

REVIEW ARTICLE



A systematic review of the characteristics of data assessment tools to measure medical doctors' work-related quality of life

Miyuki Ezura ^{a,b}, Katsuhiko Sawada ^c, Yusuke Takushima ^d, Ataru Igarashi ^{e,f} and Lida Teng ^e

^aDepartment of Corporate Planning, Otsuka Holdings Co. Ltd, Tokyo, Japan; ^bDepartment of Health Technology Assessment Program, Graduate School of Health Management, Keio University, Tokyo, Japan; ^cClinical Development Department, Otsuka Medical Devices Co. Ltd, Tokyo, Japan; ^dMedical Affairs Department, Taiho Pharmaceutical Co. Ltd., Tokyo, Japan; ^eDepartment of Health Economics and Outcomes Research, Graduate School of Pharmaceutical Sciences, The University of Tokyo, Tokyo, Japan; ^fDepartment of Public Health, Yokohama City University School of Medicine, Yokohama, Kanagawa, Japan

ABSTRACT

Purpose: Remarkable progress in healthcare technology has recently been made alongside changes in concepts related to drugs and medical devices. It is speculated that this progress benefits not only patients but also healthcare professionals, such as medical doctors. We performed a systematic review of the characteristics of current data assessment tools to measure medical doctors' work-related quality of life (QOL).

Methods: A literature search was conducted through PubMed and Ichushi-Web in 2020. The related search terms used were 'medical doctor,' 'quality of work life,' and 'questionnaire/interview.' Two reviewers independently screened the studies, and the characteristics of the QOL assessment tools used in the identified studies were qualitatively reviewed and summarized.

Results: In total, 5,443 and 760 articles were retrieved from PubMed and Ichushi-Web, respectively, of which 82 studies were included in this review. Sixty-five (79%) studies used structured questionnaires, and 17 (21%) studies used semistructured questionnaires. In terms of the study purpose, the identified studies mainly included four: mental health, the work or labor situation, satisfaction, and QOL. Components used to measure work-related QOL included satisfaction, burnout, QOL, the work environment, stress, mental health, work-life balance, and others. None of the studies used an originally developed QOL questionnaire to assess the work-related benefits of medical doctors.

Conclusion: This systematic review found that there is a lack of studies directly assessing the work-related QOL of medical doctors and a lack of effective data collection tools to assess all work-related QOL components.

ARTICLE HISTORY

Received 24 March 2023

Revised 4 July 2023

Accepted 4 July 2023

KEYWORDS



Work-related quality of life; medical doctor; QOL; questionnaire


Introduction

Remarkable progress in healthcare technology has recently been made alongside changes in concepts related to pharmaceutical drugs and medical devices. Pharmaceutical drugs have evolved from low-molecular-weight compounds to biologics and regenerative medical technology, while medical devices have evolved from robotic surgery to digital transformation (DX) using applications. With the development of these improved technologies, the resulting capabilities must be judged in an objective way. It is necessary to evaluate the benefits of new technologies from multiple perspectives, including patients and healthcare professionals [1].

In clinical practice, quality of life (QOL) is a common outcome measurement. For patients, QOL is measured

mainly as health-related QOL (HRQOL), which is specialized and quantified in terms of the change in health status. With the adoption of the Lisbon Declaration on the Rights of the Patient in 1981, patients' subjective assessment has been emphasized, and patient-reported outcomes (PROs) as well as HRQOL have been actively used as objective tools. HRQOL scales are broadly divided into generic and disease-specific measures; generic measures are further divided into the profile type (e.g., Short Form-36 [SF-36]) and index type (e.g., the EQ-5D developed by the EuroQOL foundation and the Health Utilities Index [HUI]) [2]. HRQOL is an objective measure that expresses improvement in QOL based on technological intervention at the physical, mental, functional, and social levels, and research on HRQOL is progressing [3].

CONTACT Miyuki Ezura  Ezura.Miyuki@otsuka.jp  Department of Corporate Planning, Otsuka Holdings Co. Ltd, Shinagawa Grand Central tower 2-16-4 KonanMinato-ku, Tokyo 108-8241, Japan

 Supplemental data for this article can be accessed online at <https://doi.org/10.1080/20016689.2023.2234139>.

© 2023 I work for Otsuka Holdings Co., Ltd and the joint research is the university of Tokyo. Published by Informa UK Limited, trading as Taylor & Francis Group. This is an Open Access article distributed under the terms of the Creative Commons Attribution-NonCommercial License (<http://creativecommons.org/licenses/by-nc/4.0/>), which permits unrestricted non-commercial use, distribution, and reproduction in any medium, provided the original work is properly cited. The terms on which this article has been published allow the posting of the Accepted Manuscript in a repository by the author(s) or with their consent.

On the other hand, work-related QOL in healthcare professionals is also expected to be influenced by clinical practice. A methodology to assess objective work-related QOL in healthcare professionals would have great impact in the introduction of a new technology [4]. For example, such a methodology would be helpful in measuring the improvement in medical doctors' work-related QOL, such as their mental health and time efficiency, before and after the introduction of robotic surgery technology or other medical devices [5].

As a result of a preliminary literature review, we found that the Professional QOL (ProQOL) scale [6] is the most relevant existing tool to measure QOL in healthcare professionals. The ProQOL was developed by Charles Figley as the Compassion Fatigue Self-Test in the 1980s, and the fifth edition was published in 2009 after several amendments. The ProQOL is commonly used as a tool to measure QOL in persons with trauma and experts on trauma [7]. The ProQOL measures QOL in experts from three perspectives, i.e. (1) compassion satisfaction, (2) burnout, and (3) secondary traumatic stress, to assess the impact of both positive and negative aspects of their jobs. The ProQOL generally focuses on patients or coworkers who experience stress or trauma. It is undeniable that there is a potential lack of objective factors when using this tool. It may not be an optimal tool to comprehensively measure work-related QOL among healthcare professionals. Although the ProQOL is a well-developed tool to make comparisons among experts, we find it necessary to develop a new tool that reflects all aspects of QOL and work-related QOL by focusing on healthcare professionals. However, because the definition of healthcare professionals might be difference across the countries, we focused on medical doctors as the main participant group among HCPs as the first step of our project.

Moreover, few studies have measured improvements in routine practice among medical doctors due to the introduction of new technology. Therefore, we performed a literature review to investigate whether there is a tool to measure work-related QOL in daily clinical practice among medical doctors, especially for those involved directly in the application of new technologies. The primary objective of our review was to systematically and comprehensively search the published literature to identify any existing work-related QOL tools for medical doctors. The secondary objective was to summarize the characteristics of the methodology widely used to study work-related QOL and related components among medical doctors.

Materials and methods

We conducted a systematic literature review according to the method recommended by the Cochrane Handbook

for Systematic Reviews (<http://handbook.cochrane.org>). The review was registered in PROSPERO (<http://www.crd.york.ac.uk/PROSPERO/>) (ID: CRD42020171801). The reporting format of the review results conformed to the reporting criteria of the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) 2020 Statement where possible (i.e. this review was a qualitative review of using descriptive and narrative analysis methods, some items in the PRISMA checklist may not be applicable).

Literature search

We searched PubMed (<http://www.ncbi.nlm.nih.gov/pubmed>) for English literature in February 2020 and Ichushi-Web (<http://login.jamas.or.jp>) for Japanese literature in March 2020. The search strategy, which is shown in the Appendix, included three types of terms: 'medical doctor', 'quality of work life' and 'questionnaire/interview'. Due to the large number of studies retrieved, we limited the search to articles published within the last 10 years before the search date.

