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Clinical Case Complexity in Occupational Health

Contributing Factors and a Proposed Conceptual Framework Model

Drushca Lalloo, FFOM, John Gallagher, FFOM, Ewan Macdonald, FFOM, and Conor McDonnell, FFOM

Objectives: Clinical case complexity is an inherent factor in occupational health (OH), yet it is poorly defined and understood. Our aim was to identify the multiple sources of complexity in OH and propose a conceptual complexity framework model for clinical OH practice. **Methods:** Through a scoping review, expert panel consensus, and content analysis of OH clinical case reports, we identified relevant complexity-contributing factors (CCFs) specifically tailored to the OH setting, which we defined and validated. **Results:** The proposed model consists of three primary domains (PDs); health factors, workplace factors and biopsychosocial factors. Twenty-seven CCFs are described and defined within these PDs. **Conclusions:** This work lays the foundation for improved understanding, identification, and assessment of complexity in OH. This is imperative for ensuring high quality clinical practice standards, identifying training needs and appropriate triaging/resource allocation.

Keywords: clinical case, complexity, conceptual framework, fitness for work, occupational health, return to work, training needs

COMPLEXITY IN OH

Occupational health (OH) is a dynamic clinical specialty that is continuously evolving in response to work activity and workforce demographic changes, as well as technological advances and socioeconomic factors. Performing health assessments, particularly fitness for work (FFW) assessments, in response to referrals by employers (usually human resources [HR] or managers) is a core function of OH practice throughout the world,[1] regardless of differing models of delivery. These FFW assessments are typically undertaken by specialist occupational physicians (OPs), non-specialist OPs and OH nurses but can be undertaken by other health professionals including, physiotherapists and occupational therapists.

These ''management/HR referrals'' to OH can arise from situations of long-term sickness absence (for advice on return-to-work timescales and programmes), short-term sickness absence (for advice on underlying medical causes and future attendance prognosis) or where the employee is at work with a health condition and advice is required on workplace adjustments, redeployment, or ill-health retirement. Clinical case complexity is an inherent factor in these assessments. Complexity has been studied in the context of occupational safety and health prevention research[2] and in immigrant workers in the hospitality industry to guide future health and safety risk prevention research,[3] but not in mainstream clinical OH practice or FFW assessment.

DEFINING COMPLEXITY

Defining complexity in healthcare is challenging and further complicated by the varying terminology used to describe or associated with it.[4] The complex patient has been described as ''one for whom clinical decision-making and required care processes are not routine or standard.''[5] However, there is no universally agreed definition of this or the broader clinical complexity concept.[6–9]

Earlier complexity studies limited their perspective to the individual patient and their health conditions, most commonly, comorbidity or multimorbidity.[4] Over time, understanding has evolved and clinical case complexity is now recognised to encompass a broad spectrum of contextual factors.[4,7,10,11] These include social, psychological, environmental, cultural, genetic, behavioral, and political factors as well the clinician–patient dynamic and clinician characteristics (clinical training, knowledge and experience, communication skills).[4,7,8,10–12]

A 2017 review[4] supported a theory and practice approach in studying clinical complexity. It highlighted that research should not just be focused on gaining more conceptual clarity of complexity but should also take into account how complexity manifests itself in practice, which can be undertaken for example, through clinical case or report reviews and analysis.

EXISTING CLINICAL COMPLEXITY MODELS

Factors contributing to complexity in clinical care have been studied [6–8,10–16] and existing models of clinical complexity are described in the literature.[10,11,14,15,17] Most models relate to the general healthcare or primary care setting but complexity has been studied in specific areas of medicine, including infectious diseases[14] and palliative care.[13]

The focus of many studies has been on patient factors that contribute to complexity.[6,11,12,15] A 2016 infectious disease study integrated the two perspectives of patient and task complexity, adapting the latter from industry-based models.[14]

Some healthcare framework models have been created from findings from a literature review,[10,11] that is, descriptions in the literature of the objective properties of patient and task complexity. Others have used existing healthcare models as an initial starting point, then built on this by identifying further relevant complexity-contributing factors (CCFs) and domains and validating these in the healthcare setting or specific medical disciplines using clinician judgement.[14] Some studies have used clinician judgement alone.[6,12]

From the Institute of Health and Wellbeing, College of Medical, Veterinary and Life Sciences, University of Glasgow, Glasgow G12 8RZ, UK (Dr Lalloo and Dr Macdonald); School of Public Health, University College Cork, Cork T12 YN60, Ireland (Dr Gallagher); Mid-West Region, Limerick V94 7X9, Ireland (Dr McDonnell).

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Ethics approval: Ethics approval was provided by University College Cork [2018-036].

Clinical significance: Clinical case complexity is an inherent factor in occupational health (OH), yet it is poorly defined and understood. We present a framework model for OH practice to improve our recognition and assessment of complexity. This is imperative for ensuring high practice standards, training/competency development and appropriate triage/resource allocation.

