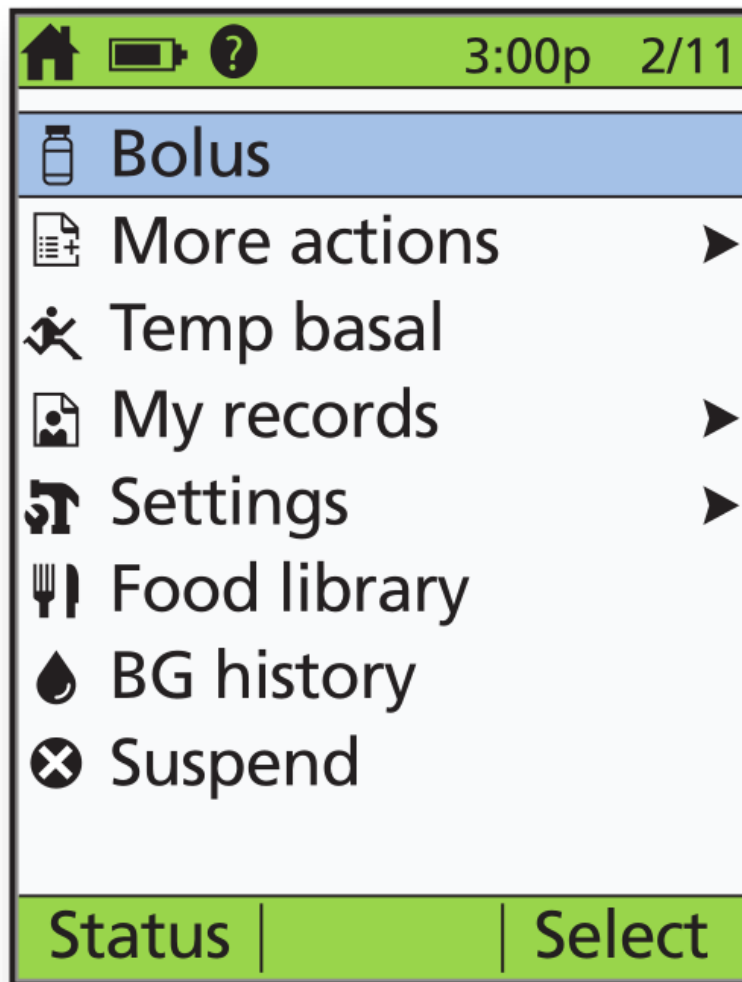


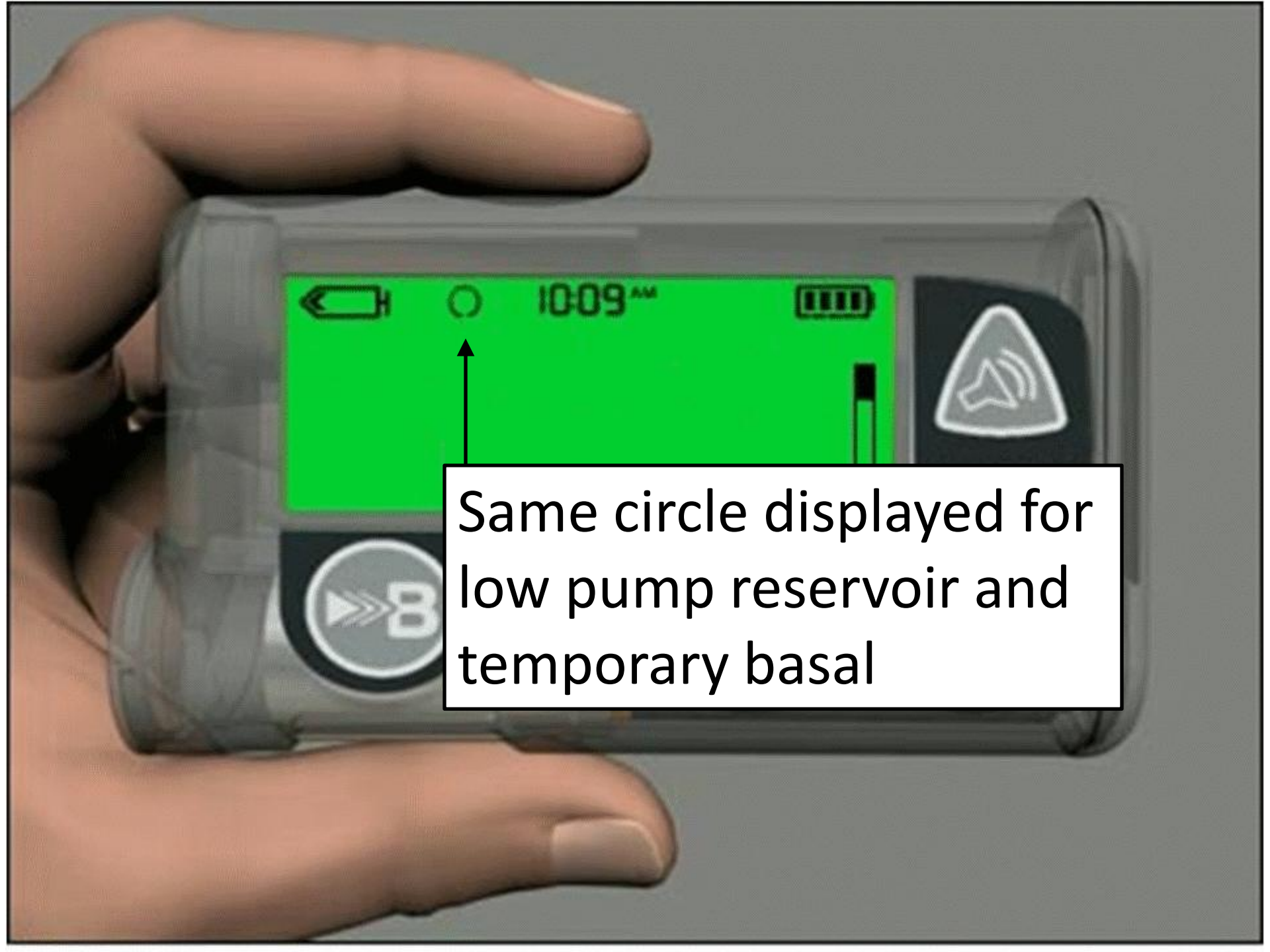
Security Risks, Low-tech User Interfaces, and Implantable Medical Devices: A Case Study with Insulin Pump Infusion Systems



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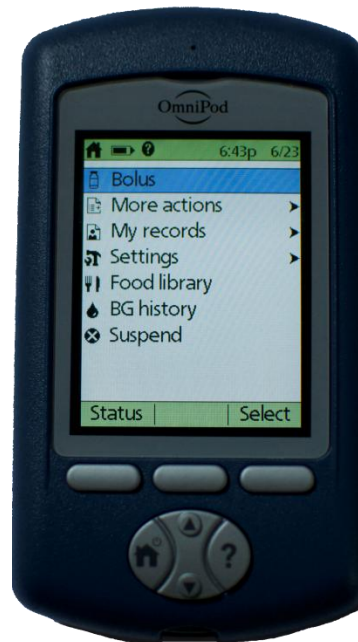
Tadayoshi Kohno
Univ. of Washington