Screening and criteria

Two reviewers independently screened the titles/abstracts and full texts of the retrieved articles. Disagreements were resolved through discussion with a third review author. Inclusion and exclusion criteria are shown as follows:

Inclusion criteria

- (1) Original studies focusing on medical doctor's QOL
- (2) Quantitative studies using scales such as self-completed questionnaires or interview questionnaires as data collection tools
- (3) Study written in English or Japanese
- (4) Study published in the last ten years of the searched date

Exclusion criteria

- (1) Studies including medical students, trainees, interns or residents as participants
- (2) Studies assessing changes in medical conditions (e.g., back pain, headache) and diseases rather than QOL
- (3) Qualitative studies, such as those involving in-depth interviews
- (4) Studies using only QOL measurement scales for patients (e.g., the ED-5D, SF-36, or SF-6)

- (5) Studies limited to a particular gender, either male or female

Data extraction and qualitative synthesis

Literature data were organized and screened using EndNote X8 and Microsoft Excel. Data were qualitatively summarized in Microsoft Excel. Items extracted from the articles included general information (study ID, author, title, journal, publication year, study purpose, and country), participant characteristics (population/specialty, age, sex, and number of participants), survey methods, number of participants, questionnaire types (scale/score/description, structured/semistructured), originality of the study tools, and names and types of particular questionnaire. As the purpose of this study was to review the methodology of the studies, we did not perform data extraction on the results, conclusions and statistical methods of each identified study.

Risk of bias assessment

This was a qualitative review focusing on the characteristics of the data components used in each study. The risk of bias and appropriateness of study methods were not examined.

Results

In total, 5,443 articles were retrieved from PubMed and 760 from Ichushi-Web. After screening, 82 studies were eligible for data extraction (see Figure 1), of which 79 articles were identified from PubMed and three from Ichushi-Web.

General characteristics of the identified studies

In total, 40 (49%) studies were conducted in the United States, followed by six (7%) studies in Brazil and five (6%) studies in Germany. The reporting year was 2018 for 16 studies (20%), 2014 for 13 (16%) studies, 2017 for 12 (15%) studies, 2011 for 11 (13%) studies, 2015 for eight (10%) studies, 2016 for seven (9%) studies, 2013 for six (7%) studies, 2019 for five (6%) studies, and 2012 and 2010 for two (2%) studies each.

Study participants

Search strategies were developed to identify any medical doctor such as cardiologist and oncologist in any clinical department. In total, 33 (40%) studies targeted physicians/general practitioners/primary care clinicians, 15 (18%) studies targeted surgeons, nine (11%) targeted oncologists, eight (10%) targeted pediatricians, two ((2%) targeted neurologists. Ten surveys focused on specialists including adult congenital heart disease (ACHD) specialists, anesthesiologists, allergists, cardiologists, emergency radiologists, headache medicine

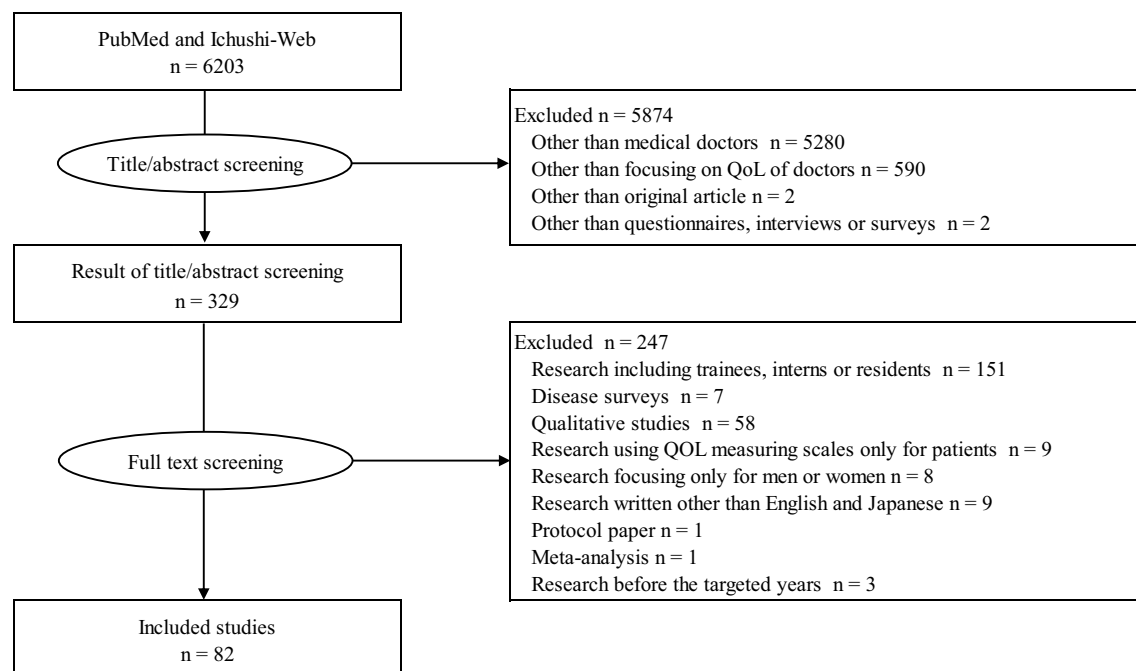


Figure 1. Screening flow chart using PubMed and Ichushi-Web.

specialists, musculoskeletal radiology fellows, obstetricians and gynecologists, ophthalmologists and urologists. In addition, five (6%) targeted other doctors whose specialists were not clarified.

The number of participants was < 1,000 in 39 (47%) studies, ≥1,000 - <5,000 in 23 (28%) studies, ≥5000 - < 10000 in seven (9%) studies, and ≥ 10,000 in 13 (16%) studies.

Data collection methods

Data collection methods included e-mail in 26 (32%) studies, online surveys in 15 (18%) studies, mail in 10 (12%) studies, person-to-person interviews in five (6%) studies, and multiple tools such as e-mail and mail in 16 (20%) studies; 10 (12%) studies provided no description of the data collection methods. Electronic data collection methods, such as e-mail or online surveys, were used in 70% of studies. The response rate ranged from 8.9% to 100% and the median was 50.7% among the 64 articles that reported response rate. Eighteen (22%) studies did not report the response rate.

Questionnaire type

In total, 65 (79%) studies used structured questionnaires, and 17 (21%) studies used semistructured questionnaires to collect the data. Among all studies using structured questionnaires, 21 (32%) used originally developed questionnaires, 35 (54%) used existing questionnaires, and nine (14%) added original questions to existing questionnaires. Among studies using semistructured questionnaires, four (24%) used originally developed questionnaires, five (29%) used existing questionnaires, and eight (47%) added new questions to existing questionnaires.

The most commonly used existing validated questionnaires were the Maslach Burnout Inventory (MBI) in 28 (34%) studies, the ProQOL in six (7%) studies, the Primary Care Evaluation of Medical Disorder (PRIME MD) in six (7%) studies, the World Health Organization Quality of Life Instruments (WHOQOL)-BREF in five (6%) studies and the 12-Item General Health Questionnaire (GHQ-12) in four (5%) studies.

Questionnaire components

The survey components/items of all identified structured questionnaires were classified into eight categories. In total, 'satisfaction' was investigated in 38 studies, 'burnout' in 35 studies, 'QOL' in 28 studies,

'work environment' in 22 studies, 'stress' in 18 studies, 'mental health' in 17 studies, 'work-life balance' in 10 studies, and others (e.g., work addiction, quality of care) in 20 studies. Detailed questionnaire components for each type of study are presented in Tables 1–5. A single study may have used various questionnaire components to achieve a certain study purpose.

