Empirical Approach to Linking the ICF to the Dictionary of Occupational Titles

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Abstract

Background: The purpose of this pilot/demonstration project is to link the International Classification of Functioning, Disability and Health (ICF) to the Dictionary of Occupational Titles (DOT) using an ICF-based computer adaptive self-report measure and the Occupational Information Network (O*NET) database. The ICF provides a logical structure and classification of physical abilities that are often associated with various jobs. The O*NET database provides a connection between DOT job classifications and O*NET job classification. This project highlights a connection between the self-report ICF Activity Measure (ICF-AM) to the DOT through the O*NET database.

Method: ICF Activity domains and item difficulty calibrations were obtained from the ICF Activity Measure secondary database. Expert panels were used to match ICF-AM constructions and O*NET job element names. Experts were asked to match the ICF-AM item difficulties with three levels of job demands. ICF-AM construct item difficulty measures and O*NET data values were calculated. The O*NET database was then modified to generate O*NET job titles associated with ICF-AM construct ability measures.

Results: The resulting database connection allows ICF based self-reported measures of physical ability to produce listings of appropriate job choices for Social Security Disability Insurance (SSDI) claimants.

Conclusion: Empirically connecting the ICF-AM to the DOT provides a practical means for identifying relevant jobs for SSDI claimants and may serve as a model for connecting the ICF to future occupational classification systems.

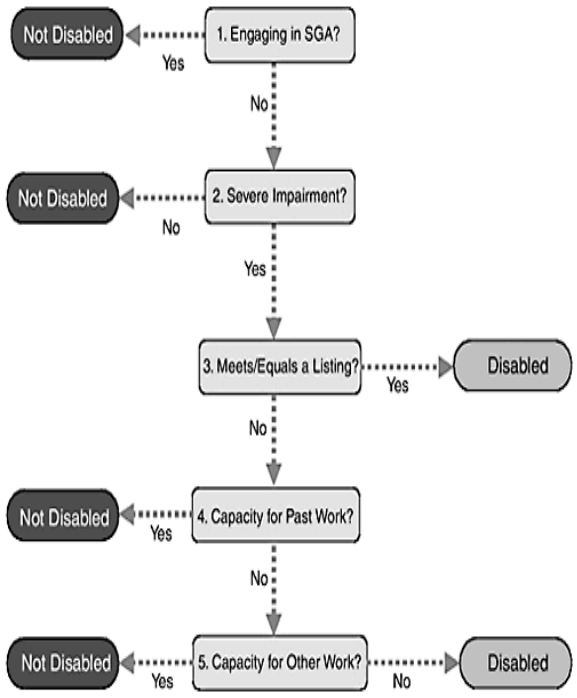
Background

The Social Security Administration (SSA) has established a thorough, but complex disability claim process. This process is based on the following definition of disability, adopted in the Social Security Amendments of 1967: "An individual shall be determined to be under a disability only if his physical or mental impairment or impairments are of such severity that he is not only unable to do his previous work but cannot, considering his age, education, and work experience, engage in any other kind of substantial gainful activity which exists in the national economy, regardless of whether such work exists in the immediate area in which he lives, or whether he would be hired if he applied for work. For purposes of the preceding sentence (with respect to any individual), 'work which exists in the national economy' means work which exists in significant numbers either in the region where such individual lives or in several regions of the country" (Social Security Act 223(d)(2)(A)).

Consistent with this definition, the SSA has established a five-step sequential evaluation process (Figure 1) that begins with determining whether the claimant is engaging in any substantial gainful activity (Step 1) and leading to the determination of the claimants capacity for performing other work (Step 2).

Figure 1

Five Stages of Disability Determination



The disability claims process has been tested by greater than 2 million annual applications since 2004 (SSA, 2014). Due to the high number of claimants and the extensive nature of the disability determination process, one of SSA's primary goals is to more quickly and accurately process claimants (Stobo et al., 2007). Information obtained in stages 4 and 5 of the disability determination process gauges the capacity for accomplishing past work and other work, respectively.

The development of a conceptual and empirical link between disability theory and job demand classification may increase the accuracy and efficiency of the work capacity evaluation and identify potential occupations for the SSA claimants. "Claimant abilities" are represented by the International Classification of Functioning Disability and Health and "job demands" are represented by the Occupational Information Network and Dictionary of Occupational Titles.