Same circle displayed for low pump reservoir and temporary basal

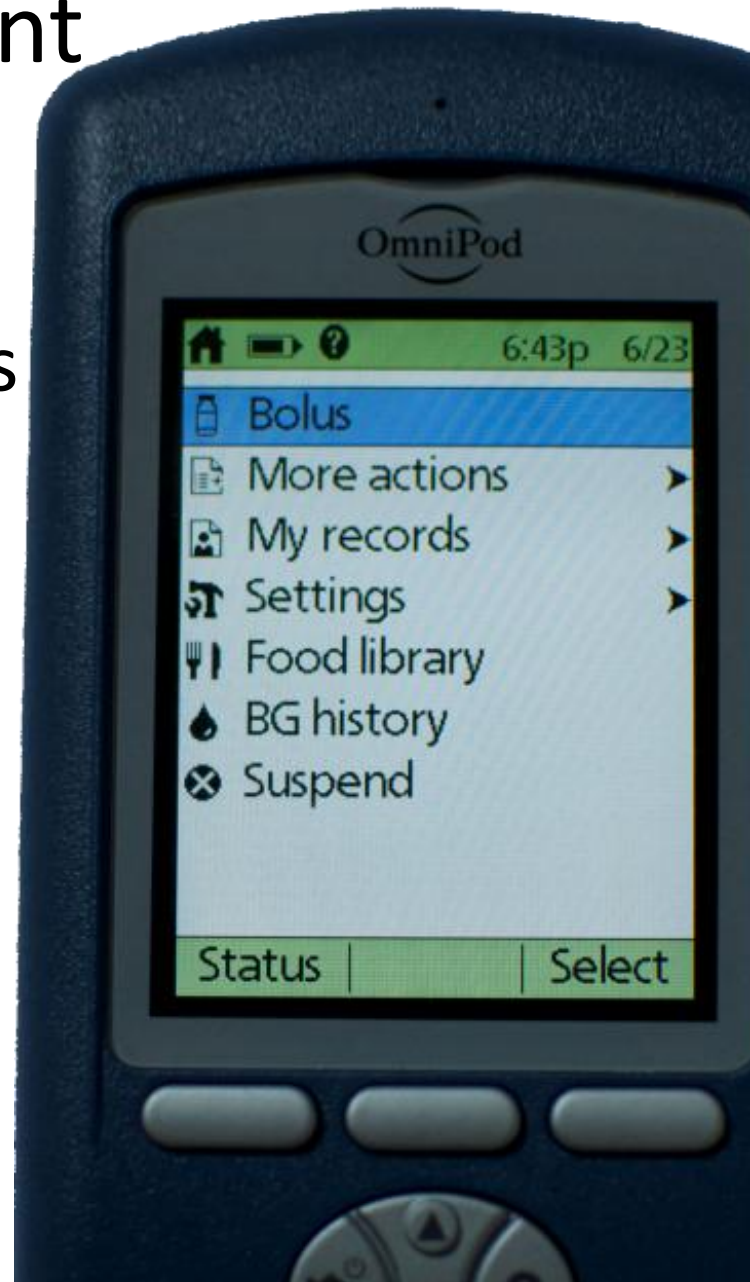
Contributing Factors to User Interface (UI) Security

- **User Interface:** Design tension between safety and security [Clark 2011]
- **Authentication:** Done through physical control of hardware [Cornelius 2012]



Main idea: Change Stored Data to Affect Patient

- **Delayed** patient effects
- **Non-lethal** security breaches
- **No technical sophistication** required
- **Targeted**



Case Study: Insulin Pump Systems

Precedent: Inject injection without detection

Our Study results

- 20 specific settings that could negatively impact patient
- 50% of the identified issues pose a greater amount of risk

Hyperglycemia

Normal

Hypoglycemia

120

80

60

What Can Happen in 30 Seconds

- **Less-risk**

- Force a change to a new reservoir (large UI change)
- Add additional BG reading (little UI change)

More risk if patient just ate.

More risk if multiple BG readings added.

- **More risk**

- Change permanent basal rate (no UI change)
- Change insulin-to-carbohydrate ratio (more significant UI change – likely ignored)

More risk if exercising/sleeping.

Example: Lunch-time Security Issue

Requirement:

- Lunch-time food – predictable.

Target blood glucose reading before lunch:

- Change ratio of insulin for food intake
- Adjust correction for high blood glucose

One can issue a command to bolus 400+ units – more than double the insulin reservoir contents.

Potential Mitigations

- User-interface
 - Change interface: Up to 24 hours after critical setting change
- Authentication & Authorization
 - Fail closed: Can duplicate settings in other device
 - Measure important patient events (e.g., sleeping)
 - Time-based: Stop undesired behaviors during these events
 - Proximity-based: Allow changes when in same area
- Auditing

Questions?

<http://web.eecs.utk.edu/~pauln/>