Main study focus

We classified all included studies into five categories based on their main study purposes and content: 'mental health-related', 'labor- or work situation-related', 'satisfaction-related', 'QOL-related', and 'others' (e.g., self-efficacy and attitude toward problem). Each category could involve various types of questionnaires (see Tables 1–5).

Mental health-related studies

The characteristics of the mental health-related studies are presented in Table 1.

Among the 33 (49%) studies focusing on *mental health-related* factors such as burnout and stress, 23 (70%) studies used existing questionnaires, one study (3%) used an original questionnaire, and nine (27%) studies used both existing and original questionnaires. Of these nine studies, six used existing questionnaires with added original questions, and three used modified existing questionnaires; none described the validation process.

Regarding the survey components, burnout-related questions were evaluated in 27 studies, QOL-related questions in 16 studies, mental health-related questions in 14 studies, satisfaction-related questions in 11 studies, stress-related questions in 11 studies, and work-life balance- and work environment-related questions in three studies each. Among all the mental health-related studies, 24 (73%) used the MBI. The mental health-related studies used existing questionnaires in 97% of cases. Thus, studies on mental health-related fields were more likely to use existing questionnaires.

Labor- or work situation-related studies

The characteristics of the labor- or work situation-related studies are presented in Table 2.

Among the 23 (28%) studies focusing on *labor*, only five (22%) studies used existing questionnaires; original questionnaires were used in 15 (65%) studies, and a combination of existing and original questionnaires was used in three (13%) studies. Of the 15 studies using original questionnaires, only two described the validation process; these two studies included a study that used a questionnaire on fairness [8] and a study that

Table 1. Mental health-related studie.

ID	Author (Years of p	Country	Summary of purpose	Participants	Number of participants	Response rate	Survey method	Questionnaire type	Survey items	Survey cpmponents	Originality
38	Zhang, 2019	USA	To assess burnout and professional fulfillment	Breast Surgeon	2,568	NA	Web	Structured	Professional Fulfillment Index(PFI)	Burnout	Existing
169	Marckini, 2019	USA	To assess burnout	Adult Congenital Heart Disease specialists General Practitioner (GP)	383	28.7%	Web	Structured	Maslach Burnout Inventory (MBI)	Burnout	Existing
195	Dreher, 2019	Germany	To assess burnout	physicians	214	74.1%	Mix	Structured	MBI	Burnout	Existing
210	Hauer, 2018	USA	To survey factors related to burnout	physicians	13,150	8.9%	Mix	Semi- structured	the mini-Z survey (on physician satisfaction and burnout)	Physicians satisfaction / Burnout	Existing
280	Dasgupta, 2018	USA	To survey burnout and WLB in pediatric cardiologists	Pediatric cardiology	50	90.0%	E-mail	Structured	1) MBI 2) Areas of Work life survey	Burnout Work life balance (WLB)	Existing
355	Pavia, 2018	Brazil	To assess emotional distress (burnout, depression, and anxiety)	oncologist	323	70.5%	Web	Structured	1) MBI 2) Hospital Anxiety and Depression scale(HADS)	Burnout Mental	Existing
376	Sheikh, 2018	Pakistan	To assess relationship between cognitive disorder and sleep disturbance, anxiety, or depression	physicians	300	89.3%	Face to face	Structured	1) HADS 2) Cognitive difficulties scale (CDS)	Mental Mental	Existing
386	LaFaver, 2018	USA	To examine age and sex differences in burnout, career satisfaction, and well-being	neurologist	4,127	40.5%	Mix	Semi- structured	3) The Pittsburgh sleep quality index(PSQI) 1) MBI-HSS 2) Career Satisfaction 3) Empowerment at work	Mental Burnout Career Satisfaction Other (empowerment) Job satisfaction	Existing
508	Noroxe, 2018	Denmark	To examine mental well-being and job satisfaction and potential associations with age, gender and practice organisation.	GP	3,350	50.7%	E-mail	Semi- structured	4) Physician job Satisfaction scale 1) MBI-HSS 2) Warr-Cook-Wall Job Satisfaction Scale(WCW-JSS) 3) Perceived Stress Scale-10 (PSS) 4) The World Health Organisation- Five Well-Being Index(WHO-5) 5) Self-rated health: one question from 12-item Short-Form Health Survey (SF-12) 6) WLB: one-item question 7) Strains in private life: one-item question	Burnout Job satisfaction Stress WLB Other(Private life) Other(Private life)	Existing Original
823	Porter, 2018	USA	To examine burnout and resiliency and characterize associated factors.	family medicine	465	53.7%	E-mail	Structured	1) MBI 2) The Brief Resilience Scale (BRS)	Burnout Other(Resilience)	Existing

(Continued)

Table 1. (Continued).

ID	Author (Years of p Trockel, 2018	Country	Summary of purpose	Participants	Number of participants	Response rate	Survey method	Questionnaire type	Survey items	Survey components	Originality
952	Trockel, 2018	USA	To evaluate the impact of burnout on job satisfaction	physicians	250	91.0%	Web	Structured	1) PFI 2) MBI 3) World Health Organization Quality of Life Instruments (WHOQOL)-BREF 4) Patient Reported Outcomes Measurement Information System (PROMIS)	Satisfaction Burnout QOL Stress	Existing
962	Wu, 2017	USA	To use the ProQOL survey assessment tool to characterize professional quality of life scores	surgeons	202	88.1%	E-mail	Structured	Professional Quality of life scale(ProQOL)	QOL	Existing
1146	Allison, 2017	Australia	To assess relationship between psychosocial job stress and health	Medical Doctors	20,157	NA	Paper	Semi-structured	1) MABEL survey 2) SF-12 3) Psychosocial job stress question (original)	Work environment QOL Stress	Existing
1202	Jackson, 2017	USA	To compare pain and fatigue in surgeons involved in nipple-sparing mastectomy and skin-sparing mastectomy	Surgeon	184	72 % SSM *1) 63 % NSM*2)	Mix	Semi-structured	1) Nordic Musculo Skeletal Questionnaire (NMSQ) 2) the Surgery Task Load Indx(SURG-TLX) 3) Original question	Stress/Mental Burnout Satisfaction (Degree) QOL	Existing Original Existing
1427	Allen, 2017	Australia	To explore the indicators of occupational stress	Obstetrics and Gynaecology	25	NA	Face to face	Structured	ProQOL	Burnout Stress	Existing
1434	Porrino, 2017	USA	To determine the prevalence of burnout and to explore causes of emotional stress.	Musculoskeletal radiology fellows	190	30.5%	E-mail	Semi-structured	1) MBI 2) Potential sources of stress stress questions 3) Career choice 4) Open-ended comment	Burnout Stress WLB Work environment QOL	Existing Original Existing
1881	Granek, 2016	Israel	To examine gender differences in the effect of grief reactions and burnout on emotional distress	Oncologist	178	NA	Mix	Structured	1) General Health Questionnaire(GHQ12) 2) Grief reactions questionnaire: Adult Oncologists Grief	Mental	Existing
2385	Randolph, 2015	USA	To survey burnout in headache medicine specialists and evaluate the impact of carrier satisfaction	Headache Medicine Specialists	749	17.0%	E-mail	Structured	3) MBI 1) MBI 2) Career satisfaction: surveyed with 13 items using modified existing questionnaire	Burnout Burnout Career satisfaction	Existing Original
2411	Rabatin, 2016	USA	To assess relationships between work conditions, burnout, quality of care, and medical errors.	Primary care physicians	422	56.0%	NA	Structured	5 questions related to burnout (correlated with emotional exhaustion in MBI)	Burnout	Existing
2512	Kellie, 2015	USA	To determine the burnout rate among gynecologic oncologists and evaluate other personal, professional, and psychosocial factors	Gynecologic oncologists	1,086	40.1%	E-mail	Semi-structured	1) SF-12 2) PRIME MD/PHQ2 3) CAGE questionnaire 4) MBI	QOL Mental Other(Alcohol abuse) Burnout Career satisfaction	Existing Original

(Continued)

Table 1. (Continued).