The International Classification of Functioning, Disability and Health (ICF) is a contemporary and widely-applied disability theory that is used to measure health and disability at individual (and population) levels (World Health Organization., 2001). Developed and adopted by the World Health Organization, the ICF incorporates both medical and social models, and describes dynamic interaction and complex relationship between health condition and

contextual factors (World Health Organization., 2001). The ICF describes "disability" as not only an attribute of an individual, but also a complicated combination of factors, including personal, environmental and social (World Health Organization., 2001). The ICF Activity domain is of particular relevance to this project. The ICF defines "Activity" as the execution of a task or action by an individual and "activity limitation" as difficulties an individual may have in executing activities (World Health Organization, 2002). Under the Activity and Participation domain are nine "chapters," five of which apply to Activity: learning and applying knowledge, general tasks and demands, communication, mobility, and self-care. This project focuses on the "mobility" chapter. Mobility has a number of categories that are relevant to the claimant's ability to accomplish job demands, such as changing and maintaining body position, carrying, moving and handling objects, walking and moving.

The oldest and most established classification of job demands is the Dictionary of Occupational Titles (DOT). Developed by the Employment and Training Administration in the Department of Labor in 1938, the DOT has been the standard reference for job placement and job classification (Photius Coutsoukis and Information Techonology Associates, 2003; US Department of Labor). While the last revision of the DOT was over 20 years ago, it has partially been superseded by an online database, the Occupational Information Network (O*NET) in 1998 (US Department of Labor, 2004). O*NET can be accessed online or through a number of public and private career and labor market information systems(US Department of Labor, 2004). Along with being updated on a regular schedule, O*NET includes a variety of descriptors for each job including: skills, abilities, knowledge, tasks, work activities, work context, experience levels required, job interests, work values/needs, and work styles (National Center for O*NET Development, 1998). O*NET includes a numerical "data value", a data point that reflects the job demand. Its entire database is publically available and completely downloadable via the web (National Center for O*NET Development, 2012).

While the ICF contains components that represent claimant abilities (i.e., maintaining body position, carrying, fine motor) that are related to, and overlap with O*NET/DOT job demands (i.e., trunk strength, dynamic strength, arm hand steadiness), the link between the two is more "conceptual" than "empirical". In stages 4 and 5 of the disability determination process disability examiners may use interviews to determine whether the claimant's residual functional capacity (i.e., their abilities) can match the job demands for particular jobs. For example, in a residual functional capacity (RFC) assessment, disability examiners may interview the claimant about abilities such as handling/grip, fingering, reaching, lifting/carrying, pushing/pulling, sitting, and standing when existing medical evidence is not sufficient to make a determination on their claim (SSA, 2014).

While these interviews are useful, it may be more empirically valid to obtain claimant ability data from a self-report measure (Velozo, Choi, Zylstra, & Santopoalo, 2006). Although the accuracy of self-report measures may be called into question when material incentives exist for the falsification of a condition, similar concerns are present in questionnaires and even physical exams (Chafetz, 2010). Existing statistical techniques may assist with the identification of falsified information in self-report measures (Griffin et al., 1996). Velozo and colleagues developed an ICF-based measure to assess physical ability in individuals with physical disabilities (Velozo, 2004; Velozo, Wang, Lehman, & Wang, 2008) . Based on the mobility chapter of the activity dimension of the ICF, Velozo and colleagues applied extensive qualitative (focus groups and cognitive interviews) and quantitative (factor analysis and item response theory analyses) methodologies to develop item banks under constructs: 1) Transfer and

positioning, 2) Gross Upper Extremity, 3) Fine Hand, 4) Walking and Moving, 5) Moving around using a wheelchair, and 6) Activities of Daily Living (Velozo, 2004). The ICF Activity Measure is available as a web-based computer adaptive measure, maximizing its measurement precision, while minimizing the number of items the respondent is required to answer (Velozo, 2004). ICF Activity measures generate item difficulty calibrations that can be matched to O*NET job demand levels.