Address correspondence to: Drushca Lalloo, FFOM, Institute of Health and Wellbeing, College of Medical, Veterinary and Life Sciences, University of Glasgow, 1 Lilybank Gardens, Glasgow G12 8RZ, UK (drushca@hotmail.com).

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Existing research and models describe complexity arising from an interaction between multiple, diverse and multi-dimensional factors, including genetic, demographic, physical, psychological, social, health, environmental, behavioral, cultural, socio-economic, and psycho-social factors.[10–15,17]

The *Cumulative Complexity model* suggests that an imbalance between patient workload of demands and patient capacity to address these demands causes complexity.[15] Workload of demands are those on the patient's energy and time, from normal day-to-day activities and responsibilities, including treatment engagement. Capacity pertains to their ability to handle workload for example, their functional capability/morbidity, social support, or financial resources. The *Vector model of complexity*[10] proposes that a number of factors or vectors can increase or decrease complexity, depending on their interaction at any time. These vectors may be biological, socioeconomic, cultural, environmental, and behavioral. Complexity exists along each axis as a force with attributes of magnitude and direction. According to this model, two patients with similar health issues may present with either increased or decreased complexity depending on the relative sum of all vectors at that time. However, the appropriateness of the application of vectors in its methodology has been questioned.[18]

The *Complexity Framework*,[11] developed by Schaink et al from a scoping review of the literature, suggests that health and social experiences, demographics, mental/physical health and social capital all co-exist and interact within the socio-political context to cause complexity. As in the *Vector model*,[10] Schaink et al[11] found evidence that chronic conditions can cause complexity, due to interconnections with many other dimensions. Half the population in developed nations live with chronic conditions.[19] These are often compounded by psycho-social factors.[6,11] Multi-morbidity, that is, the co-existence of two or more chronic conditions in the same individual[7,11,20] is highly prevalent in the primary care setting and increases significantly with age.[21] It is associated with loss of physical functioning, hospital admission, longer hospital stays, poorer quality of life, premature death, depression, psychological distress, suboptimal treatment compliance, and polypharmacy.[21–24] These patients also report poor quality of and overall dissatisfaction with their care compared to those with single conditions.[25] It is acknowledged that most current evidence-based guidelines for patient care focus on single diseases and rarely consider complexity.[20,26]

Schaink et al[11] concluded that, from their literature review on patient complexity, there were broadly three types of complexity descriptions: multi-morbidity, resource utilization and psychosocial vulnerability and of this, multi-morbidity was the most investigated description.

The authors conceptualised a complexity framework around the five dimensions of medical health, health and social experience, demographics, mental health, and social capital all set within a socio-political and physical environment.

Psychosocial factors can adversely affect survival,[27] somatic disease outcomes,[28] treatment compliance,[29] and quality of life.[30] The biopsychosocial model of disease[31] has been long recognized, yet to date, biopsychosocial care needs assessments are rarely applied in standard general healthcare. As one of the few tools of its kind, the INTERMED complexity tool specifically addresses and assesses biopsychosocial case complexity.[17] Its reliability and validity as a useful tool to identify at-risk patients for poor clinical outcomes are supported through various publications of its application.

A study in the palliative care setting[13] proposed that complexity be considered in two broad contexts. It can be *inherent to the patient* or alternatively, it can be *perceived by health professionals.* The latter concept of *perceived* complexity sits, ''in the eye of the beholder,'' and can be related to factors such as lack of confidence, time and resource constraints, healthcare environment factors, level of experience and competence of the health professional. These, in contrast to *inherent patient complexity*, are amenable to change by clinical training and support. The complexity *inherent to the patient* is related to the particular circumstances of the case and thereby considered, a more ''predictable'' source to assess.

THE NEED TO UNDERSTAND COMPLEXITY IN OH

In OH, similar to other medical disciplines, recognizing, understanding, and assessing case complexity is fundamental to ensuring high clinical practice standards. Complex patients can result in information overload and decision-making uncertainty for even the most competent and experienced OH clinicians. This can result in errors of judgment and a reduction in the quality of OH advice and recommendations made. Moreover, managing complex patients requires additional time and effort on the part of the clinician as well as higher skill levels and competencies.

Assessing complexity can help tailor OH clinician training and identify educational needs. It can also assist OH service providers in workload/appointment-time allocation and ensure assessments are provided by the most appropriate person, with a skill set matching the complexity of the case. It will help in the effective ''triage'' of cases to distinguish referrals which would benefit from an assessment by a specialist in occupational medicine from those that could be assessed by a non-specialist physician or OH nurse. With many countries reporting declining specialist OP numbers,[32,33] it is increasingly important that specialists focus their efforts on issues that demand their higher competency level.

With the OH clinician's unique position as the impartial medical advisor (pitched between employer and employee), this divergence of OH practice from other medical specialties adds further dimensions in complexity, as does the OH practice framework of additional legal, ethical, and regulatory requirements.

Yet to date, the nature of complexity in OH, its contributing factors and its assessment are poorly understood. What makes an OH assessment complex is not well defined and there is an absence of a well-developed research base in this area.