ID	Author (Years of p)	Country	Summary of purpose	Participants	Number of participants	Response rate	Survey method	Questionnaire type	Survey items	Survey components	Originality
2719	Weigl, 2015	Germany	To assess relationship among job stress, burnout and quality of care	Pediatrician	130	73.8%	Mix	Structured	1) WorkStress; 23-item effort-reward imbalance(ERI) questionnaire 2) MBI 3) Quality of care; German questionnaire for work analysis in hospitals	Stress Burnout Other(Quality of care)	Existing
3255	Nishimura, 2014	Japan	To assess personal and professional characteristics related to burnout	Stroke care physician	11,211	NA	Mail	Structured	1) Maslach Burnout Inventort General Survey(MBI-GS) 2) Psychological well-being; Mental Health(MH) subscale of 36-Item Short-Form Health Survey(SF36)	Burnout Mental	Existing
3435	Roberts, 2014	USA	Top examined burnout, satisfaction withwork-life balance, and other aspects of well-being among internal medicine hospitalists relative to outpatient general internists	General internists, internal medicine hospitalists	27,276	26.7%	E-mail	Structured	1) MBI 2) symptoms of repression and suicidal ideation; 2-item Primary Care Evaluation of Mental Disorders 3) Single-item linear analog scale assessment 4) Satisfaction w/WLB and Career plans; Mywork schedule leaves me enough 5) Health behaviors;Alcohol Use Disorders Identification Test Version C(AUDIT-C)	Burnout Mental	Existing
3616	Taycan, 2012	Turkey	To investigate the impact of the compulsory health service (CHS) on physicians and the factors associated with burnout.	Physicians	207	71.0%	NA	Structured	1) MBI 2) Beck Depression Inventory (BDI)self-reportscale 3) General Health Questionnaire(GHQ12) mental disorder 4) Job Satisfaction(JSS) 5) Satisfaction with life Scale (SWLS) 6) ProQOL 1) MBI 2) QOL(DASS-21, PSS, RS-14) 3) Santa Clara Brief Compassion Scale (SCBC)	Burnout Stress Mental Job satisfaction Job satisfaction QOL Burnout QOL Other (Compassion)	Existing
3628	Fortney, 2013	USA	To survey whether mindfulness intervention may improve job satisfaction, QOL, and compassion	Primary care clinicians	30	77.0%	Web	Structured	Statement assessment(Moral distress, Professional freedom of speech)	Work environment Stress	Original
3727	Forde, 2013	Norwegian	To survey moral distress and freedom of speech in specialists	Doctors	1,522	67.0%	Mail	Structured			Original

(Continued)

Table 1. (Continued).

ID	Author (Years of p)	Country	Summary of purpose	Participants	Number of participants	Response rate	Survey method	Questionnaire type	Survey items	Survey components	Originality
3995	Haber, 2013	Israel	To compare risks related to burnout, compassion fatigue, compassion satisfaction, and protective factors	Physicians	97	NA	NA	Semi-structured	1) Impact of Event scale-revised (IES-R) 2) Center for Epidemiologic Studies depression scale (CES-D) 3) Dissociative Experience Scale (DES) 4) Cantril's self Anchoring scale (SAS) 5) Perceived Self Efficacy: one question 6) Perceived Family support: one question 7) ProQOL	PTSD symptoms Mental Mental Stress Other (Self efficacy) Satisfaction QOL Burnout Other (Well-being)	Existing
4063	Dyrbye, 2012	USA	To evaluate the ability of the Physician Well-Being Index (PWB-I) to stratify physician well-being in several important dimensions and identify physicians whose degree of distress	Physicians	27,276	NA	E-mail	Structured	1) MBI 2) Medical Student Well-Being Index (MSWBI)	QOL Burnout Other (Well-being)	Existing
4117	Kimo, 2013	USA	To develop and evaluate a survey measuring professional stress and satisfaction	Neurosurgeons	169	50.0%	Web	Structured	3) Linear analog scale 1) MBI 2) Professional stress (16 items)	QOL/Mental Burnout Stress	Original Existing Original
4677	Balch, 2011	USA	To evaluate the prevalence of recent malpractice litigation and associations with personal well-being	Surgeons	25,073	28.7%	E-mail	Semi-structured	3) Professional Satisfaction (15 items) 4) Quality of professional life (13 questions) 5) General Question (5 questions) 1) MBI 2) Depression; Primary Care Evaluation of Medical Disorder (PRIME MD) 3) Single-item linear analog self-assessment QOL 4) Suicidal ideation; During the past 12mo have you had thoughts of taking your own life? 5) Career satisfaction: additional questions	Satisfaction QOL Other Burnout Mental	Existing
4939	Dyrbye, 2011	USA	To evaluate differences in burnout and career satisfaction between men and women surgeons and to determine the relationships among personal factors, professional	Sergions	24,922	31.5%	E-mail	Structured	1) MBI 2) Primary Care Evaluation of Medical Disorder 3) 2 questions from SF-12	QOL Mental QOL	Existing
5111	Balch, 2011	USA	To compare burnout and career satisfaction between surgical oncologists and surgeons	Surgical Oncologists	7,905	NA	E-mail	Structured	1) MBI 2) Symptoms of depression; Primary care evaluation of mental disorders (PRIME MD) 3) SF-12	Burnout Mental QOL	Existing
5414	Shanafelt, 2010	USA	To assess association between burnout and medical errors	Surgeon	24,922	32.0%	E-mail	Structured	1) MBI 2) PRIME MD 3) SF-12	QOL Burnout Mental QOL	Existing

*1): after skin-sparing mastectomy (SSM)

*2): after nipple-sparing mastectomy (NSM)

Table 2. Labor or work situation-related studies.

ID	Author (Years of pub	Country	Summary of purpose	Participants	Number of participants	Response rate	Survey method	Questionnaire type	Survey items	Survey components	Originality	
17	Amy,	USA	To examine gender discrepancies and factors related to household responsibilities and work-life balance	Pediatrician	1,801	NA	Mix	Semi-structured	1) Analyzed data for year 2015 from American Academy of Pediatrics Pediatrician Life and Career Experience Study 2) 2 open-ended questions (description) Survey (no question described)	WLB	Original	
55	Michael,	USA	To survey factors related to carrier characteristics and work force for injury/acute care surgery (ACS)	Surgery of trauma	1,552	26.0%	Web	Structured	Survey (no question described)	Career satisfaction	Original	
479	Menashe,	USA	To assess recognition and value of work conditions in part-time and full-time pediatric radiologists	Pediatric Radiology	1,877	12.0%	E-mail	Structured	2 questions (questionnaire: S1: 27 questions for part-time / S2: 25 questions for full-time)	Job satisfaction / WLB	Original	
852	Kao,	USA	To evaluate whether pay fairness perceptions were associated with work satisfaction, turnover intention, and personal health.	Physicians	3,589	63.0%	Web	Semi-structured	'-Recognition of fairness on physicians' payroll, job satisfaction, intension to leave, and health conditions (self-reported) Original question / My total compensation is fair 1) Psychological distress: GHQ12 2) Sleeping problem; Jenkins scale 3) Workability; Workability Index 4) Workload: Harris Nurse Stress Index + original questions 5) Team climate: Team Climate Inventory + original questions Original questions 1) Do you feel that working as a doctor has had ane adverse effects on your health or wellbeing? 2) The NHS of today is a good employer when doctors become ill themselves Questionnaire	Work satisfaction Other(Pay fairness) Stress other (Sleep) other (Workability) other(Workload) other(Climate) Work environment	Existing Original Existing Original Original	
859	Aalto,	Finland	To examine associations between workload and changes in distress, sleep quality and workability and whether positive social relations at work would protect from such problems	Physicians	5,000	29.0%	Mail	Semi-structured				
1348	Smith,	UK	To report adverse effects on health and wellbeing	Doctors	4,369	84.6%	Mix	Semi-structured				Original
1522	India,	India	To survey levels of job satisfaction, burnout and perception of gender disparity	Ophthalmologists	498	60.0%	E-mail	Structured			Work environment / Job satisfaction / Burnout / WLB	Original
1651	Tarek,	USA	To assess practice environment with a focus on schedule, job satisfaction, and self-perception ofhealth, wellness, and diagnostic accuracy	Emergency radiologists	1,106	29.6%	E-mail	Structured	Questionnaire	Work environment / Job satisfaction / Oter(health, wellness)	Original	

