The impact of quantified self data on healthcare
GSMS PhD congres ‘Create your Future, Discover Talent’
Dr. Martijn de Groot
Quantified Self Institute, Hanze University of Applied Sciences Groningen
12-06-2015
### 44 recorded measures

<table>
<thead>
<tr>
<th>Date</th>
<th>SYS</th>
<th>DIA</th>
<th>BPM</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>mei 2015</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>27 mei 2015 08:08</td>
<td>126</td>
<td>73</td>
<td>67</td>
</tr>
<tr>
<td>26 mei 2015 18:41</td>
<td>143</td>
<td>83</td>
<td>62</td>
</tr>
<tr>
<td>26 mei 2015 10:55</td>
<td>138</td>
<td>83</td>
<td>57</td>
</tr>
<tr>
<td>25 mei 2015 19:17</td>
<td>139</td>
<td>82</td>
<td>69</td>
</tr>
<tr>
<td>24 mei 2015 21:38</td>
<td>134</td>
<td>79</td>
<td>68</td>
</tr>
<tr>
<td>24 mei 2015 10:01</td>
<td>136</td>
<td>79</td>
<td>68</td>
</tr>
<tr>
<td>23 mei 2015 10:49</td>
<td>143</td>
<td>87</td>
<td>66</td>
</tr>
<tr>
<td>22 mei 2015 18:34</td>
<td>148</td>
<td>82</td>
<td>64</td>
</tr>
<tr>
<td>22 mei 2015 06:55</td>
<td>138</td>
<td>80</td>
<td>64</td>
</tr>
<tr>
<td>19 mei 2015 10:20</td>
<td>123</td>
<td>79</td>
<td>81</td>
</tr>
<tr>
<td>18 mei 2015 23:14</td>
<td>141</td>
<td>73</td>
<td>57</td>
</tr>
<tr>
<td>18 mei 2015 19:45</td>
<td>140</td>
<td>79</td>
<td>68</td>
</tr>
<tr>
<td>18 mei 2015 14:29</td>
<td>131</td>
<td>75</td>
<td>70</td>
</tr>
</tbody>
</table>
• As a result of self monitoring
  – Increased autonomy
  – New patient-GP interaction
  – Lowering of medicine intake!
Personal Meaning to Personal Data

Quantified Self

QS
QS Community

- Founded in 2007 by Gary Wolf and Kevin Kelly
- 2010: TED talk by Gary Wolf
- 2011: First international conference in California
- May 2015: 206 groups in 38 countries
- Almost 50 k people active worldwide
Principle questions

- What did you do?
- How did you do it?
- What did you learn?

www.meetup.com/qsgroningen
www.meetup.com/qsamsterdam

Next meetup: Groningen, 17 Sept 2015
Netwerk Organisation

• To encourage a healthy lifestyle through technology, science and fun.
• Focus on ‘the big five for healthy life’
  – Physical activity & sports
  – Food
  – Sleep
  – Stress & relaxation
  – Social interaction
• Availability, Creativity, Validity and Efficacy
• Applied research, higher education & new business development
Healthy Ageing

Ageing is an ongoing process.
“Ageing starts at fertilization.”
All about data…

A huge amount of personal data…

And a lot of stakeholders

Adapted from: www.nictiz.nl
Sharing data

Individual data
(n=1)

Quantified Self

Useful to you

Quantified Us

Citizen Science

Useful to others

Group data
(n>1)

http://www.digitalezorggids.nl/blog/quantified-self-quantified-us-quantified-other
Patients like me
Quantified Us

Community Outbreaks of Asthma Associated with Inhalation of Soybean Dust

Josep M. Argüés, M.D., Jordi Sureda, M.D., Robert Rodriguez-Roisin, M.D., Maria Suarez-Arrero, Ph.D., Luis Vazquez, Ph.D., and the Toxicologic Epidemiology Committee


Abstract

Since 1981, 26 outbreaks of asthma have been detected in the city of Barcelona. The geographic clustering of cases close to the harbor led us to consider the harbor as the probable source of the outbreaks. We therefore studied the association between the unloading of 20 products from ships in the harbor and outbreaks of asthma in 1985 and 1986.

All 13 asthma-epidemic days in these two years coincided with the unloading of soybeans (lower 95 percent confidence limit of the risk ratio, 7.7). Of the remaining 25 products, only the unloading of wheat was related to the epidemics of asthma, although when adjusted for the unloading of soybeans the relation was not statistically significant. High-pressure areas and mild southeasternly to southwesterly winds, which favored the movement of air from the harbor to the city, were registered on all epidemic days. Particles of starch and epispem cells that were recovered from air samplers placed in the city had morphologic characteristics identical to those of soybean particles. Furthermore, the lack of lag fibers at the top of one of the harbor sites into which soybeans were unloaded allowed the release of soybean dust into the air.
Within a couple of weeks, 60,000 volunteers…
Points of interest and debate

• Quality of the data (validity and reliability)
• Data acces and control (Privacy and safety)
• Data sharing (usability, interoperability and incentives)
Thea Kooiman

Oefentherapeut / Bewegingswetenschapper

Onderzoeker Lectoraat Healthy Ageing, Allied health care and Nursing.