The aim of this paper therefore is to lay the foundation for more in-depth understanding of the multiple sources of complexity in OH and to propose a conceptual complexity framework model for OH practice that can be applied to ''management/HR referral'' FFW assessments.

METHODS

As a more objective and predictable source to assess, the focus of our model is on employee and workplace CCFs (ie, arising from the individual characteristics of the employee and/or their workplace) and not task CCFs or complexity *perceived* by the health professional. This approach also recognises the uniqueness of the OH clinician role, bridged between the employer/workplace and the employee.

We reviewed existing healthcare complexity models from the literature, identifying CCFs potentially relevant to OH. Then, through expert panel consensus, alongside content analysis from a peer-review audit study (of 200 OH clinical case reports and related background referral documents from the employer),[34] we identified further relevant CCFs specifically tailored to the OH setting, which we defined. Validation was undertaken by triangulation of the three steps above (literature review, expert panel judgement, content analysis). The CCFs were categorised within higher-level domains. Details of the specific stages of this process are presented in procedures below.

Settings

The study was conducted across two academic Departments, University College Cork in Ireland and University of Glasgow in the United Kingdom (UK). It formed part of a wider peer review audit study of a sample of 200 anonymised OH reports by 30 OPs (non-

specialists and specialists) from a large Irish OH service operating nationwide and covering a broad range of employment sectors.[34] The audit was conducted from October to December 2018 and the study methodology, strengths and limitations are described in detail elsewhere.[34]

The Expert Review Panel

The four authors, (two practising in Ireland and two practising in the UK), combined to form an expert review panel. They also undertook the content analysis of OH clinical case reports. Each author is a senior specialist in occupational medicine with over 20 years of general medical experience and over 15 years in OH. Cumulatively, there is extensive academic research experience.

Procedures

Procedures for developing and validating the conceptual framework model comprised four steps:

Step 1: Baseline Model Creation from Existing Models in the Literature

A brief scoping review was conducted to identify existing clinical complexity frameworks or models in the literature in the context of healthcare provision and/or health outcomes. An electronic search was carried out using the MEDLINE (Pubmed) database. Our search strategy combined two blocks of keywords or MEsH terms intended to cover the key aspects of our review: (a) clinical/patient/task complexity, multimorbidity, comorbidity, chronic disease, biopsychosocial (b) health services, care delivery, care model, framework. Our search was limited to adults and English articles up until May 2018. Studies were included if they involved clinical, patient or task complexity models or frameworks in the context of healthcare provision/delivery. Google Scholar was also used to supplement our database searches.

One author [JG] screened titles and, when necessary, abstracts for eligibility. The reference lists from the selected papers, including systematic reviews were reviewed and additional studies derived from these were also identified. A full text was obtained for all potentially suitable publications identified. These were reviewed independently by two authors [JG, DL] and CCFs potentially relevant to the OH setting were extracted. Disagreements were resolved by discussion and the agreed CCFs were collated to create our baseline model (see Figure 1).

Step 2: Development of Preliminary OH Model from Baseline Model, CCF Definition and Higher-Level Categorization

The expert panel met for the purpose of a focused discussion on the key elements of the ''management/HR referral'' FFW health assessment. The discussion covered the following core areas: the initial referral content/paperwork from the manager or HR (containing the case background and the specific OH advice requested), the clinical consultation, the decision-making process and associated considerations, and then assimilating all of this information into the final output, which is the OH report back to the manager/HR. Potential CCFs in each stage of this process were identified and recorded by the panel. Iterative discussions on different types of related clinical scenarios within these core areas followed, to capture additional detail and to affirm their complexity contribution. The baseline model created from the scoping review in Step 1 was considered by the panel, in the context of these iterative discussions. The CCFs to be merged, modified, deleted, and retained from the baseline model were discussed and agreed by the expert panel, as were new CCFs to be added, to create the preliminary OH model developed from this iteration. This process is detailed in Figure 2. The CCF names were then confirmed; descriptive definitions for each were produced; and they were categorised into higher-level primary domains (PDs), by the expert panel. Any reviewer disagreements were discussed and reconciled. Additional discussion and a practice CCF coding exercise of a random sample of OH reports ($n = 10$) was undertaken to ensure clarity of understanding of the CCF definitions and to promote coding consistency among the panel.

Step 3: Content Analysis and CCF Coding of a Sample of 200 Anonymised OH Clinical Case Reports and Related Referral Documents by Expert Panel, for Further Validation

The four expert panel members each applied the preliminary OH complexity model to the content of a sample of 50 anonymized OH clinical case reports and related referral documents (200 reports in total). The aim of this exercise was three-fold; firstly to test and validate the coded model against a broad and diverse range of OH clinical scenarios; secondly, in doing so, to capture any previously unidentified CCFs and; thirdly to evaluate the frequency of the identified CCFs. In this step, complexity was determined from the employee and workplace specific factors of the case contained within the initial management/HR referral and the OH report to the employer. The reviewers did not have access to the clinical consultation notes.