The purpose of this pilot/demonstration project is to empirically link ICF-based claimant ability measures to O*NET/DOT job demands. This linkage has been authenticated through consensus from three disability professionals and results were incorporated into the ICF-based client ability measures and the O*NET database structure. The resulting automated system may provide disability professionals a list of potential occupations that match the ability level of the claimant. While this pilot/demonstration has only been based on physical function ability/demands applied to present job classifications available in O*NET, the methodologies used may be highly transferrable to other functional abilities (i.e., cognition) and future developments of job classification systems beyond O*NET.

Methods

This project's protocol received exemption status (#2013-U-0745) from the Institutional Review Board at the University of Florida. The pilot/demonstration involves two aims: Aim 1: Validate ICF based client ability measures against O*NET/DOT job demands, and Aim 2: Modify the O*NET database to generate O*NET/DOT job selections from claimant ICF-based ability measures. Under Aim 1, there are two objectives: 1) match ICF-AM constructs with O*NET job element names, and 2) Match the ICF-AM Item difficulties with job demands for ICF-AM job demand combinations. Three nationally-known experts in work and disability assessment participated as consensus reviews. They include: Dr. Jamie Pomeranz (Associate Professor at University of Florida, Certified Rehabilitation Counselor, Certified Life Care Planner), Dr. Rick Robinson (Certified Rehabilitation Counselor, Certified Vocational Evaluator, Certified Life Care Planner, National Certified Counselor and Diplomat of the American Board of Vocational Experts) and Dr. Karen Jacobs (Clinical Professor of Occupational Therapy at Boston University, founding editor of *Work: A Journal of Prevention, Assessment, and Rehabilitation*).

For Aim 1, objective 1 experts were asked to match four ICF-AM constructs (positioning and transfers, gross upper extremity, fine hand and walking and moving) with 12 O*NET job element names (Arm-Hand Steadiness, Manual Dexterity, Finger Dexterity, Control Movement Abilities, Control Precision, Physical Strength Abilities, Static Strength, Explosive Strength, Dynamic Strength, Trunk Strength, Endurance, and Gross Body Coordination). If there was 85% or more agreement on an ICF-AM construct and an O*NET job element, that combination was used for Aim 1, objective 2.

For Aim 1, objective 2, experts were asked to match the ICF-AM item difficulties with the three levels of job demands (sedentary, light and medium) for the ICF-AM constructs/O*NET element combinations selected from objective 1. Each job demand is defined by 3 O*NET job titles (Table 1).

Table 1
Example of Job Demands Represented by Job Titles

Sedentary	Light	Medium
Registration Clerk	Computer Programmer	Guide, Sightseeing
Customer Service Representatives	Bus Driver	Air-Compressor Operator
Monotype-Keyboard Operator	Inspector, Building	Cargo Checker

Nine items from each ICF-AM construct were randomly displayed (Table 2). Items were not chosen that reflected heavy and very heavy job demands, as it is unlikely that claimants would be at these higher levels of physical ability. If 85% or more agreement across experts in matching ICF-AM item difficulties with the job demands occurred, those job demands served as anchor points on the ICF-AM scale and O*Net data value. If multiple matches occurred for a job demand, the average ICF-AM item difficulty was calculated as the anchor point.

Table 2
Example of Positioning and Transfer Items Randomly Displayed

1. Shift sitting chair without armrests
2. Squatting 1-2 minutes
3. Change position standing to squatting
4. Change position standing to sitting chair
5. Change position standing to kneeling
6. Standing 10-20 minutes
7. Seated 10-20 minutes
8. Scooting up/back into chair
9. Change position sitting chair to standing

Aim 2 was to modify the O*NET database to generate O*NET/DOT job selections from claimant ICF-based ability measures. Based on the consensus links established through Aims 1 objectives 1 and 2, the O*NET database was modified to generate job titles based on ICF-AM Activity Measure. This was accomplished using three tables and data from the O*NET Microsoft Access Database, readily available online: 1) DOT to ONET-SOC, 2) Occupation Data, and 3) Abilities (National Crosswalk Service Center, 2014). ONET-SOC Code was used to link the three tables. Queries with Formulas to convert the ICF-AM measures to the O*Net data values were added to produce job output tables for each ICF-AM construct-O*NET element name combination.

