

# Evidence-based Software Engineering

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# Introdução

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# Introdução

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- Objetivos
  - Descrever como a engenharia de software pode se beneficiar da abordagem baseada em evidência.
  - Identificar as dificuldades associadas a esta abordagem.
- Métodos
  - Comparar a infraestrutura técnica e organizacional que apoia a medicina baseada em evidencia (EBM) com a área de engenharia de software.
  - Estudo do impacto das características específicas da engenharia de software na prática de engenharia de software baseada em evidência (EBSE).

# Porque EBSE?

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- Softwares críticos a vida estão se tornando cada vez mais populares.
  - Aceleração automobilística computadorizada.
  - Dispositivos médicos controlados por software.
- Capability Maturity Model e SPICE sugerem processos para aumenta a confiabilidade do software.
  - Certificação de empresas e pessoas.
- Softwares são construídos com tecnologias que não possuem evidencias para confirmar sua adequação, limites, qualidades, custos e riscos inerentes.

# Objetivos da EBSE

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- Um meio para os pesquisadores assegurarem que suas pesquisas estão relacionadas com a necessidade do mercado e de outros interessados.
- Um meio em que os profissionais do mercado possam tomar decisões sobre adoção de novas tecnologia.
- Um meio de melhorar a confiabilidade de softwares críticos a vida, como resultado de melhor escolha das tecnologias.
- Uma forma aumentar a aceitabilidade de softwares críticos a vida entre a população comum.
- Uma entrada para os processos de certificação.

# Praticando EBSE

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**Table 1. Five steps used in Evidence-based Medicine and (by analogy) in Evidence-based Software Engineering.**

<b>Step</b>	<b>Evidence-based Medicine</b>	<b>Evidence-based Software Engineering</b>
1	Converting the need for information (about prevention, diagnosis, prognosis, therapy, causation, etc) into an answerable question.	Converting the need for information (about development and maintenance methods, management procedures etc.) into an answerable question.
2	Tracking down the best evidence with which to answer that question.	Tracking down the best evidence with which to answer that question.
3	Critically appraising that evidence for its validity (closeness to the truth), impact (size of the effect), and applicability (usefulness in our clinical practice).	Critically appraising that evidence for its validity (closeness to the truth), impact (size of the effect), and applicability (usefulness in software development practice).
4	Integrating the critical appraisal with our clinical expertise and with our patient's unique biology, values and circumstances.	Integrating the critical appraisal with our software engineering expertise and with our stakeholders' values and circumstances.
5	Evaluating our effectiveness and efficiency in executing Steps 1-4 and seeking ways to improve them both for next time.	Evaluating our effectiveness and efficiency in executing Steps 1-4 and seeking ways to improve them both for next time.

# Passo 1

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# Passo 1

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- A questão deve ser ampla o bastante para permitir variação do fator de estudo dentre a população.
  - Não deve ser ampla demais
    - Métodos de gerência.
  - Geral o suficiente para identificar estudos empíricos.
    - Métodos ágeis, métodos de estimação de custos.
- Abstração correta para a população de interesse é difícil.
  - Experiência do usuário, tipos de problemas abordado pela tecnologia, área de aplicação.

# Passo 2

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# Passo 2

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- A questão é formulada para ajudar o pesquisador ou o profissional encontrar todos estudos relevantes.
- Um grande problema é encontrar estudos relevantes.
  - Eles procuram por revisões sistemáticas.
  - Constroem uma **string** de busca.
- EBM possuem grande infraestrutura para suportá-los.
  - Cochrane Collaboration
    - Reuni revisões sistemáticas.
    - Redução de tendência de artigo publicado.
  - Medline
    - Provê um banco de dados com referencias e os resumos de 4600 jornais.

# Infraestrutura na EBSE

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- Não possui sistema equivalente a Cochrane Collaboration ou Medline.
- IEEE Xplore
- ACM Digital Library provide access.

# Passo 3

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# Passo 3

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- A pesquisa médica reconheceu que nem mesmo um RCT ( Teste duplo cego controlado e aleatório) é suficiente para um tratamento médico.
- Várias organizações produziram diretrizes para revisão sistemática e avaliação de evidências.
  - Cochrane Collaboration publicou manual para executar um RCT.
  - Medline vários manuais para métodos experimentais.
- Jornais médicos têm pressionado por melhorias na conduta e no relato de experimentos.

# Passo 3

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- Pesquisas empíricas na Engenharia de Software
  - Fragmentado e limitado
  - Não integrado.
    - Não há um padrão aceito para revisão sistemática.
    - Apenas um jornal aceita revisões sistemáticas (ACM Surveys).
  - Análise dos dados raramente usam métodos estatísticos rigoroso.
  - Sem padrões aceitos.
    - Não há diretrizes ou protocolos para conduzir experimentos individuais.

# Passo 4

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# Passo 4

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- Conselho dado a um paciente, com uma doença em particular, pode diferir baseado na idade, gênero ou gravidade dos sintomas.
- Na engenharia de software
  - Normalmente a adoção da tecnologia é organizacional.
  - Influenciada por
    - Habilidade dos desenvolvedores.
    - Requerimento do cliente.
    - Restrição do projeto.
    - Tempo de treinamento requerido.

# Passo 5

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# Passo 5

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- Na medicina a propagação é mais ampla.
  - Médicos são responsáveis por reportar efeitos colaterais inesperados.
- Para EBSE isto envolve
  - A propagação de tecnologias de sucesso.
  - Prevenção de propagação de tecnologias ruins.
- Indústria competitiva não há incentivo para companhias auxiliarem suas concorrentes.

# O fator habilidade

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- Métodos e técnicas devem ser realizadas por pessoas especializadas.
- O fato habilidade impede uso adequado de *blinding*.
  - Desenvolver e adotar protocolos para reduzir a influência.
    - Atribuição de grupos cega.
    - Distribuição de material cega.
    - Análise cega.
    - Coleta de dados cega.
  - Aceitar que os experimentos não podem ser tão rigorosos e qualifica-los apropriadamente.

# Fator ciclo de vida

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- Técnicas impactam em diferentes partes do ciclo de vida do software.
  - Interação com outros desenvolvedores, técnicas e procedimentos.
- Efeito de uma técnica não terá necessariamente relacionamento direto sobre o resultado do projeto.
  - Experimentar técnicas isoladamente.
  - Realizar estudos empíricos.
    - Caso de uso.
    - Quasi-experimentos.

# Discussões e conclusões

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- Existem muitos problemas associados a EBSE.
  - Infraestrutura necessária disponibilizar as revisões sistemática.
  - Avaliar tecnologias que dependem da habilidade humana.
  - Obter evidencia confiável sobre as tecnologias, devido ao fator ciclo de vida.
- EBSE é interessante para os pesquisadores interessados em engenharia de software empírica e profissionais que devem decidir sobre a adoção de novas tecnologias.
- Alguns tipos de estudos, particularmente relacionados a teste de software, são bons candidatos para EBSE.
- Alguns aspectos a EBSE são de baixo risco e deveriam ser adotados o mais breve possível.
  - Desenvolvimento e adoção de diretrizes para revisões sistemáticas.

# Thanks

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