: i) Consulta de atendimento inicial ao trabalhador, vítima de acidente ou acometido por doença (Emergência), ii) Consulta de acompanhamento do trabalhador afastado por doença ou acidente e iii) Consulta de retorno ao trabalho. Visando garantir a abordagem do cuidado a partir da identificação de outros problemas mais subjetivos de ordem individual ou coletiva. Nesse sentido, foi desenvolvido um formulário para utilização durante a anamnese, possibilitando identificar aspectos relevantes, tais como: medo no processo de readaptação à nova função/atividade, medo relacionado à perda da capacidade laboral, repercussão domiciliar pós-acidente, dificuldade no manejo medicamentoso ou terapêutico de forma geral, dificuldade em implementar recomendações da fase de reabilitação e mapear as dificuldades relacionadas à acessos a serviços de saúde especializados. Para melhor direcionamento e organização das ações, foram determinados como critérios elegíveis para acompanhamento de enfermagem em visitas hospitalares e/ou domiciliares (ocorrências em que haja necessidade de cuidados próprios da enfermagem), tais como: trabalhadores em uso domiciliar de sondas (vesicais, nasogástricas, sondagem de alívio); presença de ostomias provisórias ou permanentes (Gastrostomias, colonostomias); lesões com uso de curativos: queimaduras (independente do grau e do tipo – térmica ou química), incisões cirúrgicas, cortes profundos com áreas de sutura, dentre outros; lesões/ patologias que interfiram na capacidade provisória ou permanente, de executar cuidados básicos de higiene (banho, trocar de roupa, escovar os dentes etc.) e alimentação; lesões/ patologias que interfiram na autonomia de mobilizar-se (deambulação, restrição ao leito); introdução de medicamentos que impliquem atenção e orientações específicas

aos familiares e ao indivíduo, ex. insulinas. **Resultados: **Na busca de um instrumento norteador e de avaliação da prática de enfermagem do trabalho para o direcionamento da anamnese no VISAT foi criado um formulário, que se propõe a coletar e assim, subsidiar o tratamento das demandas individuais de cada trabalhador, possibilitando identificação precoce de agravos e condicionantes que interfiram significativamente no restabelecimento à saúde dos trabalhadores adoecidos ou acidentados, independente do afastamento, rastreamento de necessidades de recursos para (re)construir a autonomia do trabalhador acometido, avaliação das mudanças a nível individual ou familiar que facilitem/ dificultem adaptação durante ou após o adoecimento ou acidente, oferecer escuta ativa ao trabalhador acometido e estabelecer estratégias assertivas para manutenção da qualidade de vida com ênfase e reforço no autocuidado. Foi selecionado um total de 257 diagnósticos de enfermagem, relacionados á saúde do trabalhador, acidente do trabalho e doenças ocupacionais, sendo subdivididos da seguinte forma: i) 52 diagnósticos relacionados à promoção da saúde e qualidade de vida, sendo 43 selecionados da CIPE e 9 do CIPET; ii) 59 diagnósticos focalizando o ambiente no cuidado, sendo 7 selecionados da CIPE e 52 da CIPET e iii) 146 diagnósticos relacionados a exposição humana a riscos ambientais e ocupacionais, sendo 133 selecionados da CIPE e 13 da CIPET. Foi selecionado um total de 96 intervenções, sendo 70 intervenções selecionadas do catálogo CIPE e 26 da CIPET5. As intervenções de enfermagem podem ser divididas em três níveis, de forma a otimizar e priorizar as demandas mais urgentes: intervenção imediata (aspectos que impliquem intervenção imediatamente após a consulta de enfermagem, com interface interdisciplinar); intervenção prioritária (nova abordagem a curto prazo,7 dias, para reavaliação) e intervenção de acompanhamento (abordagem por telefone, dentro de 30 dias apenas para monitoramento do caso). **Conclusão**: A atuação direcionada e científica a partir da consulta de enfermagem utilizando a terminologia CIPE®, amplia o nível de cuidados junto aos trabalhadores na VISAT, indo além de diagnósticos e intervenções relacionados à fatores pessoais e promoção da saúde, possibilitando a identificação, intervenção e controle dos riscos nos ambientes de trabalho.** Contribuições para a enfermagem**: Ampliação do cuidado de enfermagem em sua esfera clínica, organizacional, educacional, abordando trabalhadores singulares, proporcionando uma melhoria na qualidade da prestação do serviço de saúde ocupacional. Aprimoramento técnico-científico do profissional de enfermagem a partir da utilização customizada dos diagnósticos e intervenções do catálogo CIPE e CIPET proporcionando qualidade, eficiência e eficácia do cuidado prestado.

