
Methods of increasing ICR (Intelligent Character Recognition) functionality via CRF design

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Purpose

To investigate different avenues of
CRF design to improve ICR
functionality in DataFax



Background

- CRF designed to capture HIV disease progression via CDC Classification
- CDC Classification summarized in table format



Background

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Date/ax 001 Plate 001 Visit 001

Test Number

Paediatric CDC-Staging

Please tick all applicable tickboxes

Category A: Asymptomatic	Neurotoxic	
No opportunistic disease due to HIV infection, or only one of the conditions in Category A (WHO Stage I)	Present fever (lasting > 1 month) (WHO Stage I)	<input type="checkbox"/>
	Toxoplasmosis, onset before 1 month of age	<input type="checkbox"/>
Category B: Mildly symptomatic	Category C: Severely Symptomatic (all WHO Stage II)	
Children with two or more of the conditions listed below, but none of the Conditions listed in categories B & C	Serious bacterial infections, multiple or recurrent	<input type="checkbox"/>
Lymphadenopathy (WHO Stage II)	Candidiasis, esophageal or pulmonary (mouths, trachea, lungs)	<input type="checkbox"/>
Hepatomegaly	Cryptosporidiosis, disseminated (at site other than, or in addition to, lungs or mouth) or fatal lymph nodes	<input type="checkbox"/>
Splenomegaly	Cryptosporidiosis, disseminated (at site other than, or in addition to, lungs, genital or oral lymph nodes)	<input type="checkbox"/>
Dermatitis	Cryptosporidiosis or isosporiasis with diarrhea persisting > 1 month	<input type="checkbox"/>
Pneumonia	Cryptosporidiosis disease with onset of symptoms at age > 1 month (at site other than liver, spleen or lymph nodes)	<input type="checkbox"/>
Recurrent or persistent upper respiratory tract infections, sinusitis or otitis	Encephalopathy	<input type="checkbox"/>
Category B: Moderately Symptomatic		
Children with four symptomatic conditions, other than those listed for Category A or C that are attributed to HIV infection. Examples of conditions in either Category B or C that are not listed in this additional symptomatic conditions table (WHO Stage II)	Recurrent herpes virus infection (shingles or molluscum contagiosum) other than genital, > 1 month, or bronchitis, pneumonia or esophagitis for any child (not affecting < 6 months of age)	<input type="checkbox"/>
Anemia (Hb < 10g/dl), neutropenia (< 1500/mm ³), or thrombocytopenia (< 100,000/mm ³) persisting > 30 days	Histoplasmosis, disseminated (at site other than, or in addition to, lungs, genital or oral lymph nodes)	<input type="checkbox"/>
Bacterial meningitis, pneumonia or sepsis (single episode)	Agalactia (lactaria)	<input type="checkbox"/>
Candidiasis, oropharyngeal (thrush), persisting > 2 months in children aged > 4 months of age (WHO Stage II)	Lymphoma, primary in the brain	<input type="checkbox"/>
Cardiomyopathy	Lymphoma, small non-nodular cell (Burkitt's) or immunoblastic or large cell lymphoma of B-cell or T-cell-over immunologic phenotype	<input type="checkbox"/>
Cytomegalovirus infection with onset before age one month	Mycobacterium tuberculosis (disseminated or extrapulmonary)	<input type="checkbox"/>
Diarrhea, recurrent or chronic (WHO Stage II)	Mycobacterium, other species or unidentified species, disseminated (at site other than, or in addition to, lungs, oral or genital or oral lymph nodes)	<input type="checkbox"/>
Hepatitis	Pneumocystis carinii pneumonia	<input type="checkbox"/>
Herpes simplex virus (HSV) dermatitis, recurrent (more than 2 episodes within one year)	Progressive multifocal leukoencephalopathy	<input type="checkbox"/>
HIV bronchitis, pneumonia or esophagitis with onset before one month of age	Sarcoidosis (systemic) septicemia, recurrent	<input type="checkbox"/>
Herpes zoster (shingles) involving at least two distinct episodes or more than one dermatome	Toxoplasmosis of the brain with onset > 1 month of age	<input type="checkbox"/>
Lactopneumonia	Wasting syndrome in the absence of concurrent illness other than HIV (WHO Stage II)	<input type="checkbox"/>
Lymphoid interstitial pneumonia (LIP) or pulmonary lymphoid hyperplasia (LPH)	Other HIV Conditions (Specify):	
Hepatospleny	Weight loss or failure to thrive (only WHO Stage II)	<input type="checkbox"/>
Vertebral, disseminated (complicated) cholangiocarcinoma		<input type="checkbox"/>



Background

- Increased difficulty to validate
- Increased error rate
- Increased validation time
- Ensure that ICR functions optimally



Methods

The ruling of the table was changed to:

- Black
- Grayscale (50%)
- Dotted
- No Ruling



Methods

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Data/Fx 001 Plate 002 Visit 001