Results

Aim 1, objective 1. Table 3 presents the results for Aim 1, objective 1, expert panel matching of ICF-AM constructs and O*NET job element names. The ICF-AM construct of Positioning and Transfers had 100% agreement in matching with the O*NET element names Trunk Strength and Stamina; Gross Upper Extremity had 100% agreement in matching with

Physical Strength Abilities; Fine Hand had 100% agreement in matching with Manual Dexterity and Walking and Moving had 100% agreement in matching Stamina.

Table 3
*Matching ICF-AM constructs and O*NET job element names*

ICF Activity Measure Construct	100% Agreement	67% Agreement	33% Agreement
Positioning and Transfers	10, 12		6,7,9
Gross Upper Extremity	6	4	1,7,9,12
Fine Hand	2	3, 5	1,4
Walking and Moving	12	10	4,6,9,11

1. Arm-Hand Steadiness, 2. Manual Dexterity, 3. Finger Dexterity, 4. Control Movement Abilities, 5. Control Precision, 6. Physical Strength Abilities, 7. Static Strength, 8. Explosive Strength, 9. Dynamic Strength, 10. Trunk Strength, 11. Endurance, 12. Stamina, 13. Gross body coordination

Aim 1, objective 2. To accomplish Aim 1, objective 2, For each of the above matches, we asked the experts to then match the ICF-AM item difficulties with the three levels of job demands (sedentary, light and medium) for the ICF-AM constructs/O*NET element combinations. Most O*NET job demands had 100% agreement matches with at least one ICF-AM item except for the Fine Hand construct with light and medium Manual Dexterity job demands, the Gross Upper Extremity construct with medium Physical Strength Abilities, and the Walking and Moving construct with light Stamina job demands(Table 4). The Fine Hand with Manual Dexterity construct was excluded from the further analysis because it did not have 2 anchor points with 100% agreement, required for statistical analysis.

Table 4
*Match ICF-AM item difficulties with the three levels of O*NET job demands*

ICF-AM Difficulties	O*NET Job Demand	100% Agreement	67% Agreement	33% Agreement
Positioning and Transfers with Stamina	Sedentary	7,8,1		
	Light	4,9	6,3	
	Medium	2,5	6	3
Positioning and Transfers with Trunk Strength	Sedentary	1,7	8	4
	Light	9	4	8,6,3,2
	Medium	5	2,3,6	
ICF-AM Fine Hand with Manual Dexterity	Sedentary	3	8	6,5,2,1
	Light	*	7,6,4	9,8,1
	Medium	*	9,5,2	7,4,1
Gross Upper Extremity with Physical Strength Abilities	Sedentary	2	3,1	9,8
	Light	6	4	9,7,5,3
	Medium	*	8,7,5	9,4,1
ICF-AM Walking and Moving with Stamina	Sedentary	1,5		9,4,8
	Light		8,3,2	9,6,4
	Medium	7	6	9,4,3,2

**removed from further analysis*

Table 4 Key
Selected Nine Items of ICF-AM Five Constructs

	Construct				
Item #	Positioning and Transfers with Stamina	Positioning and Transfers with Trunk Strength	ICF-AM Fine Hand with Manual Dexterity	Gross Upper Extremity with Physical Strength Abilities	ICF-AM Walking and Moving with Stamina
1	Shift sitting chair without armrests	Shift sitting chair without armrests	Opening a soda-pop can	Pushing a shopping cart	Walking within home/living environment
2	Squatting 1-2 minutes	Squatting 1-2 minutes	Turning key in a door lock	Carrying 1 pound 25 feet	Walking crowded place
3	Change position standing to squatting	Change position standing to squatting	Pushing buttons on television remote	Lifting 5 pounds floor to waist	Walking 2-4 blocks
4	Change position standing to	Change position standing to	Opening a bag of potato chips	Lifting 10 pounds waist to shoulder	Walking on gravel

	sitting chair	sitting chair			
5	Change position standing to kneeling	Change position standing to kneeling	Putting change into vending machine	Pulling open a heavy door	Stepping into or out of an elevator
6	Standing 10-20 minutes	Standing 10-20 minutes	Turning pages on newspaper	Pulling wet laundry out washing machine	Walking on gravel walking small obstacles on floor
7	Seated 10-20 minutes	Seated 10-20 minutes	Picking up a dime	Lifting 5 pounds shoulder above head	Climbing down two flights walking 4-8 blocks
8	Scooting up/back into chair	Scooting up/back into chair	Picking up a pen or pencil	Carrying 10 pounds up one flight stair	Walking on grass
9	Change position sitting chair to standing	Change position sitting chair to standing	Opening a small medicine container	Pulling open refrigerator door	Climbing up one flight