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AUTOCUIDADO APOIADO: UM RELATO DE EXPERIÊNCIA EM SAÚDE DO TRABALHADOR NA INDÚSTRIA DE PETRÓLEO NA BAHIA, BRASIL, COM A UTILIZAÇÃO DA CIPE[24]

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AUTOCUIDADO APOIADO: UM RELATO DE EXPERIÊNCIA EM SAÚDE DO TRABALHADOR NA INDÚSTRIA DE PETRÓLEO NA BAHIA, BRASIL, COM A UTILIZAÇÃO DA CIPE

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RESUMO | Introdução: A Teoria do Autocuidado de Orem proporciona suporte para prestação da assistência de enfermagem apoiada no autocuidado, servindo como base para implementação da Sistematização da Assistência de Enfermagem (SAE). O incentivo ao autocuidado possibilita participação efetiva, manutenção dos cuidados e auto responsabilidade por parte dos trabalhadores. **Objetivo:** Descrever a experiência de utilização da terminologia de Classificação Internacional para a Prática da Enfermagem – CIPE® pelo enfermeiro do trabalho, para abordagem do autocuidado apoiado na indústria do petróleo, Bahia, Brasil. **Metodologia:** Foram coletados dados através de sistema de prontuário eletrônico utilizado para registro da consulta de enfermeiro do trabalho, abrangendo uma população de 653 trabalhadores, no período de janeiro a setembro de 2017. O processo de enfermagem aplicado ao autocuidado apoiado foi fundamentado na Teoria do Autocuidado de Orem, sendo considerados aspectos relacionados à percepção dos indivíduos em relação à sua saúde, estilo de vida e nível de cuidado com a saúde. Para definição dos diagnósticos e intervenções da população foi utilizada a terminologia CIPE®, que se mostrou mais adequada aos cuidados de enfermagem ocupacional dos trabalhadores. Foram considerados dois grupos para classificação dos trabalhadores: com nível de autocuidado prejudicado e com nível de autocuidado satisfatório. **Resultados:** 37,52% da população foi classificada com nível de autocuidado satisfatório. Foram mapeados 39 diagnósticos da CIPE®, no total de 653 ocorrências, sendo Comportamento de Busca de Saúde com 39,36% de prevalência, seguido por Comportamento de Busca de Saúde Prejudicado com 22,66%. Foram mapeados 61 intervenções, no total de 675 ocorrências, sendo Reforçar Comportamento Positivo com 24,00% de prevalência, seguido por Orientar sobre Comportamento de Busca de Saúde com 20,89%. **Considerações Finais:** A atuação direcionada e científica pelo enfermeiro, assim como o uso da terminologia CIPE®, eleva o nível dos cuidados de enfermagem, favorecendo o empoderamento e emancipação do trabalhador, a partir do autocuidado apoiado.

Palavras-chave: Promoção da Saúde; Enfermagem do Trabalho; Indústria Petroquímica; CIPE®.

UM CAMINHO PARA A SISTEMATIZAÇÃO DA ASSISTÊNCIA EM ENFERMAGEM DO TRABALHO : APLICAÇÃO NA INDÚSTRIA DO PETRÓLEO NA BAHIA , BRASIL[25]

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UM CAMINHO PARA A SISTEMATIZAÇÃO DA ASSISTÊNCIA EM ENFERMAGEM DO TRABALHO: APLICAÇÃO NA INDÚSTRIA DO PETROLEO NA BAHIA, BRASIL

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RESUMO | Introdução: Compreendendo o ambiente como determinante do processo saúde-doença, os enfermeiros devem integrar essa dimensão em sua prática profissional, planejando intervenções com este enfoque. Para sistematização da assistência em enfermagem torna-se fundamental utilizar, associado à consulta, sistemas de classificação em enfermagem, os quais são capazes de promover o desenvolvimento tecnológico e científico da profissão. Nessa perspectiva, destaca-se a Classificação Internacional para a Prática de Enfermagem – CIPE®, como terminologia unificadora e sensível a abranger as diversas culturas e cenários da prática. **Objetivo:** Descrever o perfil de diagnósticos e intervenções de enfermagem relacionados à exposição a aspectos ambientais a partir da consulta de enfermagem utilizando a terminologia CIPE® na indústria do Petróleo na Bahia - Brasil. **Metodologia:** Estudo descritivo a partir de dados das consultas de enfermagem realizadas a 875 trabalhadores, no período de janeiro a setembro de 2017, que enfatizava três dimensões: o ambiente no cuidado, a exposição humana a riscos ambientais e ocupacionais e a promoção da saúde e qualidade de vida. Em sequência foram identificados os diagnósticos e intervenções da dimensão "Focalizando o ambiente no cuidado". Esta dimensão contempla os aspectos da ergonomia, saúde ambiental (qualidade da água, ar e solo nos locais de trabalho) e exposição a agentes riscos ambientais, conforme Norma Regulamentadora do MTE no 09. **Resultados:** Foram levantados 15 enunciados de diagnósticos de enfermagem, sendo 18,2% da ergonomia, 17,9% de saúde ambiental e 2,2% de exposição a agentes de risco ambiental, e 159, 157 e 19 intervenções respectivamente. **Conclusão:** A atuação direcionada e científica a partir da consulta de enfermagem utilizando a terminologia CIPE®, amplia o nível de cuidados junto aos trabalhadores da indústria do petróleo na Bahia, indo além de diagnósticos e intervenções relacionados à fatores pessoais e promoção da saúde, possibilitando a identificação, intervenção e controle dos riscos nos ambientes de trabalho.

Palavras-chave: Enfermagem do Trabalho; CIPE®; Diagnóstico de enfermagem; Saúde Ambiental.

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