The OH reports in this audit were structured within a standard template with specified headings/sections. This ensured consistency and facilitated key aspects of the case to be covered (ie, by prompting the OH clinician to address these within the respective report section/heading). Accordingly, sufficiently detailed information was available to the expert panel reviewers, to make a judgement of complexity. This included: the referral reason, presenting medical complaint/ condition, current treatment and progress, clinical examination/functional assessment findings, FFW opinion and recommendations including; advice on workplace adjustments, relevant legal and ethical considerations, other barriers to work, (including non-medical, if relevant) and review arrangements. In their content analysis judgement, the reviewer was asked:

Is this a complex case? Yes or No

In the event of a positive response, they were then asked:

Applying the complexity framework model, select the CCFs that apply? The reviewer could choose more than one CCF, in recognition of the fact that multiple complexity factors can be present in any given case[10,11] and to capture as many CCFs as possible. Where a CCF applicable to the report content was not present in the model, a new free text CCF could be added by the reviewer.

Step 4: Iterative Modification and Addition of CCFs for Final Model

The expert panel discussed the new free text CCFs arising from step 3 and, those agreed to be relevant, were named and added to the OH model under their relevant PD. CCF heading names and definitions were revised, if indicated, and the final model confirmed. The content analysis results were collated using Smart Survey™ and analysed using Stata_{v16}.

Ethics approval was provided by University College Cork Social Research Ethics Committee [2018-036].

RESULTS

Baseline Model Creation from Existing Models in the Literature (Step 1 Above)

From existing complexity healthcare models in the literature, five ''dimensions'' were described; demographics/culture, physical

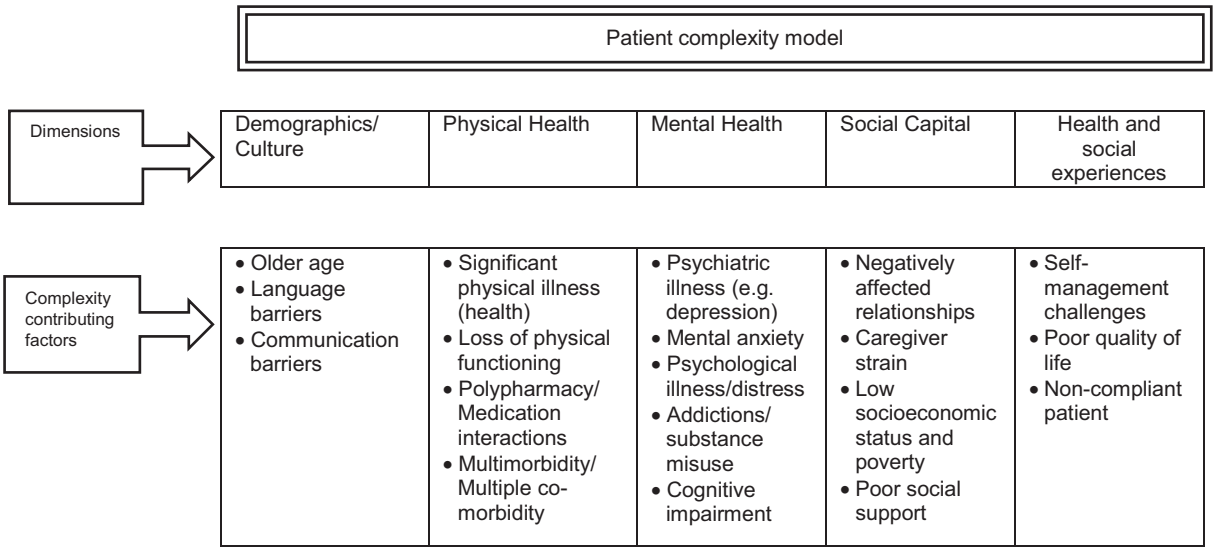

FIGURE 1. Extracted patient CCFs potentially relevant to OH practice from healthcare models in the literature (Step 1 outcome). CCF, complexity-contributing factor; OH, occupational health.

health, mental health, social capital, health, and social experiences. Within these, the expert panel identified 19 CCFs as potentially relevant to the OH assessment, which constituted the baseline model. This model is presented in Figure 1.

Development of Preliminary OH Model from Baseline Model and Classification into Higher Level PDs (Step 2 Above)

Four types of actions were applied to the baseline model CCFs (see Figure 2):

Relevant Items Were Merged

Overall, 10 CCFs were merged into four CCFs. Multiple co-morbidity and older age were merged into older worker with multiple co-morbidity; language barriers and communication barriers were merged into language/communication barriers; significant physical illness (health) and loss of physical functioning were merged into severe debilitating physical illness; low socioeconomic status/poverty, negatively affected relationships, poor social support and poor quality of life were merged into socioeconomic factors.