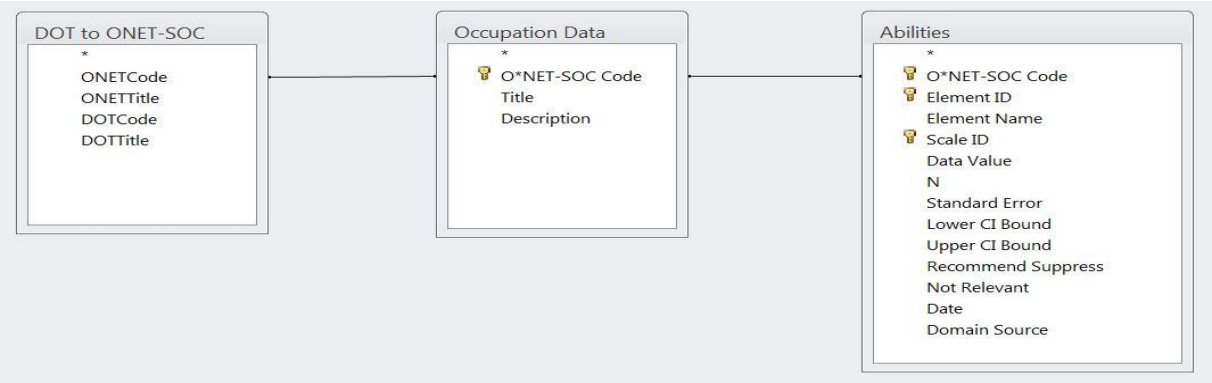
Aim 2, calculating ICF-AM and O*NET anchors. To modify the O*NET database to generate O*NET/DOT job selections from claimant ICF-based ability measures, ICF-AM construct item difficulty measures and O*NET data value anchors were calculated. If there was only 1 item with 100% agreement for the ICF-AM construct difficulty measures, the item calibration for that item was used as the anchor; if there was more than one item with 100% agreement, the average item calibration across all items was used. For the O*NET Job demand data value, the average of the data values for jobs classified in a particular category were used. For example, for the ICF-AM construct Positioning and Transfers, the average difficulty for the three items with 100% agreement was 38.0 (Table 5). The average data value was calculated from the data values associated with the sedentary job demand.

Table 5
*Example of Calculating ICF-AM Item Difficulties and O*NET Data Values*

ICF-AM Positioning and Transfers Items with 100% Agreement	**Anchor Point (ICF-AM)**	**O*NET Job Demands for Sedentary**	**Data Value (O*NET Ave Data Value for the 3 Job Examples on Data Collection Form**
#1 Shift sitting chair without armrests #7 Seated of 10-20 minutes, #8 Scooting up/back into chair	(40.42+36.47+37.12)/3=38.0	Manicurist Circulation Clerk Receptionist	**(.13+.25+.25)/3=.21**