(Continued)

Table 2. (Continued).

ID	Author (Years of pub)	Country	Summary of purpose	Participants	Number of participants	Response rate	Survey method	Questionnaire type	Survey items	Survey components	Originality
3495	Mache, 2014	Germany	To survey relationship between work and life satisfaction	Surgeon	123	NA	Paper (Box placed)	Structured	1) Work engagement; Utrecht Work Engagement Scale(UWES) self report question naire 2) Copenhagen Psychosocial Questionnaire(COPSOQ)	Work environment Other (Psychosocial factors at work)	Existing
3814	Kwong, 2014	Hong Kong	To assess work, personal life, and WLB between male and female	Surgeon	1,095	NA	Web	Structured	28-item questionnaires	WLB	Original
4805	Shrestha, 2011	Australia	To survey determinants for work life balance	GP	22,137	17.6%	Mix	Structured	1) MABEL 2) Adjusted questionnaire (3 or 5-point scale)	Work environment	Existing
4931	Perez, 2011	Spain	To analyze labor conditions in terms of quality of professional life and burnout	Allergist	404	NA	Mail	Structured	1) MBI 2) Calidad de Vida Profesional (CPV- 35)	Work environment Burnout job satisfaction/ QOL	Original
1342	Yamamoto, 2011	Japan	To survey for what physicians feel rewarded	Pediatrics	84	69.0%	NA	Structured	13 questions	Working environment Satisfaction (Salary)	Original
1368	Yamamoto, 2010	Japan	To survey the impact on motivation of pediatric hospitalists	Pediatrics	42	98.0%	NA	Structured	On-call/day-duty system and its assessment, breakdown of working the next day, broad assessment of labor environment/ educational guidance, annual income and feeling of reward	Working environment	Original
150	Kawase, 2018	Japan	To assess working style	Surgeons	29,861	20.8%	Web	Structured	1) Working conditions 2) Personal life considerations 3) Question for single 4) Question for having partner 5) Question related children 6) Question associated with care for adult family members	Other(Personal)	Original

Table 3. Satisfaction-related studies.

ID	Author (Years of publication)	Country	Summary of purpose	Participants	Number of participants	Response rate	Survey method	Questionnaire type	Survey items	Survey components	Originality
203	Michael, 2018	Canada	To survey relationship between work environment and job satisfaction	Oncologist	3,967	12.0%	Web	Structured	Global Oncology Workload Survey (51 questions)	Job satisfaction	Original
568	Brenessa, 2018	USA	To survey factors which have an impact on physicians' satisfaction	Surgical clinician	359	76.3%	NA	Structured	Survey	Satisfaction(all)	Existing
569	Malhotra, 2018	Canada	To explore the determinants of job satisfaction and work-life balance satisfaction	Family physicians	34,753	17.0%	E-mail	Structured	2013 National Physician Survey	Career satisfaction / WLB	Existing
633	Cherebillo, 2018	Russia	To explain correlation between satisfaction and WLB	Neurosurgeons	217	NA	Mix	Structured	1) Professional Stress (16 questions) 2) Professional Satisfaction (9 questions)	Stress Job Satisfaction	Original
821	Racic, 2019	Bosnia and Herzegovina	To examine self-perceived compassion fatigue and describe potential contributing factors	Family physicians	170	71.0%	Mix	Structured	3) Professional QOL (10 questions) 1) Professional quality of life compassion satisfaction and fatigue version 5 (ProQOL 5) 2) The Chalder fatigue scale(CFS)	QOL QOL/satisfaction Fatigue	Existing
1018	Sinsky, 2017	USA	To evaluate the relationship between burnout, satisfaction with electronic health records and work-life integration and	Physicians	35,922	19.2%	Web	Semi-structured	1) MBI 2) "My work schedule leaves me enough time for my personal/family life"	Burnout Satisfaction	Existing
1284	Teixeira-Poit, 2017	USA	To examine the factors associated with aspects of professional life satisfaction	Neurologist	1,700	39.1%	Mix	Structured	Five-point likert scale 1) Career in medicine, 2) medical specialty, 3) current position, 4) relationship with colleagues, 5) relationship with patients, 6) personal time off, 7) pay	Satisfaction	Original
1655	Paulo, 2016	Brazil	To examine the relationship between the hospital work environment and physicians' job satisfaction and motivation	Hospital Physicians	600	NA	E-mail	Structured	1) Questions developed by CSG/SGIM Study 44 questions. 10 domains (career, expertise, autonomy, relationship with patients—patients, relationship with colleagues—relationships with staff, personal time, income and resources, and essential characteristics)	Work environment / Satisfaction (Career / Job)	Original
2398	Coleman, 2015	USA	To assess career satisfaction and affecting factors	physicians	10,380	9.8%	E-mail	Structured	The Wisconsin Medical Society's physician satisfaction survey	Satisfaction	Original
3019	Chen, 2014	USA	To evaluate determinants for job satisfaction and work-life balance satisfaction	GIM graduate	227	56.0%	E-mail	Structured	43 questions (career data, career satisfaction, Free text responses)	Career satisfaction	Original
3116	Ruggieri, 2014	Italy	To identify factors related to compassion fatigue(CF) and compassion satisfaction(CS)	Oncologists	670	24.9%	E-mail	Structured	1) Job Satisfaction Scale(JSS); 15 items 2) Link Burnout Questionnaire(LBQ); 24 items	Job satisfaction Burnout	Existing
3123	Shanafelt, 2014	USA	To evaluate career plans, professional expectations, and work-life balance	Oncologists	1,637	83.9%	NA	Structured	1) MBI 2) "My work schedule leaves me enough time for my personal/family life"	Burnout Satisfaction	Existing
3168	Opoku, 2014	USA	To identify relationship between career satisfaction	Physicians	1,403	14.3%	Web	Structured	1) 2 item modified version of the Physician Worklife Survey	Career satisfaction	Existing

(Continued)

Table 3. (Continued).

ID	Author (Years of publicati	Country	Summary of purpose	Participants	Number of participants	Response rate	Survey method	Questionnaire type	Survey items	Survey components	Originality
3345	Shanafelt, 2014	USA	To evaluate satisfaction with work-life balance and career plans	Oncologists	2,998	37.3% (before exclusion)	Mix	Structured	60 question Survey ASCO 1) MBI 2) My work schedule leaves me enough time for my personal/family life 3) Single-item linear analog self-assessment question 4) Retirement plan: 3-point scale question (original) 17-item questionnaire (1- to 7-point scale)	Burnout Satisfaction Fatigue Other Stress / Professional satisfaction / QOL / Work environment Work environment / Career satisfaction	Existing
4639	Pemeger, 2011	Switzerland	To survey professional satisfaction and burnout	All Doctors	5,119	59.4%*3) 56.3%*4)	E-mail	Structured			Original Existing
5013	Streu, 2011	USA	To survey career plan, professionalism, and work- life balance	Plastic surgeons	708	71.0%	Mail	Structured	The surgeon questionnaire		Original

*3):survey in 1998

*4) survey in 2007

Table 4. QOL-related studies.