12-06-2015

share your talent. move the world.
Reliability and Validity of ten consumer activity trackers.

1 = Fitbit Zip
2 = Misfit Shine
3 = Nike+Fuelband
4 = Omron
5 = Withings Pulse
6 = Fitbit Flex
7 = Digiwalker SW-200
8 = Lumoback
9 = Jawbone Up
10 = Moves app
Method

• Lab condition
  – 30 minutes walking on a treadmill, 2 times.
  – N=33
  – Gold standard: Optogait system.

• Free-living condition
  – One day (9:00-16:30).
  – N=56
  – Gold standard: ActivPal.
Results – Lab condition

Mean number of steps walked (95 % CI), measured in the Lab condition.
Results – free-living condition

Mean number of steps (95% CI) walked in the free-living condition

![Graph showing mean number of steps (95% CI) for different devices in the free-living condition.](chart.png)
Norm values validity

- Activity monitors should not have more than 1% error deviation during walking on a treadmill in order to be named accurate. (Tudor-Locke, 2004)

- In free-living conditions, an acceptable mean deviation from the gold standard is 10%. (Tudor-Locke, 2004)
Validity - mean percentages error
Lab study

- Validity mean percentages error for different devices:
  - Moves app: 319; 9.8%
  - Omron: 2,5%
  - Misfit Shine:
  - Lumoback:
  - ActivPal: +1%
  - Fitbit Zip: -1.2%
  - Pulse:
  - Jawbone Up: -12%
  - Digiwalker: -5.7%
  - Fitbit Flex: -598; -18%
  - Nike+ Fuelband: -598; -18%
Validity - mean percentages error
Free-living study

-10%  -24%  -37.6%  +10%

Zip  Pulse  Shine  Flex  Jawbone Up  Nike FB  Omron  Digiwalker  Moves App  Lumoback
# Test-retest reliability

<table>
<thead>
<tr>
<th>Activity tracker</th>
<th>Intraclass Correlation Coefficient</th>
<th>95% confidence Interval</th>
</tr>
</thead>
<tbody>
<tr>
<td>Optogait</td>
<td>.92**</td>
<td>.85 - .96</td>
</tr>
<tr>
<td>ActivPAL</td>
<td>.96**</td>
<td>.90 - .99</td>
</tr>
<tr>
<td>Lumoback</td>
<td>.90**</td>
<td>.79 - .95</td>
</tr>
<tr>
<td>Fitbit Flex</td>
<td>.81**</td>
<td>.64 - .91</td>
</tr>
<tr>
<td>Jawbone UP</td>
<td>.83**</td>
<td>.66 - .91</td>
</tr>
<tr>
<td>Nike+ Fuelband</td>
<td>.53**</td>
<td>.22 - .75</td>
</tr>
<tr>
<td>Misfit Shine</td>
<td>.86**</td>
<td>.73 - .93</td>
</tr>
<tr>
<td>Withings Pulse</td>
<td>.92**</td>
<td>.83 - .96</td>
</tr>
<tr>
<td>Fitbit Zip</td>
<td>.90**</td>
<td>.80 - .95</td>
</tr>
<tr>
<td>Omron</td>
<td>.14</td>
<td>-.24 - .47</td>
</tr>
<tr>
<td>Digiwalker</td>
<td>.71 **</td>
<td>.47 - .86</td>
</tr>
<tr>
<td>Moves app</td>
<td>.37*</td>
<td>.02 - .64</td>
</tr>
</tbody>
</table>

* P < .05, ** P < .01
Conclusion

• All trackers showed good reliability, except for the Omron, Nike+Fuelband and Moves app.

• In the lab situation, the **Fitbit Zip, Lumoback, Withings Pulse, Misfit Shine and Jawbone Up** showed the highest validity.

• Nike+ Fuelband and Moves app: low validity

• In the field situation, the **Fitbit Zip** showed the best validity.
Discussion

- Reliability vs. validity /
  within subject vs. cross-sectional.
- Lab vs. field.
- Wearing position / type of activity.

*Persuasive tech for health?*
"At last we’ve reached a consensus! This meeting is boring!"
The day before tomorrow

- Preventive and predictive
- Personalised
- Participatory

Source: www.p4mi.org