Relevant Items Were Modified

Overall, eight CCFs were modified into five CCFs. Caregiver strain was modified to domestic/personal stressors; self-management challenges was modified to yellow flags/illness behaviors; mental anxiety, psychological illness/distress, psychiatric illness (eg, depression) were modified to significant psychiatric disorder; medication interactions and polypharmacy were modified to sedative or other debilitating adverse medication side-effects; non-compliant patient was modified to non-compliance with disease-stabilising medication.

Relevant Items Were Retained

Three baseline model CCFs: addictions/substance misuse, cognitive impairment and multimorbidity were retained.

New Items Were Created

Overall, 11 new CCFs were created and added: multi-system disabling conditions, functional somatic syndromes, sudden incapacitating conditions, employees with learning disabilities, high functional demands of the role, safety-critical/important work, medicalised HR policies, ill-health retirement, significant employer-employee conflict, employer's lack of understanding of the role/remit of OH, employee's lack of understanding of the role/remit of OH.

No CCFs from the baseline model were removed.

A preliminary OH model (Table 1) was created as an outcome, with 23 employee and workplace CCFs in total, classified into three higher-level PDs: health, workplace and biopsychosocial factors.

Content analysis of a sample of 200 OH reports resulted in the addition of a further four CCFs: threat of dismissal, litigation against employer, difficult to predict prognoses and employers/managers' unwillingness to consider workplace adjustments.

The Final Model

The final OH complexity framework model developed from the four-step process above is shown in Table 2. This comprises 27 CCFs listed within their respective PD (health, workplace and biopsychosocial factors) together with detailed definitions of each CCF, with included examples to guide the OH clinician in their interpretation of each CCF and how they contribute to complexity in practice.

Frequency of CCFs Through Content Analysis from a Peer Review Audit

Applying this framework in the content analysis of a sample of OH case reports and related referral documents, out of 106 complex cases identified, the most frequently observed CCFs were high functional demands of the role ($n = 47$), multi-morbidity ($n = 40$), and safety-critical work ($n = 39$). See Table 3. The expert panel reviewers also observed from this exercise, that, while independently, the health, workplace and biopsychosocial factors described in our model contribute to complexity, in combination, the contribution is likely to be increased further.

DISCUSSION

Summary of Findings

We have conceptualized and validated a complexity framework model for OH practice, comprising employee and workplace CCFs with specific detailed definitions, grouped into higher-level domains.