ID	Author (Years of public)	Country	Summary of purpose	Participants	Number of participants	Response rate	Survey method	Questionnaire type	Survey items	Survey components	Originality
1201	Azevedo, 2017	Brazil	To assess quality of life in physicians and to survey how much work addiction would impact on their QOL	Physicians	1,110	NA	NA	Structured	1) WHOQOL-BREF 2) Work Addiction Scale(WAS)	QOL Other(Work addiction)	Existing
1362	Voltmer, 2017	Germany	To identify factors related to GP's QOL and work-related behaviors	Physicians	1,670	61% (T1 *5), 53.8% (T2)*6)	Mail	Semi- structured	1) SF-12 2) Arbeitsbezogenes Verhalten und Erlebensmuster (A-VEEM):Work-related Behavior and Experience Pattern 3) Swiss study question	QOL Stress Work environment Mental	Existing
2336	Miranda, 2015	Brazil	To assess whether self-protection and human relations may be associated with physicians' QOL	Physicians	602	33.0%	Mail	Structured	1) Bell Object Relations and Reality Testing Inventory-Form O (BORRTI-O) 2) Defense Style Questionnaire-40 (DSQ-40)	Other(ego defense) QOL	Existing
2697	Hipp, 2015	Germany	To survey QOL and job stress	Oncologists	261	14.5%	E-mail	Structured	3) WHOQOL-BREF 1) 42 items: Fragebogen zur Belastung von Ärzten und Schwester (FBAS)) 2) self assessment of Global QOL	Stress QOL	Existing
3960	Vicentic, 2013	Serbia	To assess relationship between QOL and burnout or emotional profiles	GP and psychiatrists,	120	NA	NA	Structured	1) MBI 2) General psychological distress; the 12-item Genetal Health Questionnaire (GHQ)	Burnout Stress	Existing
4788	Albina, 2011	Brazil	To assess QOL,Physical health, Mental health in postgraduate medical students and their colleration with demographies and professional sapects	Physicians	2,864	44.9%	E-mail	Structured	3) QOL scale (Minesota) 4) The emotions Profile Index(EPI) 1) QOL (very good,good,fair, poor, very poor) 2) Mental health (very good,good,fair, poor, very poor) 3) Physical health (very good,good,fair, poor, very poor)	QOL Mental QOL Mental Other(physical health) QOL	Original
4817	Santos, 2011	Brazil	To survey influence of work-related variables on QOL	Anesthesiologists	83	100.0%	Face to face	Structured	WHOQOL-BREF		Existing

*5): data in 2008

*6): data in 2010

Table 5. Other studies.

ID	Author (Years of publication)	Country	Summary of purpose	Participants	Number of participants	Response rate	Survey method	Questionnaire type	Survey items	Survey components	Originality
2702	Hiary, 2015	USA	To compare help-seeking behaviors between male and female surgeons	Surgery	775	27.0%	Web	Semi-structured	Surveys developed based on literatures (multiple choices, Likert scale, and free text) -Attitudes toward problematic (impaired) co-workers -Personal happiness -Help-seeking behaviors	Other	Original
3798	Gleichgericht, 2013	Argentina	To identify experience in caregiving environments and factors that may impair outcomes	Physicians	7,584	NA	Web	Structured	1) Interpersonal Reactivity Inventory (IRI) 2) ProQOL 3) Alexithymia; Tront Alexithymia Scale (TAS) 20item 4) Self report Altruism scale	Other (Empathy) QOL Mnetal	Existing
5008	Steenbeek, 2011	Netherlands	(1) To prepare an assessment tool for behaviors of insurance physicians that may have impact (1) To assess behaviors of insurance physicians	Insurance physicians	450	51.0%	Mail	Structured	Background variables/ Self-efficacy Attitude/ Social norm/ Barriers /Knowledge/ Intention/ Behaviour process/ Behavior assessment	Other (Altruism) Other Other	Existing Original

used a questionnaire to measure the attractive aspects of a certain hospital [9].

Regarding the survey components, work environment-related questions were evaluated in 15 studies; satisfaction, such as with one's career, job, etc., was evaluated in 11 studies; and work-life balance was evaluated in six studies. Most of the existing questionnaires were used to measure the labor/work situation or relevant influencing factors. The existing questionnaire found to be directly related to the labor/work situation was the Work Ability Index (WAI), which aimed to measure labor or work, work ability and health but not QOL in certain labor or work situations.

Satisfaction-related studies

The characteristics of the satisfaction-related studies are presented in Table 3.

Among the 16 (20%) satisfaction-related studies, eight (50%) studies used existing questionnaires; original questionnaires were used in seven (44%) studies, and a combination of existing and original questionnaires was used in one (1%) study.

Regarding the survey components, career satisfaction was evaluated in five studies, job satisfaction in four studies, professional satisfaction in one study, and satisfaction in seven studies. Other survey components that were measured included burnout in four studies and the work environment in three studies.

The question '*My work schedule leaves me enough time for my personal/family life*' was used to measure satisfaction in three studies. General QOL was measured in two studies, both of which used the ProQOL.

QOL-related studies

The characteristics of the QOL-related studies are presented in Table 4.

Among the seven (9%) QOL-related studies, existing questionnaires were used in six studies (86%), and an original questionnaire was used in one (14%) study.

Regarding the survey components, QOL was measured with the WHOQOL-BREF in three studies; a QOL scale (Minnesota), the SF-12, and a self-assessment of global QOL in one study each, stress and mental health scales in three studies each and work environment, work addiction, and physical health scales in one study each.

One study used an original questionnaire to investigate QOL, physical health, and mental health on a 5-point scale without validation.

Santos et al. [10] conducted a study in which the labor-related impact on QOL was identified using the WHOQOL-BREF and reported that work-related

variables (total on-call hours, labor hours, sleep pattern, and physical activities) were significantly correlated with QOL. This study also found that the environmental domain may influence monthly income.

Other studies

The characteristics of the other studies are presented in Table 5. Three studies (4%) focused on other purposes. One study used an original questionnaire to compare male and female surgeons on their views on coworkers. One study used original and existing questionnaires to assess the behavior of insurance physicians. Other studies focused on the caregiving environment using multiple questionnaires, including QOL-related questionnaires.

Discussion

This review classified studies on the work-related QOL of medical doctors into five major categories based on their study content and purposes. Nearly all identified studies (98%) with 'mental health-related' purposes used existing questionnaires. Most studies (73%) used the MBI as a measurement tool specific to burnout. Burnout is commonly reflected by stress reactions. The risk of burnout is broadly associated with personal factors and environmental factors. Regarding personal factors, a high level of dedication and a willingness to become deeply involved with others are said to cause burnout. Regarding environmental factors, overload ('quantitative overload including labor hours and workload and qualitative overload') and independence have been found to be related [11]. Our review found that mental health-related questions, such as questions used in the MBI, should be considered a main component in the development of measures of work-related QOL for medical doctors.