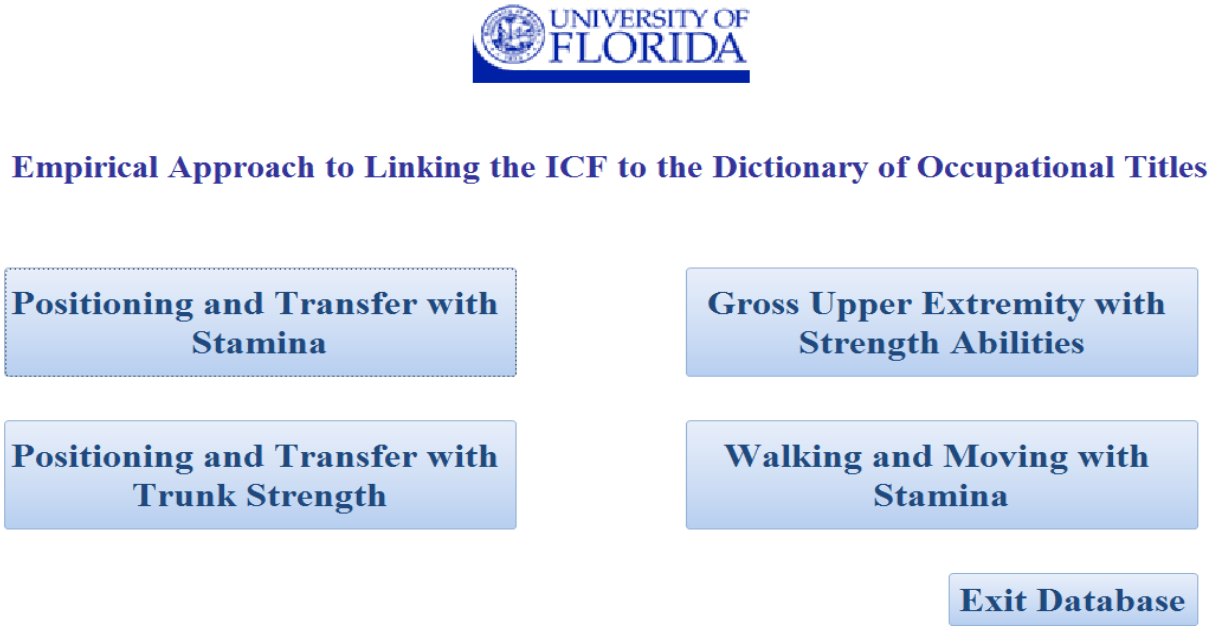
Aim 2, Modify the O*NET MS Access database. Figure 2 displays the MS Access schematic relationship, demonstrating the query used to generate O*NET job titles associated with ICF-AM construct ability measures. Three tables from the O*NET Microsoft Access Database were linked through ONET-SOC Code: 1) *DOT to ONET-SOC*, 2) *Occupation Data* and 3) *Abilities.* The Ability table (critical variables: Scale ID, Data Value and Element Name) was linked to the Occupation Data table (critical variable: Description), and DOT to ONET-SOC table to generate a list of DOT job titles (critical variable: DOTTitle).

Figure 2
*Query generating O*NET job titles associated with ICF-AM construct ability measures*



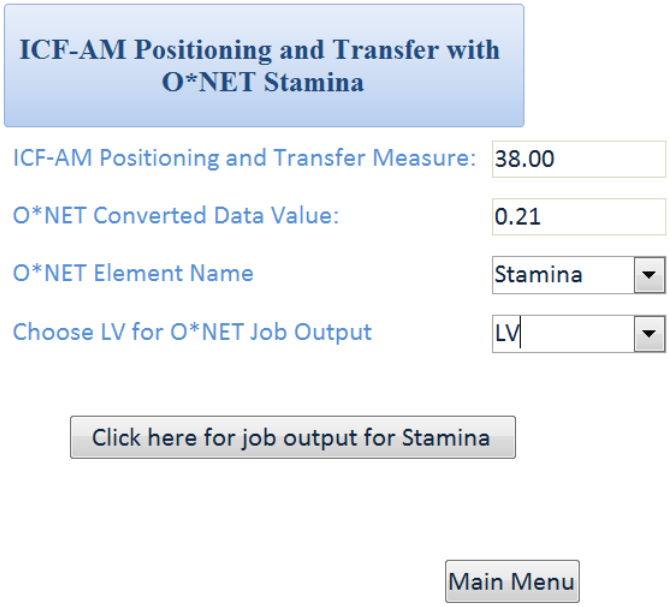
A "home page" was created in access to select the ICF-AM construct – O*NET link. For example, if a client was assessed on the ICF-AM Positioning and Transfer construct, to determine the O*NET stamina level and jobs associated with that level and below, the *Positioning and Transfer with Stamina* button would be selected (Figure 3).