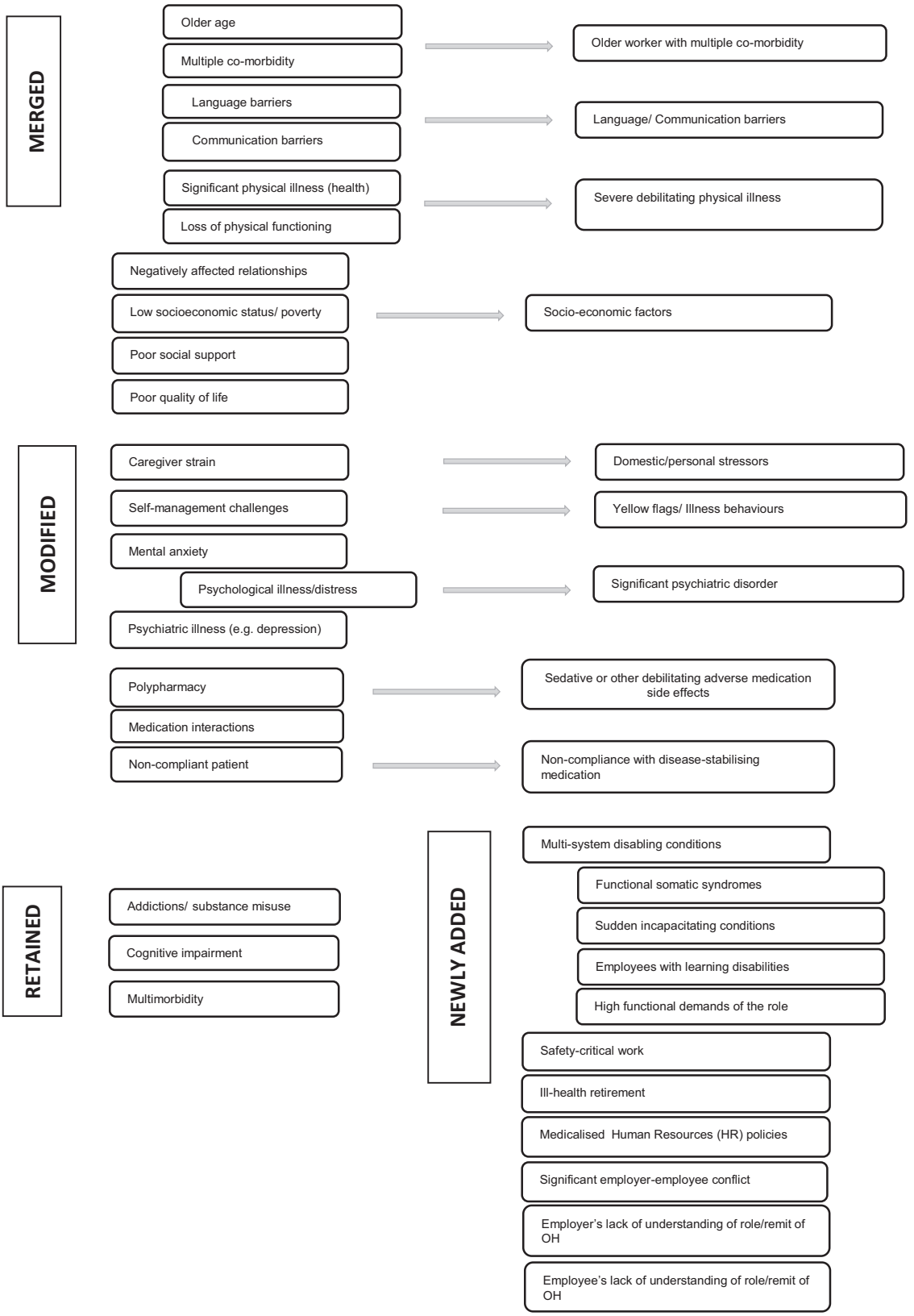

FIGURE 2. Overview of the merged, modified, retained and newly added CCFs following expert panel discussion/review (Step 2 process in detail). CCF, complexity-contributing factor.

TABLE 1. Initial OH CCF List Following Expert Panel Discussion (Step 2 Outcome)

Dimensions	OH CCFs
Health factors	
Physical Health	• Severe debilitating physical illness • Multi-system disabling conditions • Functional somatic syndromes • Sudden incapacitating conditions • Multimorbidity • An older worker with multiple co-morbidity • Sedative or other debilitating adverse medication side effects • Non-compliance with disease-stabilising medication • Cognitive impairment • Employees with learning disabilities
Mental health	• Significant psychiatric disorder • Addictions/ substance misuse
Workplace factors	
	• High functional demands of the role • Safety-critical or safety-important work • Ill-health retirement • Medicalised Human Resources (HR) policies • Significant employer-employee conflict • Employer's lack of understanding of the role/remit of OH • Employee's lack of understanding of the role/remit of OH
Biopsychosocial factors	
	• Domestic/personal stressors • Yellow flags/ Illness behaviors • Socio-economic factors • Language/ Communication barriers

CCF, complexity-contributing factor; OH, occupational health.

From our OH report content analysis, we identified that health and workplace factors are more likely to be the primary source of complexity than biopsychosocial factors.

Similar to general healthcare, multi-morbidity is an important health-related CCF in the OH setting. With government pension policies and socioeconomic factors requiring older people to remain in work for longer, OH assessment of older workers with multimorbidity has increased, together with its challenges,[35] and this is reflected in our model. Conversely, in the younger workforce, the presence of a sudden incapacitating condition (eg, seizures) or a severe and enduring mental health condition, (eg, bipolar disorder) can increase complexity. High functional work demands and safety-critical roles are important work-related CCFs. Significant biopsychosocial factors, for example, ill-founded/negative health beliefs (yellow flags), can also contribute to complexity in OH.

The ''inter-relatedness/interaction'' of factors, emphasised as a key influence in complexity from the literature[4,10,11] was also observed in our assessment. From our content analysis, while independently, the health, workplace, and biopsychosocial factors described in our model contribute to complexity, we observed that in combination, the contribution is likely to be increased further. To illustrate; while a health condition alone can infer complexity, when put in the context of high functional demands of a job/role, the degree of complexity can increase even further. Take for example, an employee with seizures (health CCF). There is likely to be an even higher degree of complexity if that individual worked in a safety critical job, as a field engineer, community care worker or in a virus laboratory (workplace CCF) than if they worked in an office environment. Likewise, assessment of an ageing (health CCF) employee with multi-morbidity (health CCF), for example, significant osteoarthritis of their knees, early Parkinson's and moderate hearing impairment, working as a nurse is likely to carry a higher degree of complexity, than if that individual worked in an office. Contribution from each of these complexity factors will vary between different employee assessments.

Comparison with Other Studies

As the first of its kind in the clinical OH setting, there are no other available models to make direct comparisons with. Aside from the INTERMED tool,[17] in general comparison with other healthcare models, we present more detailed definitions of biopsychosocial factors contributing to complexity. Despite their recognized association with poor clinical outcomes,[27–29] biopsychosocial factors/care needs are frequently overlooked in standard healthcare (where the medical model is the focus). This could explain their lack of detailed consideration in many existing healthcare complexity models.

Strengths and Limitations

To the best of our knowledge, this is the first study to address complexity in clinical OH practice and FFW assessment and the first conceptualized complexity framework model in mainstream OH. This model fills an important gap for OH clinicians and services around the world in our understanding and assessment of clinical complexity thereby facilitating (a) quality improvement through training and competency development and (b) effective triaging of referrals with more appropriate workflow/resource allocation.