Concerning labor or work situation-related measurements, most (68%) studies used original questionnaires. Only two studies described the validation process, but neither of these studies evaluated labor or the work situation itself. Of the studies using existing questionnaires, only the MABEL Survey evaluated labor or work situations [12]. The MABEL Survey was a study conducted by the University of Melbourne in Australia to evaluate the effectiveness of health policy and existing systems to make further proposals. This survey comprised four sections targeting different survey participants, including general practitioners (GPs). The GP&GP Registrars survey included 98 questions and was conducted in 2018; this survey consisted of nine domains: A. current situation, B. job satisfaction, C. places where you work, D. workload, E. finances,

F. geographic location, G. family circumstances, H. about you, and I. health and wellbeing [12]. This study aimed to understand the role and interplay of labor-related factors by analyzing the dynamics of medical labor in Australia, but it did not directly assess work-related QOL for medical doctors. In our review, we could not find any existing questionnaire that specifically focused on labor or the work situation when exploring work-related QOL for medical doctors. However, since labor and the work situation have been found to be an indispensable component in a majority of studies, it is necessary to adopt related components in future QOL studies for medical doctors.

Among the 15 studies including satisfaction-related measurements, we could not find any representative questionnaire developed to assess the QOL of medical doctors. The question *'My work schedule leaves me enough time for my personal/family life'* was used in three studies. This question was used to investigate satisfaction with work-life balance in U.S. citizens and physicians [13]. Other components associated with satisfaction included career satisfaction in five studies, job satisfaction in four studies, and professional satisfaction and overall satisfaction in one study each. Our review showed that satisfaction is an indispensable factor in the exploration of work-related QOL for medical doctors. Regarding the relation of satisfaction and QOL, satisfaction is commonly known as an own concept diverged from the concept of QOL and the measurement tools for satisfaction are considered less robust than a validated QOL tool [14]. In our review, we found that satisfaction was also commonly included as one of the elements under work-related QOL by clearly setting the purpose of satisfaction. However, we categorized 'QOL related' and 'Satisfaction related' in two major categories, since most of the studies retrieved from this review used QOL tools and other individual satisfaction measurement tools separately. In addition, the number of individual measurement tools for satisfaction only is relatively larger than the number of satisfaction components included under QOL tool.

Regarding general QOL-related measurements, existing questionnaires were used in six (86%) studies, and the WHOQOL-BREF was used in three studies. The WHOQOL-BREF is the abbreviated version of the WHOQOL, one of the purposes of which is to allow international comparison. It comprises four domains, i.e., physical, psychological, social relationships and the environment, and consists of 26 questions, with two questions added to determine the overall QOL [15,16]. General QOL measured by the WHOQOL-BREF may reflect work-related QOL, but questionnaires specifically

focusing on labor/work aspects are still needed for medical doctors and other healthcare professionals.

This review found that the main study frames (study purposes) of measuring work-related QOL were associated with mental health, labor or the work situation, QOL, and satisfaction. To achieve these study purposes, multiple questionnaires related to burnout, satisfaction, stress, mental health, QOL, the work environment and work-life balance were frequently used. Many studies have aimed to identify any work or life factors that affect the QOL of medical doctors. Other studies have explored the QOL of medical doctors working in specific clinical departments with detailed questions relating to particular medical treatments or to topics such as burnout. However, there is a lack of studies assessing the change in work-related QOL before and after the introduction of a particular technology. In addition, most studies have combined multiple questionnaires or added original questions to existing questionnaires; therefore, there is a lack of studies using only one validated questionnaire to cover all work-related QOL components.

At present, research on the work-related QOL of medical doctors is still less common than research on the HRQOL of patients. Moreover, there is also a lack of systematic reviews exploring the methodology for studying QOL among medical doctors. A systematic review of QOL research by Haraldstad et al. [17] indicated that QOL was a complex concept, clarified the definition of QOL, and explained the difference between QOL and HRQOL. In addition, this review concluded that there were challenges in the methodology of QOL research and the concept of QOL.

Moreover, our review focused on the term QOL for medical doctors only. This will not be representative to all healthcare professionals. Future studies is necessary to explore the characteristics of QOL measure tools for other types of healthcare professionals.

Conclusions

This systematic review found that there is a lack of studies directly assessing changes in the work-related QOL of medical doctors and a lack of effective data collection tools that assess all work-related QOL components. Since the application of new technologies such as robotic surgery [18,19] or DX [20] may certainly change future clinical practice and affect the work-related QOL of medical doctors, it is necessary to develop tools to measure general work-related QOL for medical doctors to examine the benefit of introducing new technology. This review also identified four major components, *'mental health-related'*,

'labor/work situation-related', 'satisfaction-related' and 'QOL-related', that are commonly examined in current studies of QOL among medical doctors. Future qualitative and quantitative research may consider including these four components in the development of QOL data assessment tools.

Limitations

This review included only studies on medical doctors as representative of the healthcare professionals rather than studies of any healthcare professionals due to a large number of retrieved articles and the different definitions of the health profession in different countries. The literature search was conducted up to 2020. This study is also a background literature review for our further study that aims to develop a new tool to generously evaluate work-related QOL for healthcare professional regardless of gender. And due to the large number of retrieved studies on both genders, we set up an exclusion criterion to remove studies only focused on one gender group. We consider that it is important to discuss the differences in the data measurement tools of QOL between male and female in the future review. Based on regular literature searches by the review group, the latest studies are less likely to change our review conclusion; however, we believe that an updated review is still necessary in the future. In addition, this study reviewed only studies written in English or Japanese.

Acknowledgments

The authors would like to thank Mr. Yuuki Inoue, Mr. Takumi Ashizawa, Mr. Naoki Maeda, Mr. Toshiya Matsuzaki, Mr. Yoichi Shiota, Mr. Shoji Yasunaga for helping with screening and data extraction, and to Mr. Takumi Ashizawa, Ms. Keiko Akaike for helping literature collection.

Disclosure statement

Miyuki Ezura is an employee of Otsuka Holdings and does not hold stock or stock options, and conducted independently from Keio University.

LidaTeng has personally received consultancy fees from the GSK group of companies for a project which is not relevant to the submitted work. LT's affiliation has received grants from Otsuka Holdings, Co. Ltd., to provide advice and supports on the submitted work.

KatsuhikoSawada is an employee of Otsuka Medical Devices, does not hold stock or stock options.

YusukeTakushima is an employee of Taiho Pharmaceutical and a stockholder of Otsuka Holdings.

Ataru Igarashi has received honoraria from Otsuka Holdings, Novartis Pharma, Pfizer Japan, Terumo

Corporation, Chugai Pharmaceuticals, Astellas Pharma, Sanofi Japan, Takeda Pharmaceuticals, Nippon BoeringerIngelheim, Ono Pharmaceutical, Eisai, AbbVie GK, Sumitomo Dainippon Pharma, Ayumi Pharmaceutical, Medilead, Novo Nordisk Japan, and Taiho Pharm; received laboratory endowments from CSL Behring Japan, Fuji Film, Terumo Corporation, and Gilead Sciences; and received grants from Gilead Sciences, IntuitiveSurgical GK, Boston Scientific Japan, Pfizer Japan, Becton, Dickinson and Company, and Milliman

Funding

This study was carried out with support by Otsuka Holdings Co. Ltd., as joint research with Graduate School of Pharmaceutical Sciences, The University of Tokyo.

Ethical approval

This article does not contain any studies with human participants or animals performed by any of the authors.

Data and Code availability

Data or Code sharing is not applicable to this article as no new data were created or analyzed in this study.