Paediatric CDC-Staging

Please tick all applicable tickboxes

Category N: Not Symptomatic	Category A: Mildly symptomatic	Category B: Moderately symptomatic	Category C: Severely symptomatic (all WHO Stage I)
No signs/symptoms since HIV infection, or only one of the conditions in Category A [WHO Stage I]	Children with fewer than three of the conditions listed below, but none of the Conditions listed in categories B or C	Children with two or more of the conditions listed below, other than those listed for Category A or C, that are attributed to HIV infection. Examples of conditions in clinical Category B include, but are not limited to, oral and/or perianthematous conditions aside from:	Children with three or more of the conditions listed below, but none of the Conditions listed in categories A or B
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Neurocognitive	Neurocognitive	Neurocognitive	Neurocognitive
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Weight loss	Weight loss	Weight loss	Weight loss
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Diarrhoea	Diarrhoea	Diarrhoea	Diarrhoea
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Oral and/or perianthematous conditions	Oral and/or perianthematous conditions	Oral and/or perianthematous conditions	Oral and/or perianthematous conditions
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Other HIV Conditions (specify)	Other HIV Conditions (specify)	Other HIV Conditions (specify)	Other HIV Conditions (specify)
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

Ruling: Dotted



Methods

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Data/Fx 001 Plate 002 Visit 001

Paediatric CDC-Staging

Please tick all applicable tickboxes

Category N: Not Symptomatic	Category A: Mildly symptomatic	Category B: Moderately symptomatic	Category C: Severely symptomatic (all WHO Stage I)
No signs/symptoms since HIV infection, or only one of the conditions in Category A [WHO Stage I]	Children with fewer than three of the conditions listed below, but none of the Conditions listed in categories B or C	Children with two or more of the conditions listed below, other than those listed for Category A or C, that are attributed to HIV infection. Examples of conditions in clinical Category B include, but are not limited to, oral and/or perianthematous conditions aside from:	Children with three or more of the conditions listed below, but none of the Conditions listed in categories A or B
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Neurocognitive	Neurocognitive	Neurocognitive	Neurocognitive
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Weight loss	Weight loss	Weight loss	Weight loss
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Diarrhoea	Diarrhoea	Diarrhoea	Diarrhoea
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Oral and/or perianthematous conditions	Oral and/or perianthematous conditions	Oral and/or perianthematous conditions	Oral and/or perianthematous conditions
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Other HIV Conditions (specify)	Other HIV Conditions (specify)	Other HIV Conditions (specify)	Other HIV Conditions (specify)
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

No Ruling



Methods

Plate Definition:

- Black ruling
- No ruling



Methods

10 tick boxes ticked randomly and faxed:

- 20 plates with black ruling & 20 plates with no rulings faxed to plate defined with black ruling
- 20 plates with black ruling & 20 plates with no ruling faxed to plate defined with no ruling



Methods

Further Investigations:

- 20 plates faxed with dotted ruling
- 20 plates faxed with grayscale ruling (50%)



Methods

Outcome:

Assessed by "Hit Rate"
(number of correctly identified/read tick boxes i.e. score out of 10)



Results

- 91% hit rate: black ruling faxed to defined plate with black ruling
- 99% hit rate: no ruling faxed to defined plate with black ruling
- 90% hit rate: black ruling faxed to defined plate with no ruling
- 99% hit rate: no ruling faxed to defined plate with no ruling



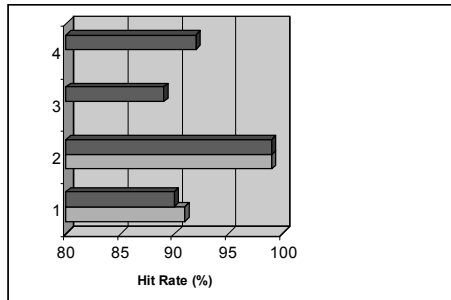
Results

Additionally:

- 89% hit rate: Dotted ruling
- 92% hit rate: Grayscale (50%)



Results

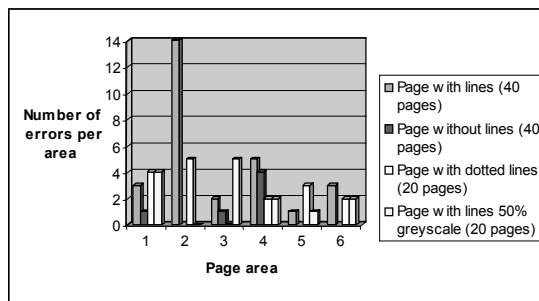


Type of pages faxed:

- 1 = Faxed with table
- 2 = Faxed without table
- 3 = Faxed with dotted lines
- 4 = Faxed with lines 50% grayscale



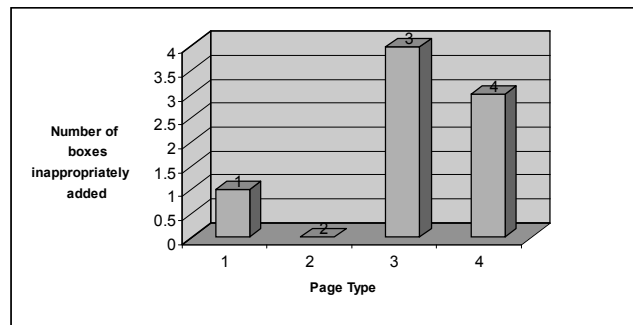
Results



- 1 = Top Left
- 2 = Top Right
- 3 = Middle Left
- 4 = Middle Right
- 5 = Top Left
- 6 = Top Right



Results



1 = Page faxed with lines

2 = Page faxed without lines

3 = Page faxed with dotted lines

4 = Page faxed with 50% grayscale lines



Conclusions

Black ruling decreases the ICR hit rate resulting in:

- Increased error rate
- Increased validation time
- Increased workload



Conclusions

- Although tables are helpful in CRF design, ruling should be either = or < 50% grayscale or none



Restrictions

- Amount of plates used for testing
- More thorough testing is recommended



Questions