The framework can be used to inform clinician training on the specific identified sources of complexity, that is, the specific CCFs within each of the PDs, how to effectively manage these and pitfalls to avoid. This in turn, could be evaluated by audit of the clinical management of such cases.

TABLE 2. Final OH Complexity Framework Model: CCFs and Their Specific Definitions, Categorised Within Higher-Level Primary Domains

Primary Domains	OH CCFs	Definition
Health factors		
	Severe debilitating physical illness	Severe physical illness with significant loss of physical functioning (eg, Parkinson's disease, motor neurone disease, progressive muscular dystrophies, severe psoriatic arthropathy or severe rheumatoid arthritis).
	Multi-system disabling conditions	Medical conditions with multi-system disability, that is, recognised physical, mental and cognitive sequelae (eg, stroke, Parkinson's disease, motor neurone disease, multiple sclerosis).
	Functional somatic syndromes	Symptoms in the absence of any demonstrable underlying medical pathology, and where the clinician is reliant on history alone, making it difficult to make an objective assessment (eg, psychosomatic disorders such as fibromyalgia and chronic fatigue syndrome).
	Sudden incapacitating conditions	Conditions resulting in sudden incapacity, loss of or altered consciousness, with or without warning (eg, seizures, lack of awareness of onset of hypoglycaemia in diabetes/hypoglycaemic episodes requiring rescue from another person).
	Multimorbidity An older worker with multiple co-morbidity	Two or more concurrent health conditions in the same individual. A worker over 50 years old, with two or more chronic health conditions, including those associated with advancing age (eg, osteo-arthritis, hearing or visual impairment).
	Sedative or other debilitating adverse medication side effects	Sedative or other debilitating adverse side-effects of regular and required medication (eg, high dose opiates, sedating anti-psychotic medication), particularly if required to be taken during working hours.
	Non-compliance with disease-stabilising medication	Non-compliance with medication required to maintain ongoing stability of condition (eg, bipolar disorder, psychosis, schizophrenia), particularly when in safety critical jobs or lone working.
	Cognitive impairment	Cognitive impairment, formally diagnosed or undiagnosed at OH referral (due to dementia or as part of another condition, eg, stroke, multiple sclerosis or chronic diabetes).
	Employees with learning disabilities	Employees with learning disabilities, particularly where there are high job demands and employers are not supportive.
	Difficult to predict prognoses in uncommon or complex conditions typically requiring specialist report/advice *	Difficult to predict prognoses in uncommon or complex conditions typically requiring specialist report/advice (eg, Menieres disease, complex traumatic injuries/fractures, unusual cancers or employees continuing to work with advancing metastatic cancer).
	Significant psychiatric disorder	Severe and enduring mental health conditions (eg, bipolar disorder, psychosis, schizophrenia), particularly when in safety critical jobs or lone working.
	Addictions/ substance misuse	Alcohol or drug misuse or dependence, particularly when in safety critical jobs or lone working.
Workplace factors		
	High functional demands of the role	Job roles that are highly physically or mentally demanding (eg, firemen, police officers, seafarers, labourers, construction workers, care work with challenging behaviors, prison officers).
	Safety-critical or safety- important work	Job roles or work activities where, because of risks to the individual concerned or to others, the employee needs to have full, unimpaired control of their physical and/or mental capabilities (eg, pilots, train drivers, heavy goods drivers, other vocational drivers, electricians, field engineers, doctors).
	Ill-health retirement	Ill-health retirement (IHR) cases (ie, applications to employer's pension schemes for early access to pension on the grounds of permanent ill-health), particularly where IHR is not appropriate and the employer/employee are not recognising or accepting of this or where employers try to use the IHR process to progress contract termination.

TABLE 2. (*Continued*)

Primary Domains	OH CCFs	Definition
	Medicalised HR policies	HR policies that place undue focus on medicalising situations (where this is not appropriate) rather than addressing organizational factors, where these are the key issues and where the solutions lie (eg, work-related stress).
	Significant employer-employee conflict	Significant conflict or interpersonal difficulties between employer and employee.
	Employer's lack of understanding of role/remit of OH	Employer's lack of understanding of the role/remit of OH, particularly the impartiality of the OH role, confidentiality considerations and what advice an OH clinician is able and not able to offer (notably, where considerations are organizational and for the employer to decide, rather than medical)
	Threat of dismissal*	Threat of employee dismissal, either relating to absence management processes or disciplinary/ investigation processes.
	Litigation against employer*	Employee initiating or actively involved in legal proceedings against their employer (eg, workplace injury/accident or other workplace matters), particularly where there is related conflict, assumption by either side of OH allegiance to them, and likelihood of the OH clinician's records/assessment being requested/used as part of the claim.
	Employers/managers' unwillingness to consider workplace adjustments*	Employers/managers' unwillingness to consider workplace adjustments as part of good employment practice or their duty under disability legislation.
	Employee's lack of understanding of role/remit of OH	Employee's lack of understanding of the role/remit of OH, particularly the impartiality of the OH role and what advice an OH clinician is able and not able to offer (notably, where considerations are organizational and for the employer to decide, rather than medical).
Biopsycho-social factors		
	Domestic/personal stressors	Domestic/personal stressors (eg, increased care responsibilities, domestic abuse, relationship breakdown), particularly where employers are not supportive or employees fail to recognise the "business continuity" perspective/duty of their employers.
	Yellow flags/ Illness behaviors	Psychological barriers to return to work, false illness perceptions and beliefs of employees (eg, "returning to work will make their condition worse" or "not being able to return to work until they are 100% better").
	Socio-economic factors	Lack of family and social support or financial hardship particularly, where the employee's motivation to return to work is financially driven, even if they are unfit to do so.
	Language/communication barriers	Consultations with employees speaking a different language, those with reduced language fluency or the hearing impaired (with or without interpreters), that can take longer and make information gathering (particularly, accurate information gathering) more challenging.