ORCID

Miyuki Ezura  <http://orcid.org/0000-0002-0550-2646>

Katsuhiko Sawada  <http://orcid.org/0000-0002-2144-3068>

Yusuke Takushima  <http://orcid.org/0000-0002-6849-4137>

Ataru Igarashi  <http://orcid.org/0000-0001-6307-6916>

Lida Teng  <http://orcid.org/0000-0001-5879-9060>

References

- [1] Thimbleby H. Technology and the future of healthcare. *J Public Health Res.* 2013; 2(3):e28. doi: 10.4081/jphr.2013.e28
- [2] Noto S. Evaluation of HRQOL as a clinical outcome. [Article In Japanese] *Niigata J Health And Welfare.* 2019;19(3):78–83.
- [3] Fayers PM, Machin D (2016). *Quality of life: the assessment, analysis and reporting of patient-reported outcomes.* Wiley Blackwell.
- [4] Crigger E, Reinbold K, Hanson C, et al. Trustworthy Augmented Intelligence in Health Care. *J Med Syst.* 2022; 46(2):12. doi: 10.1007/s10916-021-01790-z
- [5] Kiyasseh D, Ma R, Haque TF, et al. A vision transformer for decoding surgeon activity from surgical videos. *Nat Biomed Eng.* 2023;7(6):780–796. Advance online publication. doi: 10.1038/s41551-023-01010-8
- [6] Stamm BH. The concise ProQOL manual. 2nd. ed. Pocatello: ProQOL.org; 2010. <https://proqol.org/proqol-manual>
- [7] Dyrbye LN, Satele D, Sloan J, et al. Utility of a brief screening tool to identify physicians in distress. *J Gen Intern Med.* 2013;28(3):421–427. doi: 10.1007/s11606-012-2252-9
- [8] Kao AC, Jager AJ, Koenig BA, et al. Physician perception of pay fairness and its association with work satisfaction, intent to leave practice, and personal health. *J Gen*

- Intern Med. 2018;33(6):812–817. doi: [10.1007/s11606-017-4303-8](https://doi.org/10.1007/s11606-017-4303-8)
- [9] Trybou J, Gemmel P, Van Vaerenbergh Y, et al. Hospital-physician relations: the relative importance of economic, relational and professional attributes to organizational attractiveness. *BMC Health Serv Res*. 2014;14(1):232. doi: [10.1186/1472-6963-14-232](https://doi.org/10.1186/1472-6963-14-232)
- [10] Oliveira Dos Santos M, de Oliveira HJ. Influencia de las variables laborales en la calidad de vida de los anestesiólogos de la ciudad de João Pessoa [Influence of work-related variables on quality of life of anesthesiologists in the city of João Pessoa]. *Rev Bras Anestesiol*. 2011;61(3):333–343. doi: [10.1016/S0034-7094\(11\)70039-3](https://doi.org/10.1016/S0034-7094(11)70039-3)
- [11] Kubo M. バーンアウト(燃え尽き症候群)–ヒューマンサービス職のストレス. [Article In Japanese] *Japanese J Labour Studies*. 2007;49(1):54–64.
- [12] MABEL Survey. *Medicine In Australia: Balancing Employment And Life Australia's National Longitudinal Survey Of Doctors*. <https://melbourneinstitute.unimelb.edu.au/mabel/home>
- [13] Shanafelt TD, Raymond M, Kosty M, et al. Satisfaction with work-life balance and the career and retirement plans of US oncologists. *J Clin Oncol*. 2014;32(11):1127–1135. doi: [10.1200/jco.2013.53.4560](https://doi.org/10.1200/jco.2013.53.4560)
- [14] Sirgy MJ. A quality-of-life theory derived from Maslow's developmental perspective: "quality" is related to progressive satisfaction of a hierarchy of needs, lower order and higher. *Am J Econ Sociology*. 1986;45(3):329–342.
- [15] The WHOQOL Group. The world health organization quality of Life assessment (WHOQOL): Position paper from the world health organization. *Soc Sci Med*. 1995;41(10): 1403–1409. doi: [10.1016/0277-9536\(95\)00112-k](https://doi.org/10.1016/0277-9536(95)00112-k)
- [16] Amemori YC, Mizumoto T, Arakawa Y, et al. (2017). Simplified measurement method for HRQOL based on WHOQOL-BREF by smart devices. In *Multimedia, distributed, cooperative, and mobile symposium*, Hokkaido, Japan (pp. 880–887). https://ipsj.ixsq.nii.ac.jp/ej/?action=repository_action_common_download&item_id=190129&item_no=1&attribute_id=1&file_no=1
- [17] Haraldstad K, Wahl A, Andenæs R, et al. A systematic review of quality of life research in medicine and health sciences. *Qual Life Res*. 2019;28(10):2641–2650. doi: [10.1007/s11136-019-02214-9](https://doi.org/10.1007/s11136-019-02214-9)
- [18] Kajiwaru N, Taira M, Yoshida K, et al. Early experience using the da Vinci Surgical System for the treatment of mediastinal tumors. *Gen Thorac Cardiovasc Surg*. 2011;59(10):693–698. doi: [10.1007/s11748-010-0790-9](https://doi.org/10.1007/s11748-010-0790-9)
- [19] Mucksavage P, Kerbl DC, Lee JY. The da Vinci(®) Surgical System overcomes innate hand dominance. *J Endourol*. 2011;25(8):1385–1388. doi: [10.1089/end.2011.0093](https://doi.org/10.1089/end.2011.0093)
- [20] Abernethy A, Adams L, Barrett M, et al. The Promise of Digital Health: Then, Now, and the Future. *NAM Perspectives*. 2022;6(22). doi: [10.31478/202206e](https://doi.org/10.31478/202206e)

Appendix

Search Strategy

- #1 physicians[mh] or physician[tiab] or medical doctor[tiab] or medical practitioner[tiab] or general practitioner[tiab] or allergist[tiab] or Anesthesiologist[tiab] or Cardiologist[tiab] or Dermatologist[tiab] or Endocrinologist[tiab] or Gastroenterologist[tiab] or Geriatrician[tiab] or Hospitalist[tiab] or Nephrologist[tiab] or Neurologist[tiab] or Oncologist[tiab] or Ophthalmologist[tiab] or Osteopathic[tiab] or Otolaryngologist[tiab] or Pathologist[tiab] or Pediatrician[tiab] or Psychiatrist[tiab] or Pulmonologist[tiab] or Radiologist[tiab] or Rheumatologist[tiab] or Surgeon[tiab] or Neurosurgeon[tiab] or Urologist[tiab] or Physicians[tiab] or medical doctors[tiab] or medical practitioners[tiab] or general practitioners[tiab] or allergists[tiab] or Anesthesiologist[tiab] or Cardiologists[tiab] or Dermatologists[tiab] or Endocrinologists[tiab] or Gastroenterologists[tiab] or Geriatricians[tiab] or Hospitalists[tiab] or Nephrologists[tiab] or Neurologists[tiab] or Oncologists[tiab] or Ophthalmologists[tiab] or Osteopathic[tiab] or Otolaryngologists[tiab] or Pathologists[tiab] or Pediatricians[tiab] or Psychiatrists[tiab] or Pulmonologists[tiab] or Radiologists[tiab] or Rheumatologists[tiab] or Surgeons[tiab] or Neurosurgeons[tiab] or Urologists[tiab]
 - #2 Quality of life[mh] or quality of life[tiab] or HRQOL[tiab] or QOL[tiab] or life quality[tiab] or quality of work*[tiab] or working life[tiab] or work life[tiab] or ProQoL[tiab] or WRQoL[tiab]
 - #3 Questionnaire[tw] or questionnaires[tw] or interview[tw] or interviews[tw] or scale[tw] or scales[tw] or subscale[tw] or subscales[tw]
 - #4 #1 and #2 and #3
 - #5 Search #1 and #2 and #3 Filters: Journal Article; published in the last 10 years; Humans
-