Figure 3
The Home Page



The screen presented in Figure 4 allows the conversion of the ICF-AM Positioning and Transfer measure to the O*NET converted data value. For example, an inserted ICF-AM value of 38.00 produces an O*NET converted data value of 0.21. In order to generate the O*NET job titles, *Stamina* is selected for the O*NET element name and *LV* (level of task/job demands) is chosen for the O*NET job output.

Figure 4
*Converting ICF-AM Positioning and Transfer Measure to the O*NET Data Value*



Upon selecting "Click here for job output for Stamina" a job listing is generated (Figure 5). This figure lists the element name, data value, title, and job description for all jobs equal to or below the converted data value of 0.21. Note that in the example provided in Figure 5, jobs are listed with converted data values of 0.13 because there are no stamina data values below 0.25 and above 0.13.

Figure 5

Element Name, Data Value, Title, and Job Description for All Jobs Equal to or Below Converted Data Value

Element Name	Data Value	Title	Description
Stamina	0.13	Prepress Technicians and Workers	Format and proof text and images submitted by designers ar
Stamina	0.13	Sewers, Hand	Sew, join, reinforce, or finish, usually with needle and thread
Stamina	0.13	Prepress Technicians and Workers	Format and proof text and images submitted by designers ar
Stamina	0.13	Prepress Technicians and Workers	Format and proof text and images submitted by designers ar
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Stamina	0.13	Prepress Technicians and Workers	Format and proof text and images submitted by designers ar
Stamina	0.13	Sewers, Hand	Sew, join, reinforce, or finish, usually with needle and thread
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Discussion

ICF-based client ability measures were authenticated against O*NET/DOT job demands successfully. The ICF-AM item difficulties were then matched with the three levels of job demands (sedentary, light and medium) for the ICF-AM constructs/O*NET element combinations. This objective was moderately successful, with some issues arising between ICF-AM fine hand construct item difficulties and O*NET job demands. The O*NET database was successfully modified to generate O*NET/DOT job selections from claimant ICF-based ability measures. Finally, the O*NET Access Database was successfully modified to allow for a working conversion between an inserted ICF-AM value and O*NET data value.

The purpose of the expert agreement panel survey was to identify only the ICF-AM constructs/O*NET element names and item difficulties that had the <u>best</u> match (i.e., eliminate constructs/names that did not match well. The finding of 100% agreement across 3 experts for a number of aims (Aim 1, objectives 1 & 2; Aim 2) was a success.). A high percentage of constructs/names having 100% agreement was not expected. The sequential, high levels of agreement in matching ICF-AM constructs with O*NET element names and ICF-AM item difficulties with O*NET job demands served as theoretical evidence, as well as fundamental step to modify the O*NET database to generate user-friendly, and realistic job results.

Despite positive findings, some limitations exist. Expert reviewers had considerable difficulty (through consensus) matching ICF-AM fine hand construct item difficulties and O*NET job demands. This may be, in part, due to a conceptual limitation between the tools. Each ICF-AM Fine Hand item required similar levels of stamina to complete. For example, only

a few ounces of pressure are required for each item (e.g. opening a can of soda pop, opening a small medicine container, turning a key in a lock).

While 100% agreement was obtained for ICF-AM constructs/item difficulties and O*NET names/job demands, many experts reported conceptual challenges in making these connections. For example, Positioning and Transfers is not directly a measure of Stamina. These findings suggest a more direct self-report of job demands should be developed (e.g. a self-report of stamina). The use of only 3 work and disability experts to match constructs should also be highlighted as a validity threat to the pilot/demonstration. Perhaps the most significant limitation is that the SSA disability definition is work based by statute, which can only be altered through congressional action. Additionally, disability examiners have mandated limits on the data they may collect and use for the determination process, limiting the full potential of products using this, and similar designs.

This pilot/demonstration project represents a promising approach for programmatic applications seeking to modify the O*NET MS Access Database to achieve a variety of meaningful employment outcomes. Despite the methodological issues preventing O*NET's full use in the SSDI process, this project may best serve as a piloted example of what is possible in a future system with a self-report measure that closely connects abilities to job demands. Further applications may streamline the complex process of disability determination to assist both claimants and examiners alike. Future evidence-based intuitive automation may equip disability examiners to more quickly and accurately process claims, improving the system for all users.

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