*Denotes further OH CCF added after expert panel audit/content analysis of OH clinical case report sample.
CCF, complexity-contributing factor; HR, human resource; OH, occupational health.

TABLE 3. OH CCF Frequency from Expert Panel Content Analysis of a Sample of OH Clinical Case Reports*

Complex Reports ($n = 106$)†	n (%)
Health CCFs present	
Multimorbidity	40 (16)
Significant psychiatric disorder (eg, bipolar, psychosis, schizophrenia)	5 (2)
Functional somatic syndromes (eg, fibromyalgia, chronic fatigue syndrome)	6 (2.4)
Sudden incapacitating conditions	9 (3.6)
Difficult to predict prognoses	26 (10.4)
Older worker with multiple co-morbidity	3 (1.2)
Non-compliance with disease-stabilising medication	1 (0.4)
Workplace CCFs present	
High functional demands of the role	47 (18.8)
Safety-critical or safety-important work	39 (15.6)
Threat of dismissal	4 (1.6)
Litigation against employer	7 (2.8)
Ill health retirement	4 (1.6)
Medicalised HR policies	2 (0.8)
Significant employer-employee conflict	18 (7.2)
Language/ Communication barriers	4 (1.6)
Employers/managers' unwillingness to consider workplace adjustments	6 (2.4)
Biopsychosocial CCFs present	
Domestic/personal stressors	15 (6)
Yellow flags/illness behaviors	12 (4.8)
Socio-economic factors	2 (0.8)
Total	250 (100)

*Selection of more than one CCF was permitted.
†Out of a total sample of 200 OH clinical case reports audited/analyzed.
CCF, complexity-contributing factor; OH, occupational health.

The function of triaging FFW referrals may be undertaken by an OH clinician or administrator sometimes with written criteria, but there is no standard or consistency across OH services. This paper for the first time presents an evidence-based rationale for the triage process that could be applicable to OH provision in countries around the world, regardless of differences in models of delivery and which clinicians are delivering it.

By its nature, there is a risk of over-complicating complexity description and assessment, and in doing so, making it less useful to clinicians, to whom its function is most important. A strength of our framework model is its simple presentation, comprising easily understandable factors that are clearly defined and relatively simple to apply.

Ours is among a handful of studies to combine the recommended theory (CCFs identified from the literature/previous models) and practice (CCFs identified from content analysis of OH case reports and expert clinician judgement) approach in studying complexity,[4] enabling a more holistic, ''real world'' and multi-dimensional assessment. These steps also represent a triangulated approach to the validation of our model.

Non-inclusion of the clinical consultation records in the content analysis could be considered a study limitation. However, given the degree of detail of the OH reports (templated to ensure key information was included), together with information contained in the management referral, sufficient information was deemed available, to make an adequate assessment of complexity factors. Furthermore, the OH report is the main ''product'' or output of the OH assessment,[36] in which the key aspects of the case are summarized and synthesised by the assessing clinician.

The sampling method of a single (albeit large, nationwide) Irish OH provider could also be a limiting factor and the content analysis may not be representative of all OH reports or clinical case scenarios. This, however, was mitigated for by the mixed method, ''theory and practice'' and ''triangulated'' approach we adopted in developing and validating our model.

The specific focus of our model to the OH setting and potential lack of applicability to other clinical specialties could also be considered a study limitation. However, there are a number of CCFs present within our model—some included from previous models (eg, multimorbidity, addictions) - that are generalizable to other medical specialties/clinical disciplines. Consequently, there is scope for this model to be used as a base that can be adapted and tailored to other specialties. Furthermore, the overarching principles of our framework model approach, that is, ensuring high clinical quality standards, optimizing/developing clinical competencies and, appropriate use of clinician resources can be applied to other medical disciplines.

Further research could include surveying OH clinician's views on CCFs and more in-depth analysis of the most commonly occurring employee and workplace CCFs, to target training.

CONCLUSIONS

The complexity factors and framework described in this paper present a fundamental stepping-stone in our understanding of complexity in OH and consequently, improving our recognition and assessment of it. This is imperative for clinical governance, maintaining high standards of OH practice, tailoring education and training, effective triage and ensuring the most efficient use of clinician resources.

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